Optimizing Delivery of Health Care Interventions (ODHIN)

Implementation science: a scientific report describing the methods, results and conclusions of the ODHIN randomized controlled trial

Deliverable 5.2, Work Package 5

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Abstract

Objective To evaluate the impact of training and support, financial reimbursement, and referral to an internet-based method of delivering advice (e-BI), singly or in combination, on primary health care providers' intervention rates for heavy drinkers.

Design Cluster randomized factorial trial.

Setting 120 primary health care units (PHCU), equally distributed in Catalonia, England, the Netherlands, Poland and Sweden.

Participants 746 primary health care providers, 55% of which were doctors, 38% nurses, and 7% practice assistants**.**

Interventions PHCUs were randomized to eight groups: care as usual, training and support, financial reimbursement, and referral to e-BI, paired combinations of training and support, financial reimbursement, and referral to e-BI, and all of training and support, financial reimbursement, and referral to e-BI. The implementation strategies were only delivered during a twelve-week period.

Outcome measures The main outcome was the brief intervention rate, calculated as the number of AUDIT-C positive patients that received one or more of oral advice, an advice leaflet, referral to the e-BI programme, or referral for advice to another provider in or outside the PHCU, divided by the total number of adult (age 18+ years) consultations per PHCU. Other outcomes were screening rates per adult consultation, AUDIT-C positive rates per screened patient and advice rates per positive screen per PHCU.

Results During the 4-week baseline measurement period, the mean intervention rate was 11.1 (95% CI 5.2-17.1) per 1,000 adult consultations per PHCU. Training and support was associated with a 69% (95% CI 30 to 119) higher intervention rate during the 12-week implementation period than no training and support, and financial reimbursement with a 125% (95% CI 73 to 193) higher rate. Referral to e-BI was not associated with a higher rate. A combination of training and support plus financial reimbursement was associated with a 280% (95% CI 162 to 451) higher intervention rate, higher than training and support and financial reimbursement alone. During the 4-week measurement period at six month follow-up, the mean intervention rate across all eight groups dropped to 8.2 (95%CI=4.3 to 12.2) per 1,000 adult consultations per PHCU. However, training and support was associated with a 41% (95% CI 3 to 93) higher intervention rate at follow-up than no training and support. Financial reimbursement provided during the 12-week implementation period and the opportunity of referral to e-BI were not associated with a higher rate in the follow up period.

Conclusions To increase brief advice activity in primary health care for heavy drinking, jurisdictions are recommended to provide specific training on dealing with heavy drinking for the primary health care professionals and are recommended to consider providing financial reimbursement to primary health care providers for delivering advice.

Trial registration ClinicalTrials.gov. Trial identifier: NCT01501552

1. Why we undertook the trial

Alcohol consumption is a wholly or contributory cause for more than 200 diseases, injuries and other health conditions with ICD-10 codes.[1] For most diseases and injuries, there is a dose–response relationship with alcohol.Not only the volume of alcohol consumed, but also the pattern of drinking over time affects the risks of harm. Patterns of drinking are linked to injuries (both unintentional and intentional) and risk of cardiovascular diseases (mainly ischaemic heart disease and ischaemic stroke). The cardio-protective effect of low-risk patterns of alcohol consumption disappears completely in the presence of heavy episodic drinking.[2] Globally, alcohol is the fifth most important risk factor for ill-health and premature death after high blood pressure, tobacco smoke (including second-hand smoke), household air pollution from solid fuels, and diets low in fruits.[3] Reduction in alcohol consumption is a key risk factor, whose reduction is essential to achieve global targets of reducing deaths from non-communicable diseases by 25% between 2010 and 2025.[4]

Heavy drinkers (which includes those drinking at hazardous and harmful levels) who reduce their drinking also reduce their risk of mortality in comparison to those who continue to drink heavily.[5.6] The higher the level of drinking, the stronger the effects of a given reduction.[7]There is a wealth of evidence that demonstrates the effectiveness[8-10] and cost-effectiveness [11, 12]of screening and advice programmes to reduce alcohol consumption and alcohol-related mortality[13]. The recent SIPS trial in England suggested that screening followed by simple feedback and written information may be an appropriate strategy in primary health care to reduce heavy drinking.[14]

Many national and international guidelines recommend routine screening in primary health care and the offer of advice to screen positive patients (e.g.[15, 16]). With strong government support for delivering advice, supported by financial and performance management arrangements, training and guidance, and strategic leadership, it is possible to increase the volume of advice delivered (e.g.[17]). However, in many jurisdictions there is a large gap between need and provision of advice. Commonly, less than 10% of the population at risk are identified, and less than 5% of those who could benefit are offered screening and advice in primary health care settings.[18, 19]

Some of the reasons for this gap have been identified and include: substantial lack of knowledge and training among primary health care providers; lack of adequate resources and support; negative attitudes; and, time constraints in terms of perceived workload and work pressure for screening and advice activities.[20]

A systematic review and meta-regression analysis of 29 studies of determinants of successful implementation of screening and advice for hazardous and harmful alcohol consumption in primary health care found that professional and patient-oriented implementation strategies could improve screening (standardized effect 0.53;95%-CI 0.28-0.78) and advice (standardized effect 0.64;95%-CI 0.27-1.02) rates.[21] Eleven studies used professional-oriented implementation strategies (for example education programmes and outreach training), three studies reported organisational-oriented strategies (e.g., delivering counselling by telephone), and one study reported a patient-oriented strategy (e.g., educational materials for patients). Six studies reported a combination of professional-oriented and organisational-oriented interventions. The other eight studies reported various combinations of professional-oriented, organisational-oriented, patient-oriented and financial-oriented strategies. Applying multiple components of any implementation category and combining professional with patient-oriented implementation strategies were more effective than single

strategies implemented alone. Furthermore, targeting implementation strategies at multidisciplinary primary health care teams increased overall screening rates.

In this deliverable, we report on a five country study to test the effectiveness of providingprimary health care professionals with training and support, financial reimbursement, and referral to an internet-based method of delivering advice (e-BI), on these providers' brief intervention rates for heavy drinking. The definition of brief intervention rate for heavy drinking adopted in this study is the proportion of AUDIT-C[22] positive adult patients who consult during any one measurement period who receive brief advice in one of the following modalities: oral advice, an advice leaflet, referral to the e-BI programme, or referral for advice to another provider in or outside the PHCU.

As set out in the ODHIN Description of Work, this work package aimed to fulfil the following objectives: To examine the effect of training and support (objective 1), financial reimbursement (objective 2)and the possibility of referring patients to an internet-based method of delivering advice (objective 3) on provider's screening and brief advice for heavy drinking; and to determine if the combination of several implementation strategies are more effective than each strategy alone (objective 4).

Providingtraining and support plus financialreimbursement were chosen as professional oriented interventions for which there is some evidence of impact in changing provider behaviour.[21] E-BI was chosen, since there is evidence for its impact in reducing alcohol consumption; [23]referral to e-BI might be helpful as an organizational-oriented strategy in reducing the workload of healthcare professionals after identification of patients at risk and thus might increase screening activity of primary health care providers.

The following hypotheses were tested:

1. The provision of each of training and support, financial reimbursement, and referral to an internet-based method of delivering advice (e-BI) will increase intervention ratesduring the 12 week implementation period, compared to non-provision;
2. The combination of training and support, financial reimbursement, and e-BI in pairs or all together will be more effective in increasing intervention ratesduring the 12 week implementation period,compared to single-focused implementation strategies (training and support, financial reimbursement, and e-BI each alone).
3. Patient and provider characteristics of PHCUs will influence the impact of training and support, financial reimbursement, and e-BI on intervention ratesduring the 12 week implementation period.
4. Intervention rates will drop off at six month follow-up, less so in the training and support group.

