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Cost-effectiveness of strategies to improve delivery of brief interventions for heavy drinking in primary care: results from the ODHIN trial

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Abstract

Background

Screening and Brief Interventions (SBIs) for heavy drinking are an effective and cost-effective approach to reducing alcohol-related harm, yet delivery rates remain low. This study uses trial data to estimate the cost effectiveness of alternative strategies to increase SBI delivery.

Methods

Data from a large cluster-randomised trial were combined with the Sheffield Alcohol Policy Model, a policy appraisal tool, to estimate the cost effectiveness of eight strategies to increase SBI delivery in primary care in England, Poland and the Netherlands: care as usual (control), training and support (TS), financial reimbursement (FR), referral of patients to an online intervention (eBI) and all combinations of TS, FR and eBI. Cost-effectiveness was assessed from a healthcare perspective by comparing health benefits (measured in Quality-Adjusted Life Years (QALYs)) with total implementation costs and downstream healthcare savings for each strategy over a 30-year horizon and calculating Incremental Cost-Effectiveness Ratios (ICERs).

Results

All trialled strategies were cost-effective compared to control. TS combined with FR was the most cost-effective approach in England (more effective and less costly than control) and Poland (ICER €4,632 vs. next best strategy). This combination is not cost-effective in the Netherlands, where TS alone is the most cost-effective approach (ICER €3,386 vs. next best strategy).

Conclusions

Structured training and support, financial incentives and access to online interventions are all estimated to be cost-effective methods of improving delivery of alcohol brief interventions. TS and FR together may be the most cost-effective approach, however this is sensitive to country characteristics and alternative BI effect assumptions.

Trial registration

ClinicalTrials.gov trial identifier: NCT01501552

Key Words

Alcohol policy, Brief Interventions, Cost-Effectiveness, Implementation Science

Introduction

The harmful use of alcohol is one of the most important risk factors for disease, disability and death worldwide, with 4.2% of the global burden of disease and injury in 2016 estimated to be attributable to alcohol consumption (1). Besides these health consequences, alcohol-related harm is associated with significant negative economic and other impacts on society (2) and, as a result, there is an increasing awareness of negative effects of alcohol in public health policy (3).

Screening and Brief Interventions (SBI), delivered in primary care, have been shown to be an effective (4,5) and cost-effective, or even cost-saving (6), policy option for the reduction of alcohol-related harm, although there are significant variations in the potential impacts of SBI programmes between countries (7). In spite of this promise, delivery rates by primary health care practitioners have been found to be consistently low, with only around 1 in 20 eligible patients being screened (8). These rates compare extremely unfavourably to those for Brief Interventions for smoking, which are supported by a similarly robust evidence base, with a recent UK study finding an eightfold difference in Brief Intervention delivery rates for smoking and drinking (9).

A wide range of approaches, including the provision of training, support and financial reimbursement, have been identified as potentially effective levers to improve the uptake of SBIs among primary care practitioners (10). Online Brief Interventions (often referred to as eBI) have also emerged as a potentially effective alternative to face-to-face interventions which may reduce the burden on healthcare providers' time (11). The recent Optimising Delivery of Health care Interventions (ODHIN) trial tested the effects of several of these strategies on SBI delivery rates and demonstrated that training and support and financial reimbursement are effective, particularly in combination, at increasing uptake in primary care (12). These strategies, however, have costs attached to them and it is unclear whether these approaches are cost-effective and if this varies between countries. Previous cost-effectiveness studies in this area have focussed only on online interventions in settings outside primary care (e.g. (13–15)).

This study aims to address this gap by using the Sheffield Alcohol Policy Model, a widely-used alcohol policy appraisal tool which has previously been applied to assess the potential cost-effectiveness of SBIs across Europe (7,16,17), to evaluate the long-term cost-effectiveness in England, the Netherlands and Poland of training and support, financial incentives and referral to online interventions at improving SBI delivery and the resulting effects on population health outcomes. The findings will enable policy makers to understand the potential costs and benefits of engaging in such programmes and make more informed health policy decisions when allocating potentially scarce resources.

