INTRODUCTION

Alcohol-related disorders show a high prevalence in general practice, with prevalence estimates ranging from 4% to 29% in international populations (Reid et al., 1999). Seventy percent of patients with alcohol problems in Germany see their general practitioner (GP) at least once a year, but not necessarily because of their alcohol problem (Mann, 2002). So primary care health workers are considered to play a key role in the detection of patients with hazardous alcohol consumption, and general practices are claimed to be the ideal place for primary and secondary prevention of alcohol-related disorders (U.S. Preventive Services Task Force, 1996). However, less than half of the patients who require treatment concerning an alcohol problem are correctly identified by physicians (Kaner et al., 2001a; Berner et al., 2007). Only few GPs screen their patients for alcohol-related disorders (Spandorfer et al., 1999). Often alcohol-related disorders are either not correctly or too late identified (Berner et al., 2007; Kaner et al., 2001a), and formal ICD-10: (International Classification of Diseases, 10th Revision) criteria are hardly used (Berner, Zeidler et al., 2006c). Physicians also perceive a high demand for information (Berner, Härter et al., 2006b), but studies and continuing education do not adequately prepare them for the treatment of patients with alcohol-related disorders (Berner, Zeidler et al., 2006c; Geller et al., 1989; Kaner et al., 2001b). GPs name three central barriers for an effective treatment of patients with alcohol-related disorders: the negative impact the advice might have on the relationship to the patient, lack of time and insufficient training during education (Beich et al., 2002; Kaner et al., 1999a). Strategies to improve this are seen in the implementation of better screening and intervention techniques, an optimized education, campaigns for health education and better possibilities of payment (Andreason et al., 2000; Beich et al., 2002; Kaner et al., 1999a).

But the situation and problems of GPs in Germany in general have to be considered, too. They have a gatekeeper function in the German health care system and are the first contact point for a great number of patients. There is a lack of referral possibilities, and they are also under pressure to treat a lot of patients because their payment depends on the number of patients they treat.

Various studies have investigated the efficacy of the implementation of primary-care-based alcohol interventions and documented their efficacy (Bien et al., 1993; Kaner et al., 1999a; Curry et al., 2003), but there are fewer studies dealing with the first step of introducing alcohol interventions into clinical practice, that is, the dissemination of such intervention programmes (Kaner et al., 1999b; Lock et al., 1999).

In the first funding period of the project ‘Outpatient Quality Management of Alcohol-Related Disorders in Primary Care’, funded by the German Ministry for Education and Research, a comprehensive quality management system for alcohol-related disorders in primary care was developed (Mänz et al., 2003; Berner et al., 2007). It includes practice guidelines, screening and documentation materials and is based on a con-
tent analysis of guidelines (Berner et al., 2004), outpatient care (Berner, Härter et al., 2006b, 2006c) and the analysis of diagnostic instruments (Berner et al., 2006a).

The objective of the subsequent 3-year, bi-centre project presented here was to investigate different dissemination strategies of an online version of the quality improvement programme for alcohol-related disorders into general practice in South Baden and South Württemberg in Germany. In addition, we investigated further factors influencing the use of the system. Through the development of an online system and the use of the Internet, we offered physicians the advantage of flexibility of time and place and easy access to high-quality information on the topic of alcohol-related disorders.

METHODS

Design

We assessed the effectiveness of three different strategies for disseminating the online system in terms of its acceptance at the level of general practice: Strategy 1: access to the system and GP training; Strategy 2: access to the system and GP and practice team training; Strategy 3: access to the system without any training. The primary hypothesis was that educating practice nurses in addition to physicians would increase the acceptance of the system in comparison to educating physicians alone, and that both strategies would be superior to a dissemination strategy without any additional training. We used a cluster-randomized controlled trial with practice as the unit of randomization because this approach provides the most robust design for the evaluation of different dissemination strategies into practice.

Participants

In June 2006, all GPs in 12 districts (n=2647) of South Baden and South Württemberg in Germany were invited to participate in the study. They were sent a letter with a short explanation of the study and a fax reply to send back. On the fax reply, they were able to state interest in more information about the study or no interest and their reasons for not being interested in the study. The interested GPs got further information and were randomized after having completed a short questionnaire on practice and personal characteristics.