2. What we did

Details of the trial protocol were submitted as deliverable D5.1 and have been published.[20] Implementation of the trial deviated from the protocol in six ways:

1. The hypotheses listed in the trial protocol are not an accurate reflection of a factorial design; they have been amended in the present report.
2. We have added two outcome measures: AUDIT-C positive rates (the proportion of screened patients that are AUDIT-C positive); and, intervention rates (advice rates per adult (18+ years) consultation per PHCU). We view the intervention rate as the most meaningful of the outcome measures from the perspectives of clinical practice and public health; thus, it is the rate emphasized in this report.

3. As an additional hypothesis, we tested whether or not the patient and provider mix (according to age and sex (patients) and also type of professional for the providers) in the PHCU influenced the impact of the implementation strategies on intervention rates.
4. As an additional hypothesis, we postulated that intervention rates would drop off at six month follow-up.
5. Since it is the PHCU, rather than the provider, that is the unit of randomization and implementation, this report reports only the PHCU as the unit of analysis, and not the individual provider as a separate level of analysis.
6. IBM SPSS v22 was used as the statistical package and not SAS V9.2.

2.1 Design

In a cluster randomized 2x2x2 factorial trial, data from primary health care units (PHCU) in Catalonia, England, the Netherlands, Poland and Sweden were combined to examine the effect of three different implementation strategies (training and support, financial reimbursement and referral opportunities to an internet-based advice programme) on intervention rates for heavy drinking as operationalized by AUDIT-C[22]. Data were collected between August 2012 and July 2014.

2.2 Participants

PHCUs with approximately 5,000-20,000 registered patients were the unit of randomization and implementation. In Poland, since practitioners normally operate as single-handed entities working with other practitioners in one building, three practitioners and their staff working in one building were the unit of randomization. PHCUs who agreed to participate in the study were volunteers drawn from administrative or academic registries of PHCUs at national or regional levels.

Eligible providers in each PHCU included any fully trained medical practitioner, nurse or PHCU assistant with a permanent appointment working in the PHCU and involved in medical and/or preventive care. Participating providers were those eligible providers who signed consent to participate in the trial. In all jurisdictions, except Catalonia, PHCUs received a trial participation fee that ranged from €250-€3000.

2.3 Implementation strategies

After formal agreement of the PHCU to take part in the trial, a 4-week baseline measurement period took place. After a 2-6 week gap, the 12-week implementation period occurred, with the start date for each country between January and May 2013. All seven groups received the same input as controls but with additional components added.

1. Control Group: The control group were given a package containing a summary card of the national guideline recommendations for screening and advice for hazardous and harmful alcohol consumption, without demonstration. In Poland, where no national guidelines existed, the booklet was adapted from the PHEPA guidelines for the purposes of this trial.[24, 25] Instructions were given on how to complete the record sheet designed for the trial (in Spain (Catalonia), a computerized record sheet was used).

2. Training and support (TS): In addition to receiving the same package as the control group, the TS group were offered two initial 1-2 hours face-to-face educational trainings, and one (10-30 minutes) telephone support call to the lead PHCU contact person during the 12-week implementation period. If necessary one additional face-to-face training of 1-2 hours duration was offered. The training addressed knowledge, skills, attitudes, and perceived barriers and facilitators in implementing screening and advice, combining theory and practical exercises. Each country used an adapted existing country-based TS package. In the

case of Poland, the TS package was based on the PHEPA training programme.[26] In England, PHCU were reimbursed up to €1300 for taking part in the training sessions.

3. Financial reimbursement (FR): Financial reimbursement groups were paid for screening and advice activities, with rates based on existing country-specific financial reimbursement for clinical preventive activities. In Catalonia, a maximum ceiling payment of €250 per provider was established, and fees were calculated based on the average individual performance of the 12-week implementation period. A minimum rate had to be met in order to receive any payment, and above this rate, the amount received increased proportionally up until the maximum of €250. In England, fees were €6 per screening and €25 per advice, with a maximum ceiling rate of €2200 per PHCU. In the Netherlands, fees were €9 per screening and €13.50per advice, with a maximum ceiling rate of €1250 per provider unit. In Poland, fees were €1.25 per screening and €10 per advice, with no ceiling rate. In Sweden, fees were €2 per screening and €15 per advice with a maximum ceiling rate of €3300 per PHCU.The type of advice that was reimbursable differed by country. In Catalonia and the Netherlands, reimbursement was given for any of delivering oral advice; giving an advice leaflet; referring to the e-BI programme; or referral to another provider in or outside the PHCU. In England and Poland, reimbursement was given for either delivering oral advice; or, referring to the e-BI programme. In Sweden, reimbursement was given for any of delivering oral advice; referring to the e-BI programme; or referral to another provider in or outside the PHCU.

4. e-BI: In addition to receiving the same package as the control group, the e-BI group were asked to refer identified at risk patients with an e-leaflet containing unique log in codes to an approved e-BI specific package, which was country specific, or, for Poland based on the WHO e-SBI programme. The website included: log in facility to allow monitoring of the patient (i.e. patient actually log-in); suitable brief screening tool with ability to calculate score and give feedback (i.e. intervention); appropriate information on sensible drinking guidelines; information on impact of alcohol on health and wellbeing; and a drink diary facility.

5. TS and financial reimbursement: The TS and FR received the control group package, training and support, and the financial reimbursement as described above.

6. TS and e-BI: The TS and e-BI group received the control group package, training and support as above, and were asked to refer identified at risk patients to e-BI as above.

7. Financial reimbursement and e-BI: The FR and e-BI group received the control group package, were asked to refer identified at risk patients to e-BI, and received financial reimbursement as described above.

8. TS, financial reimbursement and e-BI: The TS, FR and e-BI group received the control group package and training and support as above. They were asked to refer identified at risk patients to e-BI and received financial reimbursement as described above.

At the end of the 12-week implementation period a six month gap ensued, during which no implementation strategies were delivered, apart from ensuring that each PHCU had sufficient e-BI referral leaflets. After the six month no implementation period, a four week follow-up period took place, with the start date for each country between October 2013 and May 2014.

Figure 1 graphically summarises the design of the ODHIN RCT, identifying procedure activities, measures and implementation strategies and the timeframe in which these activities took place in the five participating countries.

Figure 1: Graphical depiction of the ODHIN RCT

Time schedule	***Period (range from five countries)***	***Control group***	***T&S***	***Financial***	***e-BI***	***T&S+ Financial***	***T&S+e-BI***	***Financial +e-BI***	***T&S+ Financial +e-BI***
Baseline: 1 month	*November 2012 – May 2013*	1 a b	1 a b	1 a b	1 a b	1 a b	1 a b	1 a b	1 a b
1 month	*December 2012 – June 2013*	2	2	2	2	2	2	2	2
Implementation period: 3 months	*January – October 2013*	a b	a b	a b	a b	a b	a b	a b	a b
Follow-up: 6 months after implementation finished	*October 2013– May 2014*	a b	a b	a b	a b	a b	a b	a b	a b

Legend:
T&S = Training and support; Financial = financial reimbursement; e-BI = internet-based brief intervention

Procedure activities

○ *1) 30 min introduction to study*
2) 15-45 min meeting introduction to study arms (within control and financial reimbursement only arm- briefing either face to face or by telephone)

Measures

□ *a) Collecting tally sheets of SBI activity (baseline and follow-up 1 month; implementation period 3 months)*
b) SAAPPQ measurement

PHCU were asked to screen adult patients (aged 18 years and over who attended the PHCU) for heavy drinking, using a paper version of AUDIT-C, except in Catalonia, where a computerized version was used. Screen positives were defined in Catalonia and England as men and women who scored ≥5 on AUDIT-C, and in Poland, Netherlands and Sweden as men who scored ≥5 and women who scored ≥4 on AUDIT-C. PHCU were asked to deliver brief alcohol advice of 5-15 minutes duration to screen positives, with the length and format of the advice based on country specific guidelines or, for Poland, where national guidelines were not available, the European guidelines developed by PHEPA.[24] Providers who were allocated to e-BI activity were asked to refer patients to a computerized advice programme, taking a few minutes to explain why the patient ought to log on to the web site.