Methods

ODHIN Trial design

The ODHIN trial took place in 120 primary health care units (PHCUs) equally distributed across five countries (England, Netherlands, Poland, Catalonia and Sweden). The trial examined the impact of three alternative strategies for improving the uptake of Screening and Brief Intervention (SBI) delivery in primary care:

- Training and Support (TS) in which providers were offered two 1-2 hour face-to-face educational training sessions on SBI and follow-up telephone support
- Financial Reimbursement (FR) in which providers were offered financial incentives for screening and intervention delivery
- Referral to an Online Brief Intervention (eBI) in which providers were able to refer patients identified as risky drinkers to an online-based intervention.

Practices were randomised to either control or any combination of the three strategies (e.g. TS alone or FR together with eBI) to give eight arms in total. See the trial protocol or outcomes report for further details on the trial design (12,18).

Trial outcomes

The trial collected data on three key performance measures of SBI delivery:

1) The screening proportion – the proportion of eligible patients who were screened for heavy drinking using the AUDIT-C screening tool[1]
2) The screen positive proportion – the proportion of screened patients who were identified as heavy drinkers by the screening test[2].

[1] A small number of patients in Catalonia were screened using an alternative screening tool, ALRIS, although practitioners were encouraged to use AUDIT-C wherever possible.
[2] 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

3) The Brief Intervention proportion – the proportion of patients who screened positive on AUDIT-C who subsequently received a Brief Intervention

Trial data was collected at three time points – baseline (i.e. pre-intervention), during a 12-week implementation period at which time the strategies were being implemented, and during a 4-week follow-up period 6-months later (i.e. post-intervention). The baseline values of each measure were derived for each country, and the effect of each strategy on each measure during the implementation period and at follow-up, as presented in Table 1. See Appendix A for further details of this analysis. Whilst the trial took place across five countries, versions of the Sheffield Alcohol Policy Model, used to estimate the long-term costs and effects of the trialled strategies, were only available for three of these countries: England, Netherlands and Poland. Full details of these models have previously been published (16,19). The analysis presented here therefore focusses on these three countries.

TABLE 1 ABOUT HERE

For each country data was also collected on the costs associated with implementing each strategy, as summarised in Appendix B. Costs specific to organising the trial itself were excluded (e.g. the cost of printing the tally sheets used to record practitioners' SBI activity). Finally, full details of the structure of the financial incentives offered to providers in FR arms of the trial were collected (as each country set their own incentive structure using the budget allocated within the trial). This data was used to estimate, for each strategy in each country, the long-term costs of implementation in primary care at a national level using data on the total number of practitioners, practices and patients in each country. See Appendix B for full details.

Modelling health outcomes

The SBI delivery outcomes collected in the trial were converted into long-term health outcomes, in terms of Quality-Adjusted Life Years (QALYs) and healthcare costs associated with the treatment of alcohol-related health conditions, using the Sheffield Alcohol Policy Model (SAPM). SAPM is a causal epidemiological model which has previously been used to appraise pricing and SBI policies in England, the Netherlands and Poland (16,19,20) and whose findings have informed the development of primary care guidelines for the treatment of alcohol problems in the UK and the Netherlands (21,22). The model synthesises published evidence and country-specific data on current alcohol consumption, mortality and hospitalisation rates for 48 different alcohol-related health conditions, primary care usage, healthcare service utilisation costs and health-related quality of life data in order to estimate the proportion of the total adult population (18+ years) who would receive a brief intervention over a 10-year time horizon. The model then estimates the resulting changes in alcohol consumption and subsequent changes in mortality, hospitalisations and healthcare costs. Health outcomes are reported at a 30-year time horizon in order to account for the time lags which exist between changes in alcohol consumption and changes in risk of alcohol-related harm (23). Full methodological details of SAPM have previously been published elsewhere (24,25).