Inclusion criteria were the use of broadband Internet and a practice team consisting of at least one nurse. No explicit exclusion criteria for GPs were defined, and all willing physicians in the region of South Baden–Württemberg were included in the trial. Patients were recruited and documented by the GPs. Physicians were required to ask a maximum of 10 patients with an alcohol-related disorder (at-risk drinking, harmful drinking or alcohol dependence—judged by the GPs), who visited the practices for consultation in a 6-month interval, to participate in the trial. All patients who provided informed consent were included, and no explicit exclusion criteria were defined.

Randomization

We randomized 112 practices to the three Strategy groups by minimization, a valid alternative to ordinary randomization in small trials (Altman and Bland, 2005). Study centre, size of the practice team and Internet know-how of the GPs were used as factors in the minimization process. As we were dis-

seminating an online system, Internet know-how was assumed as an important factor to balance. Because of the fact that one of the dissemination Strategies was the integration of the practice team, the size of the practice team was considered as a further important factor. To keep the size of the groups for the additional training equal in each centre, we used study centre as a third factor in the randomization process. In another study (Ruf et al., 2009), we investigated the impact of socio-demographic factors on the use of online continuing medical education (CME) and found a very low impact of these variables in univariate analyses, but hours spent on the Internet per week, as one indicator for Internet know-how, was associated with a higher use of online CME in multivariable analyses. Due to the fact that the number of factors that can be considered in the minimization process is limited, we decided to consider the factors that seemed to be more relevant than socio-demographic ones.

The allocation sequence was generated using the software MINIM v1.5 by a researcher who was blind to the identity of the practices. The primary care physicians were blind to the allocation sequence until the intervention was performed. Patients were blind to the allocation of the physicians in all phases of the trial.

Procedures

Online system www.alkohol-leitlinie.de. In the first step, the system developed in the first funding period was optimized and transformed into an electronic version. The online system was developed on the basis of a needs assessment (Ruf et al., 2008b). The website, www.alkohol-leitlinie.de, offers extensive information for physicians and other experts working with patients with alcohol-related disorders. A guideline, an e-learning tool and a documentation system for baseline and follow-up are available on the site. The main parts of the documentation system are: socio-demographic data, diagnostic assessment by the GP, AUDIT-C (three alcohol consumption questions from the Alcohol Use Disorders Identification Test; Bush et al., 1998), ICD-10 criteria, treatment and referral. Additionally available information includes printable material and links (Ruf et al., 2006).

Thus, the system offers GPs the possibility to learn about guideline-based information on diagnostic assessment and treatment of alcohol-related disorders through an e-learning tool and the documentation–feedback system by documenting their own patients.

Training and implementation programme. The training for the intervention groups was carried out in November 2006. In Strategy 1, physicians received a 4-h central training session that included an introduction to the topic of alcohol-related disorders, the developed online system, exercises at the computer to test the system and a discussion of the transfer of the system into practice. In Strategy 2, physicians and the practice team received a training session. The training for the physicians was the same as in the first intervention group. However, while the physicians were doing the exercises at the computer, the nurses received an introduction to the guidelines and possible responsibilities of nurses in the treatment of patients with alcohol-related disorders. In the final part of the training, the transfer of the system into practice was discussed together with physicians and nurses. In Strategy 3, physicians were given access to the online system but received no training.
Further procedures. After the training (for those who received it), all practices were contacted by telephone to solve possible technological problems with the system. The physicians were then required to draw up baseline documentation in the online system for a maximum of 10 patients with an alcohol-related disorder in a 6-month period. Four months after completing the baseline documentation, they received an automatic mail reminding them to complete a follow-up documentation. They were not contacted between baseline and follow-up.

Baseline data were collected from December 2006 to May 2007 by the GP practices. The follow-up documentation had to be completed 3–4 months after baseline documentation in each case, meaning that the data collection lasted until September 2007 in order to include follow-up documentations for all baseline documentations carried out up to May 2007.