2.4 Outcomes

SBI activity was measured at five time points: during the 4-week baseline period, during each of the three consecutive 4-week blocks during the 12-week implementation period, and during a 4-week follow-up period that commenced six months after the end of the 12-week implementation period. Using paper tally sheets, with the exception of Catalonia, where electronic patient records were used, the SBI activity of the participating providers was recorded using paper tally sheets. These tally sheets, and also the Catalan electronic records, included AUDIT-C questions, AUDIT-C scores, and tick boxes to indicate the type of advice that was delivered. The 12-week rates were calculated as the mean of the three 4-week blocks, with, in the case of missing data from any of the three blocks, the mean calculated from the blocks that contained data.

For each of the measurement periods, the outcomes were as follows:

Intervention rate: number of AUDIT-C positive patients that received one or more of oral advice, an advice leaflet, referral to the e-BI programme, or referral for advice to another provider in or outside the PHCU, divided by the total number of adult consultations per PHCU.

Screening rate: number of patients screened divided by the number of adult consultations per PHCU.

AUDIT-C positive rate: number of patients with an AUDIT-C positive score divided by the number of patients screened per PHCU.

Advice rate: number of AUDIT-C positive patients that received one or more of oral advice, an advice leaflet, referral to the e-BI programme, or referral for advice to another provider in or outside the PHCU, divided by the total number of screen positive patients per PHCU.

2.5 Randomization and blinding

Randomization took place after formal agreement of the PHCU to take part in the trial. The PHCUs were randomly allocated to one of the eight groups by the ODHIN coordinating centre, using computerized randomization, stratified by country, ensuring 15 PHCUs per group (three per country). Although the PHCUs were randomly allocated before the baseline measurement, the research team in each of the jurisdictions and the PHCU were only informed of the allocation after collection of the baseline measurement to avoid bias as a result of group allocation. For the remainder of the study period, the PHCUs and investigators were not blind to group allocation.

2.6 Sample size

It was estimated that 56 PHCUs (seven per eight allocation groups) with a minimum of 1,000 adult patients per month would be needed for a 80% chance of detecting an increase in screening rates from 8% to 12% (ICC = 0.029) and that 120 PHCUs (15 per eight allocation groups) would be needed for a 80% chance of detecting an increase in intervention rates from 4% to 6% (ICC = 0.029) (alpha =

5 %). As country was used as stratification criteria each country included a minimum of 24 PHCU. These conservative estimates were based on published evidence of screening and advice rates (see[20]).

2.7 Statistical methods

The data analysed were the mean outcome rates per PHCU for the 12-week implementation period and the six-month 4-week follow-up period, controlling for the rates for the 4-week baseline period.

The study was a factorial design[27-29], in which (-1,1) coding was used, resulting in regression coefficients having half the effects. A factorial design recognises that when evaluating the impact of, for example, training and support, we compare PHCU that received training and support with those that did not. Thus, the comparison also compares PHCU with training and support plus financial reimbursement versus PHCU with just financial reimbursement.

The factors for the interventions were coded as follows:

TS=-1 for control, FR, e-BI, FR+e-BI and +1 for TS, TS+FR, TS+e-BI , TS+FR+e-BI;
FR=-1 for control, TS, e-BI, TS+e-BI and +1 for FR, FR +TS, FR+e-BI, FR+TS+e-BI;
e-BI=-1 for control, FR, TS, TS+FR and +1 for e-BI, e-BI+TS, e-BI+FR, e-BI+TS+FR.

Analyses were performed in IBM SPSS V22, using procedure MIXED with a random intercept and fixed variables that included the baseline measurements. Because of the hierarchical structure of the data (PHCU nested within country), models were analysed with random variable subject (country). Evidence for interactions between TS, FR and e-BI was investigated. There was an interaction between FR and e-BI and the interaction term FR*eBI was entered in the models. Presented outcome rates are estimated marginal means per PHCU with 95% confidence intervals, accounting for PHCU nested within country. Contrast estimates were used to test for differences in mean rates with and without the factor at baseline. Trends in rates across the three 4-week blocks of the 12-week implementation period were tested with type III tests with time as a fixed independent variable, giving an F value.

When examining the impact of the factors on the 12-week implementation and follow-up rates, examination of residuals found them to be not symmetrically distributed around 0, so log transformed data, which provided a better fit, were used. Prior to logging, rates with a value of zero were assigned a value of 0.001. Coefficients for the combined effects of TS+FR and TS+e-BI were the sum of the individual coefficients. Coefficients for the combined effects of FR+e-BI and FR+TS+e-BI were the sum of the individual coefficients plus the coefficient of FR*eBI (due to the interaction between FR and e-BI). Since the data were logged, the contrast coefficients are relative effects. The per centdifference in outcome rates with a factor as opposed to without a factor was calculated with the equation: difference (%)= 100*(exp(2*coefficient estimate from procedure MIXED) minus 1).

3. What we found

3.1 PHCU characteristics

Of the 120 PHCUs, 15 were allocated to each of the eight groups (of the 24 PHCU per country, 3 were allocated to each of the eight groups). The number of registered patients averaged 10,000 across the 120 PHCUs. There were 1500 adult (age 18+ years) consultations per PHCU during the 4-week baseline period, mean age 55 years (SD=7), of whom 53% were men. Thus, the PHCUs catered for a population of 1.2 million people, and saw about 180,000 adult patients during a 4-week period. The mean number of full or part-time providers (doctors, nurses and practice assistants) working per PHCU was 15.1 (SD=10.4), of which half were doctors, and two-fifths nurses; of these, 6.2 (SD=3.7)

per PHCU (41%) participated in the study. Just over half of the participating providers were doctors (55%), 38% were nurses, and 7% were practice assistants**.** The mean age of the providers was 47 years (SD=5), and 26% were men.

During the 4-week baseline period, intervention rates were 11.1‰ (95%CI=5.2-17.1) per PHCU; screening rates were 5.9% (95%CI=3.4-8.4) per PHCU; AUDIT-C positive rates were 33.3% (95%CI=18.8-47.8) per PHCU; and, advice rates were 73.7% (95%CI=60.6-86.8) per PHCU. The use of electronic records in Catalonia did not appear to affect the rates – excluding Catalonia, the screening rates were 5.6% (95%CI=2.6-8.7).

The screening rate did not vary by the sex of screened patients but was marginally higher amongst older patients (coefficient = 0.0025, p=0.003). The AUDIT-C positive rate was lower the greater the screening rate (coefficient = -1.128, p=<0.001), and marginally lower, the greater the age of the patient (coefficient = -0.0064, p=0.018). The brief advice rates did not differ by screening rate, AUDIT-C positive rate or sex and age of the patient. The intervention rate did not differ by the sex or age of the patient.