A key challenge in estimating the impact of the trial strategies on SBI delivery over a 10-year period is that, whilst Training & Support and eBI strategies are essentially 'one-off' policies, in the sense that practitioners are trained or introduced to the eBI tool at the outset and not subsequently re-trained, Financial Reimbursement requires continuous investment. The follow-up measures are therefore not directly comparable across all strategies as practices allocated to TS and eBI strategies were essentially still under implementation conditions (e.g. practitioners could still refer patients to the eBI tool), whilst those allocated to FR strategies were not under implementation conditions, as no further payments were made after the 12-week implementation period. In order to overcome this issue, two separate long-term analyses were conducted. First, a 'trial only' analysis models exactly what was implemented in the trial (i.e. FR withdrawn after 12 weeks) and assumes that the effects observed at follow-up would be sustained in the long term. Second, a 'full implementation' analysis models FR payments

continuing for the full 10 years and assumes, as observed in previous SBI studies (e.g. (26)), that the effect of these on provider behaviour is maintained in the long term. As a sensitivity analysis within the full implementation analysis, we also examine the impact of assuming that training must be re-delivered every five, or every two, years in order to achieve this persistence of effect.

In order to incorporate the three SBI delivery measures recorded in the trial into SAPM, two modifications are required to the country-specific models. First, the probability that any individual who receives a screen, screens positive is estimated from their alcohol consumption and demographic characteristics using a logistic regression whose parameters are calibrated to ensure that the modelled screen positive proportion matches that estimated from the trial data –see Appendix C for full details. Second, the model was adapted to account for the fact that not all patients who screen positive actually receive an intervention in practice using data from the trial as reported in Table 1. Receipt of an intervention is assumed to lead to a 12.3% reduction in mean alcohol consumption in line with evidence from a Cochrane review on the effectiveness of BIs in primary care (4). This reduction is assumed to decay linearly back to age-adjusted pre-intervention consumption levels over the following 7 years as suggested by long-term follow up evidence from a previous trial (27). Due to the uncertainty in this persistence of effect, we test a more conservative assumption of 3 years in a sensitivity analysis. It is assumed that no individuals are screened more than once over the 10-year SBI implementation period.

Health Economic analysis

For each of the three countries (England, Netherlands and Poland), for each of the eight strategies (control, TS, FR, eBI, TS+FR, TS+eBI, FR+eBI, TS+FR+eBI), we conducted three primary analyses. Firstly, we model the number of BIs delivered and the associated implementation and delivery costs over the 9 month trial period. This produces a 'within-trial' estimate of the cost per additional BI delivered over control. Subsequently we present a full long-term cost-utility analysis for each of the two scenarios ('trial only' and 'full implementation') from the perspective of the health care system.

Total QALYs accrued in each scenario are estimated from SAPM alongside estimates of the healthcare costs associated with alcohol. These are combined with the estimated costs of implementing the eight strategies and the costs associated with actual SBI delivery for each country to estimate the net cost of each strategy over 30 years. Within each country and scenario, these net costs and QALY gains are compared to give Incremental Cost-Effectiveness Ratios (ICERs) for every strategy. These are compared to national cost-effectiveness thresholds to determine the most cost-effective strategy for each country under each scenario. All costs are converted to 2016 Euros using OECD Purchasing Power Parities (28) and all costs and health benefits are discounted using locally-appropriate discount rates for each country (see Appendix D for full details).

Results

Within-trial analysis

Results from the within-trial analysis in Table 2 show that all strategies are estimated to increase the numbers of BIs delivered across the population in all countries. TS+FR is the most effective strategy at increasing BI delivery, although it has one of the highest marginal costs for each additional BI delivered across all three countries. In contrast, eBI appears to offer the cheapest way to achieve delivery of additional BIs, although it is among the least effective strategies overall.

TABLE 2 ABOUT HERE

Trial only cost-effectiveness analysis

Results from the trial only analysis in Table 3 show that TS+FR is the strategy which produces the largest health benefits while remaining cost-effective across all three countries. The ICERS of €3,257, €3,953 and €8,319 in England, the Netherlands and Poland respectively compared to the next-best alternative are all substantially lower than the respective thresholds of €22,918, €20,000 and €14,666 below which interventions are generally considered cost-effective. In both England and the Netherlands the FR strategy dominates control (i.e. it produces greater health benefits while costing less), although the scale of savings is very different between the two countries (€150m and €7.8m respectively). Both TS and TS+FR strategies incur a net cost to the healthcare system in Poland, with the most effective strategy, TS+FR, costing €6.8m over 30 years compared to control. Estimated health gains under TS+FR are also larger in England, at 15,400 QALYs over 30 years compared to 2,400 in the Netherlands and 2,600 in Poland. Full results for all strategies can be found in Appendix E.