Outcomes. The primary outcome was the acceptance and use of the system (registration and at least one login). Secondary outcomes were: (i) number of logins (due to the non-normal distribution of variables, this was collapsed into categories); (ii) time spent logged in (due to the non-normal distribution of variables, this was also collapsed into categories); (iii) accomplishment of CME module; (iv) at least one patient documentation at baseline; (v) at least one patient documentation at follow-up; (vi) proportion of correct diagnoses (diagnostic assessment of the GP compared with ICD-10 diagnosis—both the assessment by the GP (at-risk drinking, harmful drinking or alcohol dependence) and the ICD-10 criteria for harmful drinking and alcohol dependence were included in the documentation system); (vii) combined correct treatment and referral rate, i.e. the proportion of treated/referred patients in accordance with guideline recommendations; and (viii) change in the severity of the alcohol problem after 3 months’ treatment (reduction of AUDIT-C score from baseline to follow-up).

Statistical methods. Physicians and patients were described using descriptive statistical methods.

Characteristics and outcomes of patients who visited the same GP are likely to be more similar than those of patients treated by different GPs. This clustered structure of the data (with the GPs being higher level and the patients of lower level) was accounted for by an adjustment for the clustering effect in patient-based analyses. For this procedure, a method by Wears (Wears 2002) was applied, which adjusts statistical parameters using the variance inflation factor (VIF, also called design effect).

Differences between groups were tested using a χ² statistic (Fisher’s exact test in the case of low cell frequencies) in the case of nominally scaled variables and using t-test in the case of interval-scaled variables. Between-group differences were examined in order (i) to test for an intervention effect on outcomes, (ii) to test for baseline differences, and (iii) to test for differences between completers and drop-outs. Furthermore, an exploratory logistic regression analysis was performed to examine further influences on the primary outcome.

A primary intention-to-treat (ITT) analysis was performed including all physicians who were randomized. Additionally, a per-protocol (PP) analysis of completers and an as-treated (AT) analysis were performed. Results with a probability of a type 1 (alpha) error of <0.05 were considered as statistically significant. Findings with a corresponding error level of <0.10 were termed as a trend and were also reported. All statistical analyses were carried out using SPSS 14.0 (Chicago, IL, USA).

Ethical approval. The protocol of the project ‘Outpatient Quality Management of Alcohol-Related Disorders in Primary Care,’ of which context this study was conducted in, was approved by the local ethics committee at the University Medical Centre, Freiburg.

RESULTS

Participant flow

Of the invited 2647 GPs, 2160 did not answer at all, 371 refused to take part and four did not meet the inclusion criteria; 343 of the GPs refusing to take part named one or more reasons for their decision; 40% of them named lack of time as a reason, 20% no interest in the topic of alcohol-related disorders, 17% no Internet access and 12% no Internet offers; 26% named other reasons, e.g. that they would soon be leaving or were already retired.

One hundred and twelve (4%) practices agreed to participate and were randomized. There were no statistically significant differences between the contacted practices and the randomized ones concerning sex and specialization.

In the ITT analysis, we analysed 43 practices in Strategy 1 (GP group: training only for the GPs), 42 practices in Strategy 2 (GP+nurse group: training for the GPs and the practice team) and 27 in Strategy 3 (no training). Twenty-eight of the 43 practices allocated to Strategy 1 actually took part in the training; 10 of the 42 practices allocated to Strategy 2 (GP+nurse) took part with the GP and nurses, and eight participated with the GP but without nurses.

Fig. 1 shows the number of practices in each group for the ITT analysis, the PP analysis and the AT analysis and the number of baseline and follow-up documentations.

The drop-out rate of practices was significantly higher in the GP+nurse group, but there were no differences concerning sex, age, population of the town/city, patients seen per quarter and Internet know-how.

Baseline data

Table 1 shows baseline information for each group and for the whole sample for the physician cluster and individual levels. There were no statistically significant differences on any variables.

Across all groups, 65.2% of the physicians were male, the mean age was 51.5 years (SD=7.1) and they had been in practice for an average of 14.5 years (SD=8.9); 83.8% were general practitioners and 16.2% were specialists in internal medicine; 34.8% of the physicians worked in practices with more than one physician.

Of the patients, 73.6% were male (mean age 54.2 years (SD=10.4)); 85.7% had an AUDIT-C score ≥5 14.3% <5 (GPs were asked to document only patients they assumed to have an alcohol-related disorder).

ITT analysis of primary and secondary outcomes

No significant differences were found for ‘use of the system’ (primary outcome, defined by at least one login). Also, 41.9% in the GP group, 42.9% in the GP+nurse group and 44.4% in the control group had logged in at least once.
Number of logins (secondary outcome) was significantly different between groups ($P=0.019$). In the GP group, 55.6% of the GPs with at least one login showed six or more logins, while this lay at 33.3% in the GP+nurse group and 8.3% in the control group. There were no statistically significant differences between the groups regarding time spent logged in, CME accomplishment and baseline and follow-up documentation.