The screening and intervention rates were higher the greater the proportion that PHCU providers were nurses or practice assistants (screening rates, coefficient = 0.087, p<0.001; intervention rates, coefficient = 0.011, p=0.014), but was not related to provider sex or age. Audit-C positive rates and brief advice rates were not related to provider characteristics.

3.2 Impact of implementation factors during the 12-week implementation period

Of the 120 PHCUs, one PHCU that dropped out of the study after the baseline measurement, and two PHCUs failed to provide data for any of the three 4-week blocks during the 12-week implementation period. For these PHCUs, data outcome measurements during the 12-week implementation period were set as the rates for the baseline measurement period (intention to treat analysis).

Table 1 displays the intervention rates (estimated marginal means) for each of the four measurement periods and the mean of the 12-week implementation period, without or with the factors, singly and in combination. At baseline, contrast estimates found no statistically significant differences in rates without or with any one factor or their combinations. Table 2 displays the relative per cent difference (95% CI) in 12-week implementation rates with, as opposed to without factor, controlling for baseline rates.

3.2.1 Training and support

PHCU receiving training and support experienced an increase in their intervention rate from 10.2‰ in the baseline to 17.5‰ on average through the implementation period. In fact, looking at the 3 4-week implementation blocks separately, the intervention rate reached 22.1‰ in the first 4-week block, more than doubling the baseline level. After this sharp rise, we see a drop-off trend ofthe intervention rate during the 12-week implementation period, which was statistically significant, with most of the drop-off occurring between the first and second four-week blocks (Table 1). PHCU that received training and support (TS) demonstrated a 69% (95% CI 30 to 119) higher 12-week intervention rate than PHCUs that did not receive training and support (Table 2). Adding screening rates to the model reduced the size of the higher rate to 33.5% (95% CI 8.3 to 64.6), and then adding brief advice rates to the model reduced the size further to 28.1% (95% CI 4.2 to 57.4), indicating that about one half of the higher intervention rate was due to a higher screening rate.

Table 1 Mean intervention rates[1] (‰ (95% CI)) per PHCU without and with each of the factors, singly and in combination over the measurement periods

Factor		Baseline[2]	12 week Implementation period				12 week Implementation period as a whole[4]
			Weeks 1-4	Weeks 5-8	Weeks 9-12	Test for trend; F value[3]	
Training and support	Without factor	12.1 (5.6-18.5)	12.5 (6.1-18.9)	9.5 (5.1-13.9)	9.3 (4.4-14.2)	3.07	10.3 (5.1-15.4)
	With factor	10.2 (4.5-15.9)	22.1 (9.3-34.8)	16.3 (7.7-24.9)	14.2 (6.6-21.7)	4.92*	17.5 (8.2-26.7)
Financial reimbursement	Without factor	12.7 (5.3-20.0)	10.9 (5.5-16.2)	8.7 (4.8-12.5)	8.0 (4.0-12.0)	3.59	9.0 (4.9-13.2)
	With factor	9.6 (5.0-14.3)	23.8 (8.0-39.6)	17.2 (8.4-26.0)	15.4 (6.2-24.7)	5.65*	18.7 (7.8-29.7)
e-BI	Without factor	11.6 (5.8-17.4)	19.4 (8.1-30.8)	16.6 (6.9-26.3)	14.9 (5.0-24.7)	1.39	16.6 (6.6-26.7)
	With factor	10.7 (4.2-17.3)	15.2 (7.3-23.3)	9.3 (6.2-12.3)	8.6 (4.4-12.7)	14.64***	11.1 (6.4-15.8)
Training and support plus financial reimbursement	Without factor	12.0 (5.4 to 18.5)	12.5 (6.4 to 18.7)	9.7 (5.1 to 14.4)	9.3 (4.5 to 14.0)	4.87*	10.3 (5.3 to 15.4)
	With factor	8.7 (4.3 to 13.2)	31.5 (9.5 to 5.4)	22.3 (10.5 to 34.0)	19.2 (8.1 to 30.2)	4.74*	24.5 (10.2 to 38.8)
Training and support plus e-BI	Without factor	12.2 (5.8 to 18.6)	17.1 (7.5 to 26.7)	13.6 (6.6 to 20.6)	12.5 (5.5 to 19.6)	2.92	14.2 (6.5 to 21.9)
	With factor	8.0 (3.2 to 12.8)	18.2 (8.6 to 27.8)	11.1 (7.0 to 15.2)	9.4 (5.2 to 13.5)	8.51**	13.1 (7.7 to 18.5)
Financial reimbursement plus e-BI	Without factor	11.9 (5.6 to 18.2)	16.8 (7.6 to 26.0)	13.9 (6.4 to 21.4)	12.9 (5.8 to 20.0)	2.18	14.3 (6.6 to 22.1)
	With factor	8.9 (3.8 to 14.0)	19.0 (8.6 to 29.4)	10.2 (6.5 to 14.0)	8.2 (5.5 to 10.8)	12.57**	12.7 (8.0 to 17.4)
Financial reimbursement plus training and support plus e-BI	Without factor	11.8 (5.4 to 18.2)	16.3 (7.3 to 25.3)	12.8 (6.2 to 19.4)	12.0 (5.5 to 18.4)	3.60	13.5 (6.3 to 20.7)
	With factor	6.6 (4.1 to 9.1)	24.6 (12.2 to 37.1)	14.2 (8.6 to 19.7)	10.3 (6.7 to 13.9)	7.58**	16.9 (11.5 to 22.3)

[1] Estimated marginal means accounting for PHCU nested within country
[2] Contrast estimates found no differences in mean rates with and without the factor at baseline
[3] Type III tests with time as a fixed independent variable accounting for PHCU nested within country
[4] Calculated as the mean of the three 4-week blocks, with, in the case of missing data from any of the three blocks, the mean calculated from the blocks that contained data
* P<0.05; ** p<0.01; *** p<0.001 (accounting for PHCU nested within country)

3.2.2 Financial reimbursement

PHCU receiving financial reimbursement almost doubled their baseline intervention rate (9.6‰) in the implementation period (18.7‰), whereas PHCU without this pay-for-performance dropped from 12.7‰ to 9.0‰. As was the case with training and support, the intervention rate of PHCU with financial reimbursement experienced a sharp increase in the first four-week block of the implementation period, followed by a statistically significant drop-off trend, with most of the drop-off occurring between the first and second four-week blocks (Table 1). PHCU that received financial reimbursement (FR) demonstrated a 125% (95% CI 73 to 193) higher 12-week intervention rate than PHCUs that did not receive financial reimbursement (Table 2). Adding screening rates to the model reduced the size of the higher rate to 49.1% (95% CI 19 to 87), and then adding brief advice rates to the model reduced the size further to 42% (95% CI 14 to 77), indicating that about two-thirds of the higher intervention rate was due to a higher screening rate.

3.2.3 E-BI

Providing referral to e-BI was not associated with a higher intervention rate (the definition of intervention and advice included a referral to e-BI), Table 2. Although PHCU with the opportunity to hand out *ad hoc* referral leaflets to patients experienced a raise in their intervention rate between baseline and the first of the four-week blocks (from 10.7‰ to 15.2‰), there was also a statistically significant trend in drop-off of this group's intervention rate during the 12-week period, , with most of the drop-off occurring between the first and second four-week blocks, and an intervention rate lower than the baseline in both the second and third four-week blocks (Table 1).