TABLE 3 ABOUT HERE

Full implementation analysis

Assuming that the costs and impacts of FR are maintained at implementation levels across the modelled 10-year implementation period leads to broadly similar results, shown in Table 4. TS+FR is still the optimal strategy in England and Poland, but the incremental analysis shows that it is no longer cost-effective in the Netherlands compared to TS alone (ICER €29,952). As for the within-trial analysis, the optimal strategies are estimated to be cost saving in England and the Netherlands, but not Poland, and the health gains in England are significantly larger than in the other countries. Full results for all strategies can be found in Appendix F.

TABLE 4 ABOUT HERE

Sensitivity analyses

In order to investigate the uncertainty in our assumptions of continued effectiveness for strategies other than FR in the longer-term in the full implementation analysis, we tested the assumption that training had to be re-delivered every 5 or every 2 years in order to achieve this persistence of effect (at the same cost as the original training, before discounting). Full results for these alternative assumptions can be found in Appendix G.

These alternative assumptions lead to significant increases in the costs associated with implementing all strategies involving Training & Support. For example, the cost over 10 years of delivering TS in the Netherlands increased from €8.6m to €15.9m with retraining every 5 years and €36.9m with retraining every 2 years. However, these increased costs made little difference to the overall cost-effectiveness results and the overall conclusions of the analysis. The only significant change is that TS ceases to be cost-effective in the Netherlands if re-training is required every 2 years, with eBI referral becoming the most cost-effective option under this scenario.

Finally, we tested the impact on the trial only analysis of assuming a shorter persistence of effect of BI receipt on alcohol consumption. Full results for this can be found in Appendix H. As may be

expected the overall cost-effectiveness is reduced for all strategies, however TS+FR remains the most cost-effective option for both England and the Netherlands, with ICERS of €21,668 and €13,413 respectively. In contrast, this alternative assumption means that TS+FR is no longer estimated to be cost-effective in Poland, with TS alone offering the most cost-effective strategy with an ICER of €2,609

Discussion

The findings of this study highlight that current SBI delivery rates in primary care are extremely low, while demonstrating that several cost-effective strategies exist to increase these rates. This analysis, which presents the first available estimates of the cost-effectiveness of strategies to increase these proportions, consistently shows that Training and Support or Training and Support in combination with Financial Reimbursement are effective and cost-effective strategies for increasing these delivery proportions. Modelling using only the trial data suggests that TS+FR is the most cost-effective strategy in all countries, whilst assuming that increased screening proportions in practices receiving FR would be maintained if incentives continued to be paid makes TS+FR the optimal strategy in two of the three modelled countries, with TS alone the best option in the Netherlands. Sensitivity analyses show that these results are generally robust to more pessimistic assumptions of long-term effectiveness, although TS+FR may not to be cost-effective in Poland if the duration of effect of BIs is shorter than we have assumed in our base case. Whilst eBI alone is the least costly way of increasing BI delivery, and is estimated to be cost-effective versus control, as suggested by studies in other settings (13,15), this analysis shows that it is dominated by other strategies (i.e. it is less effective and costs more).