There was a significant difference in the correctness of the diagnostic assessment of the GPs in the documentation ($P=0.034$). Moreover, 72.2% of diagnoses in the GP group, 69.7% in the GP+nurse group and 36.4% in the control group were correct according to ICD-10 criteria. There was no significant difference between the groups concerning correct referral and reduction of AUDIT-C score from baseline to follow-up. Table 2 shows the results in detail.

**PP analysis of primary and secondary outcomes**

There was no significant difference between the three groups in the primary outcome (at least one login) within the PP analysis (Table 3). Number of logins was significantly higher in the two intervention groups ($P=0.032$), and the diagnostic assess-
The intervention was more often correct in the intervention groups ($P = 0.006$). The only difference compared to the ITT analysis was that the intervention groups showed more follow-up documentations ($P = 0.025$).

**AT analysis of primary and secondary outcomes**

Within the AT analysis, no differences were found in the primary outcome between the three groups. In the intervention groups, there was a higher number of logins ($P = 0.002$), more correct diagnoses ($P = 0.011$; Table 4) and significantly more baseline and follow-up documentations ($P < 0.001$).

**Exploration of further effects**

The training in the intervention groups had no effect on the use of the system (primary outcome). Sex, age, patients seen per quarter and number of patients with alcohol-related disor-
ders seen also had no effect on system use. Population of the town/city and Internet know-how showed a significant influence on system use (Fig. 2). The lower the population in the respective city, the higher the use of the system (odds ratio, OR=0.17), and the higher the Internet know-how, the higher the use of the system (OR=2.00).

**DISCUSSION**

The aim of the presented study was to compare the effects of different dissemination strategies of an Internet-based information and continuing medical education system for alcohol-related disorders into routine care. The study addresses the im-

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<th>Table 2. Intention-to-treat analysis</th>
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<td>GP group (n=43)</td>
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<td>System use</td>
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<td>At least one login (%)</td>
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<td>Number of logins (%)</td>
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<td>Time spent logged in (%)</td>
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<td>CME module accomplished (%)</td>
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<td>At least one patient documentation at baseline (%)</td>
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**Clinical outcomes**

| Diagnosis | n=36 | n=33 | n=22 |
| correct diagnosis (%) | 26 (72.2) | 23 (69.7) | 8 (36.4) |
| Referral | n=33 | n=32 | n=19 |
| correct referral (%) | 27 (81.8) | 27 (84.4) | 14 (73.7) |
| AUDIT-C | n=29 | n=33 | n=18 |
| Reduction of AUDIT-C score from baseline to follow-up (%) | 12 (41.4) | 24 (72.7) | 11 (61.1) |

*of GPs with at least one login.
**cluster correction.
CME= continuing medical education; df= degrees of freedom; Ex. Test= Fisher’s exact test.

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<th>Table 3. Per-protocol analysis</th>
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<td>GP group (n=28)</td>
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<td>At least one patient documentation at follow-up (%)</td>
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**Clinical outcomes**

| Diagnosis | n=36 | n=21 | n=22 |
| correct diagnosis (%) | 26 (72.2) | 18 (85.7) | 8 (36.4) |
| Referral | n=33 | n=20 | n=19 |
| correct referral (%) | 27 (81.8) | 16 (80.0) | 14 (73.7) |
| AUDIT-C | n=29 | n=21 | n=18 |
| Reduction of AUDIT-C—score from baseline to follow-up (%) | 12 (41.4) | 15 (71.4) | 11 (61.1) |

*of GPs with at least one login.
**cluster correction.
CME= continuing medical education; df= degrees of freedom; Ex. Test= Fisher’s exact test.
important issue of transfer of research findings into practice in the area of alcohol-related disorders. The knowledge transfer in our study uses the opportunities and advantages of the Internet, which offers an easy and broad dissemination of information, by developing an online system. The study also takes into account the importance of integrating the whole practice team in the treatment of patients with alcohol-related disorders (Kaner et al., 2003) by offering additional training for the whole practice team as one dissemination strategy.