3.2.4 Training and support plus financial reimbursement

The intervention rate of PHCU provided with both training and support and financial reimbursement almost increased threefold in comparison to the baseline measurement (24.5‰vs 8.7‰). After peaking at 31.5‰in the first of the four-week blocks, intervention rates both without and with the combined factors during the 12-week implementation period presented a statistically significant drop-off trend, with most of the drop-off occurring between the first and second four-week blocks (Table 1). PHCU that received training and support plus financial reimbursement demonstrated a 280% (95% CI 162 to 451) higher 12-week intervention rate than PHCUs that did not receive training and support plus financial reimbursement (Table 2). Adding screening rates to the model reduced the size of the higher rate to 99% (95% CI 45 to 174), and then adding brief advice rates to the model reduced the size further to 81% (95% CI 32 to 148), indicating that about two-thirds of the higher intervention rate was due to a higher screening rate.

The combination of training and support plus financial reimbursement led to 165.4% (95% CI 80.8 to 289.6) higher intervention rates than training and support alone ($p<0.001$) and to 101.6% (95% CI 41 to 188) higher intervention rates than financial reimbursement alone ($p<0.001$).

3.2.5 Training and support plus e-BI

PHCU receiving both these strategies also increased their intervention rate in the implementation period in comparison to the baseline, from 8.0‰ to 13.1‰. The highest intervention rate was registered in the first four-week period, followed by a drop-off trend that was statistically significant, with most of the drop-off occurring between the first and second four-week blocks (Table 1). PHCU that received training and support plus e-BI demonstrated a 48% (95% CI 2 to 113) higher 12-week intervention rate than PHCUs that did not receive training and support plus e-BI (Table 2). The combination of training and support plus e-BI led to a non-significant 28.6% (95% CI -54.8 to 12.6) lower intervention rate than training and support alone.

3.2.6 Financial reimbursement plus e-BI

The intervention rate of PHCU who received both financial reimbursement and the opportunity to refer patients to an e-BI website increased from 8.9‰ in the baseline to 12.7‰ in the implementation period. However, the intervention rate in the third four-week block was in fact lower than the intervention rate, following a trend in drop-off of intervention rates during the 12-week implementation period that was statistically significant, with most of the drop-off occurring between the first and second four-week blocks (Table 1). The combination of financial reimbursement and referral to e-BI was not associated with a higher intervention rate (the definition of intervention and advice included a referral to e-BI), Table 2.

3.2.7 Training and support plus financial reimbursement plus e-BI

By chance, due to the random allocation of PHCU to each implementation strategy, the 15 PHCU who were provided with all three types strategies combined registered the lowest intervention rate of the baseline measurement when analysed together, 6.6‰. This rate rose to 24.6‰ in the first of the four-week blocks of the implementation period, but, here too there was statistically significant

trend in drop-off of intervention rates with the combined factors during the 12-week implementation period, with most of the drop-off occurring between the first and second four-week blocks (Table 1). PHCU that received training and support plus financial reimbursement plus e-BI demonstrated a 144% (95% CI 44 to 312) higher 12-week intervention rate than PHCUs that did not receive training and support plus financial reimbursement plus e-BI (Table 2). The combination of training and support plus financial reimbursement plus e-BI led to a non-significant 34.7% (95% CI -62.4 to 13.5) lower intervention rate than training and support plus financial reimbursement alone.

Table 2 Relative per cent difference[1] (95% CI) in 12-week implementation rates with factor as opposed to without factor (controlling for baseline rates and accounting for PHCU nested within country)

Factor	Intervention rate	Screening rate	AUDIT-C positive rate	Advice rate
Training and support	68.6*** (29.9 to 118.6)	46.0** (12.0 to 90.3)	11.2 (-9.0 to 35.9)	31.1 (-16.0 to 104.5)
Financial reimbursement	125.3*** (73.2 to 193.0)	96.0*** (50.8 to 154.9)	-0.2 (-18.4 to 21.9)	21.4 (-22.2 to 89.6)
e-BI	-12.4 (-32.4 to 13.6)	-18.9 (-37.7 to 5.6)	13.6 (-6.9 to 38.5)	-9.5 (-42.0 to 41.2)
Training and support plus financial reimbursement	279.7*** (161.6 to 451.2)	186.2*** (97.6 to 314.7)	10.9 (-16.5 to 47.3)	59.2 (-14.8 to 197.5)
Training and support plus e-BI	47.7* (2.2 to 113.5)	18.4 (-18.9 to 72.9)	26.3 (-5.3 to 68.3)	18.6 (-37.3 to 124.5)
Financial reimbursement plus e-BI	44.4 (-8.3 to 127.5)	28.5 (-18.7 to 103.0)	5.0 (-25.1 to 47.1)	-7.3 (-56.6 to 98.1)
Financial reimbursement plus training and support plus e-BI	143.5** (43.8 to 312.2)	87.6* (10.0 to 219.9)	16.7 (-21.0 to 72.5)	21.5 (-49.2 to 190.6)

[1] As an example, for the intervention rate for the factor training and support, the 12-week rate was 68.6% higher (95% CI=29.9 to 118.6) with the factor (training and support) as opposed to without the factor (this is not the same as the factor increasing the baseline rate by 68.6%).

* P<0.05; ** p<0.01; *** p<0.001

3.2.8 Provider and patient characteristics

The models were re-run for the main outcome intervention rates, first, including provider characteristics per PHCU (provider profession, gender and age) in the model; and, second, including patient characteristics per PHCU (number of registered patients, adult consultation rate, age and gender of screened patients) in the model. When including either the provider characteristics or the patient characteristics, no statistically significant differences were detected between the model estimates and the model without including the provider characteristics or the patient characteristics. As an aside to these analyses, it was noted that the PHCU provider gender mix was related to intervention rates - the higher the proportion of providers per PHCU being female, the greater the intervention rate during the 12-week implementation period (coefficient = 0.924; 95%CI=0.292 to 1.557). No other provider or patient characteristics were related to intervention rates. Interactions between each of the providers and each of the patient characteristics and the factors were investigated, with no interactions found.

3.2.9 Sensitivity analyses

Per protocol analysis (excluding the three PHCUs with no data during the 12 week implementation period) did not change the results. The relative per cent difference (95% CI) in 12-week implementation rates with factor as opposed to without factor for the three single factors in the per protocol analysis were: training and support 96.4% (30.3 to 120.2); financial reimbursement 124.2% (72.0 to 192.2); and, e-BI -11.9% (-32.2 to 14.4).

The rates dropped off during the 12-week implementation period, so the analyses were rerun with the outcome as the intervention rates during weeks 9-12, controlling for baseline rates. The relative per cent difference (95% CI) in 9-12-week implementation rates with factor as opposed to without factor for the three single factors were: training and support 77.3% (27.7 to 146.0); financial reimbursement 92.3% (38.1 to 167.8); and, e-BI -19.5% (-47.0 to 11.6).

3.3 Sustainability of findings at 6 month follow-up

Eighteen of the 120 PHCU failed to provide adequate data to calculate intervention rates during the 4-week follow-up period. For these PHCUs, intention-to-treat analyses were used, with implementation rates during the 4-week follow-up period set as the rates for the baseline measurement period. Per protocol analyses were also undertaken, excluding the 18 PHCUs with no data during the 6-month follow-up period. During the 4-week period that occurred six monthsafter the implementation period, intervention rates across all eight allocation groups dropped to 8.2 (95%CI=4.3 to 12.2) per 1,000 adult consultations per PHCU, significantly lower than at baseline (11.1‰ (95%CI=5.2-17.1)); t=2.23; df=216; p=0.027.