There are a number of limitations to the methods used in this study, including those limitations inherent to SAPM which have been widely discussed previously (16,17,19,24), for example we do not model individuals who do not engage with primary care services, or explicitly model individual trajectories of alcohol consumption across the life course. There are also a number of assumptions relating to the trial data that should be considered alongside the results of this analysis. These include assumptions around the ongoing effect on provider behaviour of the eight strategies after the 6-month follow-up in the trial. We have examined some of these assumptions in sensitivity analyses and it should be noted that other more pessimistic assumptions of long-term effects would lead to implementation levels somewhere between the ‘trial-only’ and ‘full implementation’ analyses

presented here. As both of these produce similar results, it is unlikely that reduced long-term effects would alter our conclusions. A further consideration is that the trial did not collect data on the demographics (or alcohol consumption) of those patients who consulted with, but were not screened by, participating practitioners. It is therefore difficult to determine whether the increased proportion of patients screening positive were a consequence of practitioners screening patients from different population groups which have a higher prevalence of risky drinking behaviour, or practitioners screening the same number of patients in each population group but with more successful identification of risky drinkers within each group. We have assumed the latter, but the impact of this assumption on the model results is unclear, as it will depend on the distribution of alcohol consumption and alcohol-related harms across the population in each country. We have used scenario analysis to explore key uncertainties in the model, however we have not been able to consider joint uncertainty across multiple input parameters, or attempt a full probabilistic analysis of uncertainty. Finally, as the focus of BI delivery in Europe is generally on early identification of potentially harmful drinking we have not explicitly modelled referral of patients identified as having some form of Alcohol Use Disorder to specialist treatment. As treatment itself is highly likely to be cost-saving (29,30) this exclusion means our estimates are likely to underestimate the true cost-effectiveness of each strategy.

The finding that SBI programmes themselves are cost-effective has been widely replicated in many studies across many countries (e.g. (31,32)), however the costs and health benefits of such programmes between countries are likely to vary significantly (33). This is due to variation in underlying factors such as alcohol consumption, primary care usage, alcohol-related health and healthcare system costs as well as population (7). It is therefore perhaps unsurprising that the findings of this study suggest considerably variation in both costs and benefits of each strategy between countries, particularly since the trial results have shown there is additional variation between countries in terms of current screening. In spite of this heterogeneity, several clear patterns in the results that suggest some findings from this study may be generalizable to other countries with different healthcare systems and drinking cultures. Across all countries, TS is a relatively low-cost but

effective policy option, while the addition of FR roughly doubles the health benefits at substantial additional cost. Across all countries, in spite of the relatively low cost of implementation and delivery of eBI programmes, these were consistently found to be less cost-effective than other strategies, perhaps related to a lack of familiarity or trust among practitioners of its efficacy (12,34).

Whilst these results provide strong support for training programmes and the introduction of financial incentives, further research should address the questions of how to design training and support programmes and financial incentive structures to achieve maximum engagement with practitioners. One possibility, which could also potentially reduce training costs in the longer term, may be to embed an SBI component into routine training for primary care practitioners. Consideration for variation in provider response to different strategies, e.g. if training is more effective at encouraging practitioners who have not previously been delivering SBIs to start, or whether the effect is achieved through increasing delivery levels among practitioners who were already active, would also help in designing more effective, tailored approaches to increasing the delivery of Brief Interventions. Finally, relatively little is understood about the ways in which different subgroups of the population may respond to Brief Interventions and whether, as a result, greater effects on population health can be achieved through targeting interventions at certain patient groups.

The findings of this study show that providing primary care providers with tailored training and support, financial incentives and the option to refer patients to an online intervention, either alone or in combination, are likely to be cost-effective options compared to providing no support or incentives to practitioners. Policy makers may, however, be mindful of the potential ethical issues associated with offering financial incentives to healthcare practitioners (35,36). Training and support and financial incentives together may offer the most cost-effective strategy for increasing delivery of Screening and Brief Interventions and so reducing alcohol-related harm and associated costs to society, although this finding is sensitive to both the characteristics of the country and also assumptions around the long-term effects of BIs.

Conflict of Interest

CA has received funding related to commissioned research from Systembolaget and Alko, the Swedish and Finnish government-owned alcohol retail monopolies. PA has received fees from AB InBev for public health comment on its goals to reduce the harmful use of alcohol, outside the submitted work. JL, ER, SP and AB have no interests to declare.