The results of the RCT showed no significant group differences concerning the acceptance of the system, with about 40% of the GPs in all groups logging in at least once. The study results raise the question of why none of the dissemination strategies was able to achieve a higher amount than approximately 40% of GPs using the system. Our study showed that Internet know-how had an effect — the higher the know-how, the higher the use of the system. However, considering the fact that all GPs had the possibility to call a
support helpline, it might be argued that Internet know-how cannot be seen as a central reason for not using the system. However, with future generations of physicians all having grown up with the Internet, a lack of Internet know-how will in any case no longer be a reason in the future for GPs not to use online systems. Nevertheless, a further main impediment might be the fact that still only half of physicians have Internet access in their practices by now (Ruf et al., 2008b). Another factor for the limited use of the system might be lack of time and prioritisation, although an Internet-based system offers the opportunity to tackle the time problem due to its high flexibility concerning time and place of use (Ruf et al., 2008a). Interestingly, our system seemed to provide such help for GPs living in smaller towns/cities, where the participation in a training session might require more time for travel than in larger cities. The lower the population of the city, the higher the use of the system. However, considering the parts of the system which were used less, more complex and time-consuming parts like the CME module and the documentation tool were hardly used. These two parts were the only ones for which a registration and login was mandatory. Thus, fast and easy access seems to be very important. Due to the fact that we were only able to count the GPs who logged in, we cannot rule out that more than the approximately 40% of the GPs in each group actually used the system, as they might have been only using the parts of the system for which logging in was unnecessary. However, the system was designed to enable the user to access as many parts as possible without a login since passwords were identified as a major barrier for using online offers (Cook et al., 2005).

Another problem was that the dissemination strategy with an additional training session for the GPs and the practice team was not really implemented successfully - only ten physicians took part in the training together with their nurses (Ruf et al., 2007). It might be argued that the low incentive for nurses to attend the training might be responsible for this. In addition, many physicians also do not want to integrate their practice team into the treatment of patients with alcohol-related disorders and might therefore not have encouraged their nurses to attend the training session. However, in our opinion, the importance and the advantages of the integration of the practice team into the care of patients with alcohol-related disorders has to be made clear to the target group.

The training appeared to have an impact on the diagnostic assessments of the GPs. In the groups with additional training, their diagnoses were more often correct. Nevertheless, these results are based on a small sample of GPs, and the effort involved in the training was high and the attendance of the GPs participating in the training low. Thus, further cost-effectiveness studies should investigate whether the effort involved in providing training additionally to the system is justified.

Some methodological shortcomings of the present study should be considered. Only 112 of the invited 2,647 practices ultimately took part in the study. Although representativeness of the sample for the reference population can be assumed regarding gender and qualifications, other factors (e.g. attitude towards the use of the Internet and of online CME) might have led to a self-selective non-responder bias, meaning that we cannot rule out a specific motivational bias. Moreover, the amount of practices which received the per-protocol intervention was only about 65% in the GP group and as low as 24% in the GP+nurse group. The number of documented patients by the GPs was low, but concerning socio-demographic characteristics the patient sample is comparable to patient samples of other German primary care studies with larger samples (Berner et al., 2006c; Berner et al., 2007). The low number of documented patients limits the power of the conclusions concerning clinical outcomes, but these outcomes were secondary, the primary outcome was measured on GP level.

The results of the study are based on a selective practice population, meaning that generalisability is limited. Nevertheless, the fact that the per-protocol analysis and the as-treated analysis show very similar results to the intention-to-treat analysis suggests robustness of the results of the intention-to-treat analysis.

In our study, it was possible to motivate at least 44% of the GPs in the control group to use the system merely by the simple transfer strategy of telling them the Internet address. An additional training session did not increase this proportion. Thus, further efforts to raise the use of such systems should centre on advertising the system, providing easy access and solving barriers to its use. This might be achieved by integrating it into main practice software systems and other informational sources for physicians. Finally, the hitherto very low incentive to use online CME is a further important barrier to the broad use in continuing medical education. Thus, it can be assumed that all of the efforts can only be effective when supported by a higher incentive to use online systems, e.g. gaining more credits for using it.

In summary, although we created an evidence-based online informational source that was judged to be helpful by the target group, it appears that an effective dissemination strategy has yet to be discovered. Otherwise, the proportion of the GPs reached by our study marks today's ceiling effect for online strategies.

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