Table 3 displays the mean intervention rates (estimated marginal means) per PHCU without and with each of the factors, singly and in combination over the three measurement periods. The right hand columns displays t-test and p value contrasting the intervention rate at 6-months follow-up with the intervention rate during the implementation period and during the baseline period. Table 4 displays the relative per cent difference (95% CI) in follow-up implementation rates with, as opposed to without, factor controlling for baseline rates. One column displays the intention-to-treat rates, and the other, the per protocol rates.

3.3.1 Training and support

The 6-month intervention rate in PHCU without training and support was not statistically different than the 12-week implementation rate, but significantly less than the baseline rate; in contrast, the 6-month rate in PHCU with training and support was statistically less than the 12-week implementation rate, but not significantly different from the baseline rate (Table 3). PHCU that received training and support demonstrated a 41% (95% CI 3 to 93) higher 6-month intervention rate than PHCUs that did not receive training and support (Table 4).

3.3.2 Financial reimbursement

The 6-month intervention rate in PHCU without financial reimbursement was not statistically different than the 12-week implementation rate, but significantly less than the baseline rate; in contrast, the 6-month rate in PHCU with financial reimbursement was statistically less than the 12-week implementation rate, but not significantly different from the baseline rate (Table 3). Providing financial reimbursement during (and only during) the 12-week implementation period was not associated with a higher intervention rate at 6-month follow-up, Table 4.

3.3.3 E-BI

The 6-month intervention rate in PHCU without e-BI was not statistically different than the 12-week implementation rate, but statistically less than the baseline rate; in contrast, the 6-month rate in PHCU with e-BI was statistically less than both the 12-week implementation and the baseline rates (Table 3). Providing referral to e-BI was not associated with a higher intervention rate at 6-month follow-up, Table 4.

Table 3 Mean intervention rates[1] (‰ (95% CI)) per PHCU without and with each of the factors, singly and in combination over the measurement periods

Factor		Baseline	12-week implementation period	6 month follow-up	Comparing 6-month follow-up with 12-week implementation period; t-test; p value	Comparing 6-month follow-up with baseline; t-test; p value
Training and support	Without factor	12.1 (5.6-18.5)	10.3 (5.2-15.3)	7.5 (4.2-10.8)	-1.37; 0.17	-2.57*; 0.012
	With factor	10.2 (4.5-15.9)	17.5 (8.2-26.7)	9.0 (5.3-12.8)	-2.58*; 0.011	-0.45; 0.65
Financial reimbursement	Without factor	12.7 (5.3-20.0)	9.0 (4.9-13.2)	7.4 (3.9-10.8)	-1.05; 0.30	-3.25**; 0.002
	With factor	9.6 (5.0-14.3)	18.7 (7.8-29.7)	9.2 (5.5-12.9)	-2.87**; 0.005	-0.22; 0.82
e-BI	Without factor	11.6 (5.8-17.4)	16.6 (6.6-26.7)	9.0 (5.1-12.9)	-2.0*; 0.048	-1.15; 0.26
	With factor	10.7 (4.2-17.3)	11.1 (6.4-15.8)	7.6 (3.9-11.1)	-2.43*; 0.017	-2.39*; 0.03
Training and support plus financial reimbursement	Without factor	13.6 (5.9-21.3)	5.4 (1.1-9.8)	6.6 (3.5-9.7)	-1.76; .08	-3.02**; 0.003
	With factor	8.7 (4.5-12.9)	22.3 (8.8-35.8)	10.0 (6.1-13.9)	-2.64*; 0.011	0.77; 0.44
Training and support plus e-BI	Without factor	12.5 (6.4-18.6)	13.1 (5.4-20.7)	8.3 (4.0-12.5)	-2.36*; 0.020	-2.51*; 0.013
	With factor	9.8 (3.7-15.8)	14.7 (8.4-21.0)	8.3 (3.9-12.8)	-1.82; 0.075	-0.36; 0.72
Financial reimbursement plus e-BI	Without factor	12.8 (5.3-20.3)	8.5 (4.9-12.2)	6.7 (3.9-9.5)	-2.18*; 0.031	-2.08*; 0.039
	With factor	8.9 (3.8-14.0)	12.7 (8.0-17.4)	7.1 (3.8-10.3	-2.10*; 0.041	-0.75; 0.455
Financial reimbursement plus training and support plus e-BI	Without factor	13.7 (6.3-21.2)	4.9 (2.1-7.8)	5.9 (3.6-8.3)	-2.43*; 0.016	-2.62**; 0.009
	With factor	8.0 (3.3-12.6)	16.3 (9.2-23.3)	7.8 (3.6-12.1)	-1.79; 0.086	-1.06; 0.3

[1] Estimated marginal means accounting for PHCU nested within country

* P<0.05; ** p<0.01; *** p<0.001 (accounting for PHCU nested within country)

3.3.4 Training and support plus financial reimbursement

The 6-month intervention rate in PHCU without training and support plus financial reimbursement was not statistically different than the 12-week implementation rate, but significantly less than the baseline rate; in contrast, the 6-month rate in PHCU with training and support plus financial reimbursement was statistically less than the 12-week implementation rate, but not significantly different from the baseline rate (Table 3). PHCU that received training and supportplus financial reimbursement demonstrated an 80% (95% CI 15 to 182) higher 6-month intervention rate than PHCUs that did not receive training and support (Table 4). The combination of training and support plus financial reimbursement did not lead to higher intervention rates than either training and support (coefficient=0.20; 95%CI=-0.02 to 0.43) or financial reimbursement (coefficient=0.25; 95%CI=-0.006 to 0.51) alone.

3.3.5 Training and support plus e-BI

The 6-month intervention rate in PHCU without training and support plus e-BI was statistically less than both the 12-week implementation and baseline rates; in contrast, the 6-month rate in PHCU with training and support plus e-BI was not statistically different from either the 12-week

implementation or the baseline rates (Table 3). Providing training and support plus referral to e-BI was not associated with a higher intervention rate at 6-month follow-up, Table 4.

Table 4 Relative per cent difference[1] (95% CI) in 12-week implementation rates with factor as opposed to without factor (controlling for baseline rates and accounting for PHCU nested within country).

Factor	Intention to treat	Per protocol
Training and support	41.1* (3.0 to 93.3)	46.8* (3.5 to 108.1)
Financial reimbursement	27.4 (-7.3 to 75.0)	20.4 (-15.9 to 72.4)
e-BI	-7.0 (-32.1 to 27.3)	-10.2 (-36.7 to 27.3)
Training and support plus financial reimbursement	79.8* (14.6 to 182.1)	76.8* (7.7 to 190.1)
Training and support plus e-BI	31.2 (-16.0 to 104.9	31.8 (-20.1 to 117.3)
Financial reimbursement plus e-BI	-12.4 (-49.4 to 51.8)	-11.7 (-51.4 to 60.3)
Financial reimbursement plus training and support plus e-BI	23.7 (-34.6 to 133.8)	29.6 (-35.1 to 158.8)

[1] As an example, for the intervention rate for the factor training and support, the 12-week rate was 41.1% higher (95% CI=3.0 to 93.3) with the factor (training and support) as opposed to without the factor (this is not the same as the factor increasing the baseline rate by 41.16%).
* P<0.05; ** p<0.01; *** p<0.001

3.3.6 Financial reimbursement plus e-BI

The 6-month intervention rate in PHCU without financial reimbursement plus e-BI was statistically less than both the 12-week implementation and baseline rates; in contrast, the 6-month rate in PHCU with financial reimbursement plus e-BI was statistically less than the 12-week implementation rate but not statistically different from the baseline rate (Table 3). Providing training and support plus referral to e-BI was not associated with a higher intervention rate at 6-month follow-up, Table 4.