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Key Points

- Current provision of Screening and Brief Advice in primary care is low across Europe
- Training and Support, Financial Reimbursement and the opportunity to refer patients to an online tool, and all combinations of these strategies are likely to be cost-effective compared to current practice
- Training and Support in combination with Financial Reimbursement is the most effective strategy at increasing SBI delivery, but also the most costly and as a result may not be cost-effective in all countries
- Referring patients to an online Brief Intervention is a low-cost way of increasing SBI delivery, although the scale of increase may be modest and other, more costly options are likely to be more cost-effective overall

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Table 1 - Baseline Screening and Brief Intervention rates and the impact on these as estimated from the ODHIN trial

		Screening proportion	Screen positive proportion	Brief Intervention proportion
Baseline				
Country	**England**	4.6%	48.9%	85.9%
	Netherlands	5.3%	44.4%	70.4%
	Poland	2.0%	41.2%	95.8%
Change between baseline and implementation				
Strategy	**Control**	-45.8%	-7.1%	0.2%
	TS	59.8%	-7.4%	21.2%
	FR	90.7%	-12.5%	18.2%
	eBI	12.5%	3.8%	14.0%
	TS+FR	129.5%	-15.8%	24.8%
	TS+eBI	28.0%	-4.0%	17.8%
	FR+eBI	43.1%	-6.3%	14.9%
	TS+FR+eBI	68.2%	-20.6%	22.9%
Change between baseline and follow-up				
Strategy	**Control**	-37.5%	-8.4%	-22.1%
	TS	-9.5%	-17.6%	7.5%
	FR	-7.6%	-16.8%	3.8%
	eBI	-20.0%	-1.4%	1.2%
	TS+FR	3.2%	-27.8%	10.0%
	TS+eBI	-8.3%	-18.7%	3.1%
	FR+eBI	-20.1%	-13.4%	3.8%
	TS+FR+eBI	10.7%	-35.3%	4.4%

Table 2 – Estimated additional Brief Interventions delivered and associated costs compared to control over trial period

	Additional BIs delivered			Cost per additional BI		
	England	**Netherlands**	**Poland**	**England**	**Netherlands**	**Poland**
TS	399,247	209,344	72,615	€ 38	€ 33	€ 18
FR	433,430	302,798	103,166	€ 40	€ 29	€ 16
eBI	290,112	202,927	96,203	€ 25	€ 17	€ 5
TS+FR	517,849	451,470	116,390	€ 41	€ 24	€ 19
TS+eBI	266,193	180,936	29,294	€ 31	€ 21	€ 7
FR+eBI	315,354	206,759	12,411	€ 27	€ 22	€ 15
TS+FR+eBI	306,728	363,923	98,261	€ 37	€ 20	€ 10

Table 3 – Trial-only analysis results for cost-effective strategies

Country	Strategy	Net cost of programme (€m)	Net QALY gain vs. no SBIs (,000s)	Incremental cost (€m)	Incremental QALYs (,000s)	ICER (per QALY)
England	Control	-35.5	4.6			
	FR	-150.0	18.5	-114.5	13.8	Dominates
	TS+FR	-145.1	20.0	4.8	1.5	€ 3,257
Netherlands	Control	-4.0	1.0			
	FR	-7.8	2.3	-3.9	1.3	Dominates
	TS+FR	-3.4	3.4	4.5	1.1	€ 3,953
Poland	Control	0.8	0.1			
	TS	3.3	2.2	2.5	2.1	€ 1,168
	TS+FR	7.6	2.7	4.2	0.5	€ 8,319

Table 4 – Full implementation analysis results for cost-effective strategies

Country	Strategy	Net cost of programme (€m)	Net QALY gain vs. no SBIs (,000s)	Incremental cost (€m)	Incremental QALYs (,000s)	ICER (per QALY)
England	Control	-35.4	4.6			
	TS+FR	-233.8	38.0	-198.4	33.4	Dominates
Netherlands	Control	-4.0	1.0			
	eBI	-7.9	1.3	-3.9	0.4	Dominates
	TS	-3.9	2.5	4.0	1.2	€ 3,386
Poland	Control	0.8	0.1			
	TS	3.3	2.2	2.5	2.1	€ 1,168
	TS+FR	18.5	5.5	15.2	3.3	€ 4,632