3.3.7 Financial reimbursement plus training and support plus e-BI

The 6-month intervention rate in PHCU without financial reimbursement plus training and support plus e-BI was statistically less than both the 12-week implementation and baseline rates; in contrast, the 6-month rate in PHCU with financial reimbursement plus training and support plus e-BI was not statistically different from either the 12-week implementation or the baseline rates (Table 3). Providing financial reimbursement plus training and support plus e-BI was not associated with a higher intervention rate at 6-month follow-up, Table 4.

3.3.8 Sensitivity analyses

Per protocol analysis (excluding the 18 PHCUs with no data during the post six-month 4-week follow-up period) did not change the results, Table 4.

4. Discussion

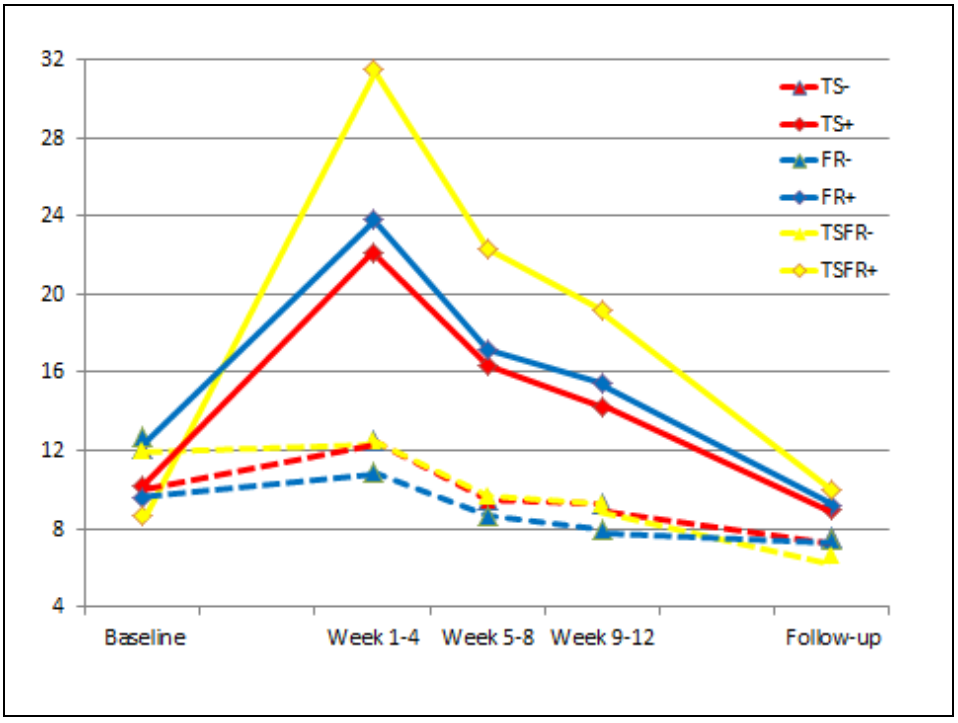
4.1 Overall findings

The ODHIN study was designed to investigate the effects of different implementation strategies to promotebrief intervention for heavy drinking in 120 primary health care units (PHCU) across five European jurisdictions (Catalonia, England, the Netherlands, Poland and Sweden). During a 4-week

baseline measurement period, the mean intervention rate was 11.1 per 1,000 adult consultations per PHCU. An AUDIT-C cut-off score of 5 is equivalent to a consumption level of 20 grams of alcohol per day[22]. Amongst EU citizens aged 15-64 years, 230/1,000 women regularly drink 20 grams of alcohol or more per day and 300/1, 000 men regularly drink 40 grams of alcohol or more per day.[30] Of those screened in the ODHIN study, 330/1000 were AUDIT-C positive (≥5 in Catalonia and England and ≥5 for men ≥4 for women in Poland, Netherlands and Sweden), suggesting that only some 3% (11.1/330) of those who might benefit from brief advice were receiving it.

In the absence of both training and support and financial reimbursement, intervention rates decreased over the course of the study to a little under 8 per 1,000 adult consultations per PHCU at six month follow-up; whereas, in the presence of both training and support and financial reimbursement, intervention rates increased during the 12-week implementation period, with the greatest increase during the first four weeks of the 12-week period, when it reached 31.5‰, Figure 2. The rates then decreased over time. The intervention rates were 69% higher with training and support than without training and support during the 12-week implementation period (adjusting for the baseline levels), an effect that was partially maintained at six month follow-up, where intervention rates were 41% higher with training and support than without training and support. The intervention rates were 125% higher with financial reimbursement than without financial reimbursement during the 12-week implementation period (adjusting for the baseline levels) an effect that was not maintained at six month follow-up. The intervention rates were 280% higher with the combination of training and support plus financial reimbursement than without the combination of training and support plus financial reimbursement during the 12-week implementation period (adjusting for the baseline levels) an effect that was partially maintained at six month follow-up, where intervention rates were 80% with the combination of training and support plus financial reimbursement than without the combination of training and support.

Figure 2 Mean intervention rates (‰) per PHCU without and with training and support (TS) and financial reimbursement (FR) singly and in combination over the measurement periods

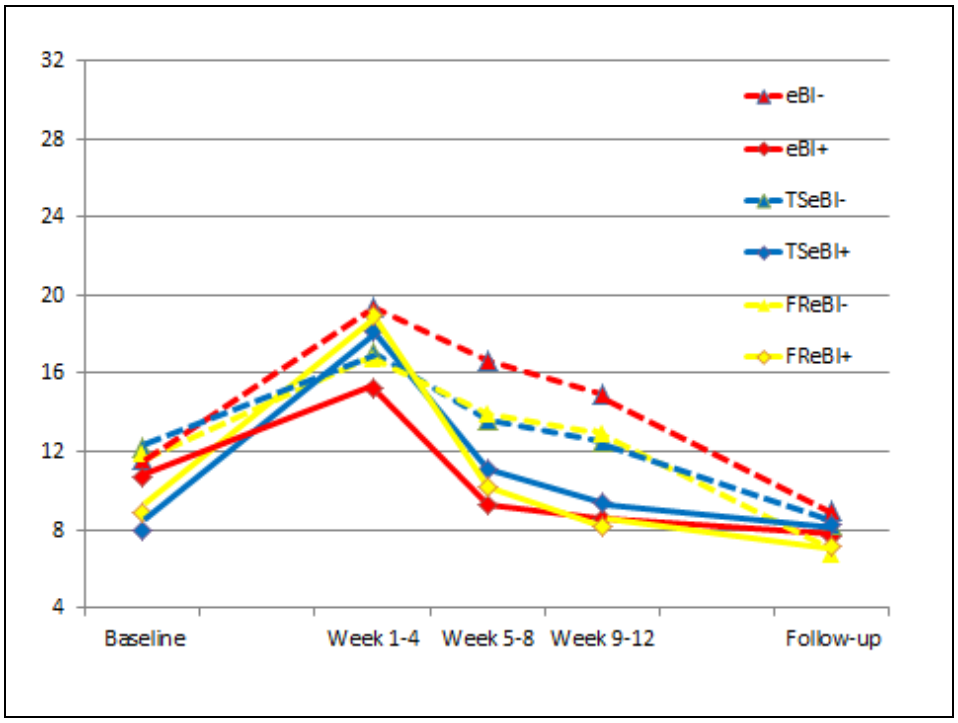


The combination of training and support plus financial reimbursement led to higher intervention rates than training and support or financial reimbursement alone during the 12-week implementation period, but not at 6-month follow-up.

The findings with e-BI were different, Figure 3. Similar patterns of intervention rates followed in the presence or absence of e-BI, singly or in combination with training and support and financial reimbursement. Intervention rates increased during the first four weeks of the 12-week implementation period, and then tailed off with time. E-BI alone did not impact intervention rates, but, when combined with training and support and with training and support plus financial reimbursement, did, this effect being due to the impact of training and support and of financial reimbursement.

Neither characteristics of the providers nor of the patients influenced the impact of the factors on the intervention rates.

Figure 3 Mean intervention rates (‰) per PHCU without and with e-BI singly and in combination with training and support (TSeBI) and financial reimbursement (FReBI) over the measurement periods



Thus, for the first hypothesis (*the provision of each of training and support, financial reimbursement, and referral possibility to an internet-based method of delivering Advice (e-BI) will increase intervention rates compared to non-provision*), it was found that provision of training and support and of financialreimbursement increased intervention rates, largely due to increases in screening activity, whereas the offer of e-BI referral did not impact intervention rates.

For the second hypothesis (*the combination of training and support, financial reimbursement, and e-BI in pairs or all together will be more effective in increasing intervention rates compared to single-focused implementation strategies*), the combination of training and support plus financial

reimbursement was found to increase intervention rates more than either training and support or financial reimbursement alone.

For the third hypothesis (*patient and provider characteristics of PHCU will influence the impact of training and support, financial reimbursement, and e-BI on intervention rates during the 12 week implementation period*) neither provider nor patient characteristics affected the relationships between the impact of training and support, financial reimbursement, and e-BI on intervention rates.

For the fourth hypothesis (*intervention rates will drop off at six month follow-up, less so in the training and support group*), intervention rates did drop off at follow-up. Yet, the rates remained 41% higher with training and support than without.

Thus, 2-4 hours of training and support led to higher intervention rates during the 12-week implementation period, an effect that was partially maintained six months after the end of the implementation period. Modest financial reimbursement was associated with higher intervention rates for the time of reimbursement, an effect that was not maintained when the financial reimbursement ceased. The combination of training and support and financial reimbursement was far more effective in its association with higher intervention rates than either training and support or financial reimbursement alone.

4.2 Strengths and weaknesses

One strength of the present study is its factorial design, which ensured that it had sufficient power to detect small changes with a relatively small number of PHCU (120). Another strength of the study is that it was conducted across five different European jurisdictions, with differing health system financing and management structures. The hierarchical nature of the data (PHCU nested within jurisdictions) was taken into account in the analysis.

One weakness of the present study was that the outcome measures were of provider behaviour, rather than patient outcomes. Another weakness of the study is that the record sheet to measure AUDIT-C included the options for giving advice. In itself, this is an organizational intervention to support provider behaviour, although equal across all intervention groups. Completion of the record sheet was made by the provider, and the study had no independent check that the advice was actually carried out, or that a screen or advice were done without being registered on the record sheet.

4.3 Comparison with other studies

The impact of training and support is similar to the results of the World Health Organization four country (Australia, Belgium, Catalonia and England) collaborative randomized controlled trial which demonstrated the effectiveness of training and support in promoting screening and Intervention for hazardous and harmful alcohol consumption.[31, 32]Screening and advice rates were defined in the same way as in the present study, and intervention rates were calculated as the product of screening and advice rates. In the WHO study, one analysis compared general practitioners who had been randomly allocated into either a high training and support group or a control group.[32] The odds ratios for the impact of high training and support on increasing higher screening rates (defined as 20% or more) was 2.2 (95% CI=1.3 to 3.1) and on increasing higher intervention rates (defined as 10% or more) was 2.8 (95% CI = 1.6 to 4.0). [32]

In contrast, a cluster randomized controlled trial in the Netherlands, which investigated the impact of an improvement programme combining professional, organisation, and patient directed activities, with an emphasis on educational training and support visits by a trained facilitator, tailored to the

participants' needs and attitudes, failed to find an impact of the intervention on the number of adult patients who received screening and advice as measured in patients' electronic medical records and via self-administered questionnaires completed by the general practitioners.[33] One of the given reasons for failing to find an impact was sub-optimal implementation of the programme due to difficulties in recruiting GPs and in motivating GPs for participation in the tailored parts of the programme. Another given reason was that follow-up was at twelve months; whilst there were increased screening and advice rates in the short-term, these improvements did not persist at the twelve month follow-up.

5. Implications for service commissioners and policy makers

The potential of screening and brief advice programmes to improve health (and sometimes to reduce costs) has been shown elsewhere.[11,12] For example, in England, screening patients with AUDIT-C on registration with a family doctor would steadily capture about 40% of the population over a 10-year programme.[11]The registration approach, delivered by a practice nursewith subsequent five minutes of brief advice, would cost the health service £95 million over 10 years, offset by savings to the health care system of £215 million over 30 years. In contrast, screening patients at the next primary health care consultation would capture 96% of the population over a ten year period, but with high resourcing needs in the first year. The consultation approach, delivered by a doctor with subsequent five minutes of brief advice, would cost the health service £702 million over 10 years, offset by savings to the health care system of £594 million over 30 years.

With strong government support for alcohol brief interventions, reinforced by financial and performance management arrangements, guidance and strategic leadership, as well as training, it is possible to increase alcohol screening and brief interventions. In Scotland, population 5.2 million, Health Service Boards were required to deliver 271,611 alcohol brief interventions cumulatively over the period 2008/9 to 2012/13.[17, 34-36] To calculate the target, a primary care presentation rate of 190 potentially alcohol-related presentations per 1,000 population was estimated (presentations for mental disorders, injuries and gastrointestinal problems). It was estimated that 25% of these presentations would screen positive, and a cumulative target was set at 75% of those identified as requiring a brief intervention receiving one by 2012-2013. The number of alcohol brief interventions carried out between 2008/09 and 2012/13 was 366,184, exceeding the cumulative target of 271,611 by 94,573 interventions.

There is little doubt that internet-based screening and brief advice programmes have an impact in reducing alcohol consumption amongst those drinkers who use them.[23] We included the option of referral to an e-BI programme as one of the implementation strategies in the belief that this might encourage high screening rates, as providers did not then have to deliver a brief advice themselves. The failure of this strategy to impact on any of the rates would suggest that providers in this study are not yet ready to refer patients to e-BI programmes. We do not know if this is due to the fact that providers do not regard e-BI programmes as effective, if more training was needed, or if they found the referral process too complicated, and thus did not want to engage with it. Elsewhere, we have shown that providers who more strongly believe that heavy drinking is the drinker's own responsibility report that they are less likely to engage in delivering brief advice.[37] Thus, for the time being, it might be preferable to offer e-BI programmes directly to drinkers, rather than through their primary health care providers.

The ODHIN trial demonstrates that providing training and support to PHCU providers is associated with higher intervention rates, an effect still present at least six months after the training and support sessions. Given the modesty of training and support (less than 4 hours face-to face training),

it would be expedient to offer training and support in screening and brief advice programmes for heavy drinking to all PHCU providers.

The ODHIN trial also demonstrates that providing financial reimbursement for screening and advice activity is associated with higher intervention rates for the duration of financial reimbursement. When financial reimbursement is withdrawn, intervention rates drop to their baseline rates. Further, the combination of training and support plus financial reimbursement resulted in higher intervention rates than either training and support or financial reimbursement alone, at least for the duration of financial reimbursement. Thus, it might be worthwhile to consider implementing and testing a financial reimbursement programme to increase the volume of screening and brief advice activity. If financial reimbursement is to be introduced, it should be done in combination with training and support.

6. Acknowledgements

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