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ORIGINAL ARTICLE

Information and feedback to improve occupational physicians' reporting of occupational diseases: a randomised controlled trial

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Abstract
Purpose To assess the effectiveness of supplying occupational physicians (OPs) with targeted and stage-matched information or with feedback on reporting occupational diseases to the national registry in the Netherlands.
Methods In a randomized controlled design, 1076 OPs were divided into three groups based on previous reporting behaviour: precontemplators not considering reporting, contemplators considering reporting and actioners reporting occupational diseases. Precontemplators and contemplators were randomly assigned to receive stage-matched, stage-mismatched or general information. Actioners were randomly assigned to receive personalized or standardized feedback upon notification. Outcome measures were the number of OPs reporting and the number of reported occupational diseases in a 180-day period before and after the intervention.
Results Precontemplators were significantly more male and self-employed compared to contemplators and actioners. There was no significant effect of stage-matched information versus stage-mismatched or general information on the percentage of reporting OPs and on the mean number of notifications in each group. Receiving any information affected reporting more in contemplators than in precontemplators. The mean number of notifications in actioners increased more after personalized feedback than after standardized feedback, but the difference was not significant.
Conclusions This study supports the concept that contemplators are more susceptible to receiving information but could not confirm an effect of stage-matching this information on reporting occupational diseases to the national registry.

Keywords Reporting · Occupational diseases · Psychological models · Information dissemination · Occupational health physicians

Abbreviations

OPs	Occupational Physicians
ODs	Occupational Diseases
OHS	Occupational health services
NCOD	Netherlands Center for Occupational Diseases
TTM	Trans theoretical model
SM	Stage-matched
SMM	Stage-mismatched

Introduction

Reliable statistics on work-related diseases are critical in establishing occupational health policy; therefore, every country strives to generate accurate figures, but surprisingly few reliable figures on occupational diseases are available. Although each of the 25 EU countries has a national registry of occupational diseases, there are great differences in the reported incidences (Blandin et al. 2002). While in Greece the reported incidence of all occupational diseases in 2001 was 3.4/100,000 per year (py),

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while in Finland the incidence in 2002 was almost 60-fold higher with 200/100,000 py (Alexopoulos et al. 2005; Kauppinen et al. 2004). The incidence in the 15 EU countries in 2001 was estimated 37/100,000 py (Karjalainen and Niederlaender 2004).

The international variations in reported occupational diseases reflect the fact that under-recognition and under-reporting of occupational diseases is both an important issue. Factors that influence these variations are differences in social security arrangements for occupational diseases, in diagnostic criteria and in guidelines for reporting. (Nordman et al. 1999; Coggon 2001; Karjalainen and Niederlaender 2004; Rosenman et al. 2006).

Under-recognition and under-reporting of occupational diseases starts with workers. Research based on surveys of employees has described under-reporting of occupational diseases of more than 60% across different industrial sectors and jobs (Biddle et al. 1998; Pransky et al. 1999; Scherzer et al. 2005). Workers share often the same reasons for not reporting: fear of retribution by the employer, concern about supervisors' opinion, lack of knowledge on the reporting and compensating system and feeling that symptoms are not serious enough (Rosenman et al. 2000; Azaroff et al. 2002; Galizzi et al. 2006). If a worker with symptoms visits a doctor, the work relatedness may not be considered for some time, delaying the diagnosis of, i.e., occupational asthma for several years (Poonai et al. 2005). If (occupational) physicians are insecure about their diagnosis they might not report it. Administrative barriers, lack of adverse consequences for under-reporting and the absence of positive reinforcement for reporting may also contribute to the problem (Pransky et al. 1999; Blandin et al. 2002). Similar problems and barriers are described in other registries like the reporting of infectious diseases (Silk and Berkelman 2005; Friedman et al. 2006) or adverse drug reactions (Bäckström et al. 2004; Vallano et al. 2005; Hazell and Shakir 2006).

In the Netherlands, both occupational physicians (OPs) and occupational health services (OHS) are obliged to report occupational diseases to the Netherlands Center for Occupational Diseases (NCOD) for preventive reasons. Since this is no workers' compensation system, there is no financial compensation for reported occupational diseases. In this national registry, there has been considerable under-reporting over the years. Dutch OPs mentioned several reasons for not reporting: lack of time, uncertainty about work as a causal factor for a specific disease, lack of awareness of the requirements for reporting, disagreement about the criteria to determine a work-relation, (alleged) legal objections and lack of motivation to report. (Lenderink 2005; de Vos and Nieuwenhuijsen 2006).

Several interventions to improve the reporting behaviour of physicians are proposed and sometimes tested. There is some evidence that keeping in close contact with reporters, user-friendly reporting systems, assured confidentiality, education, regular contact, provision of feedback information, accreditation points for continuing education or a small fee might improve reporting. (Hazell and Shakir 2006; Orriols et al. 2006; Scott et al. 1990; McGettigan et al. 1997; Bracchi et al. 2005; Figueiras et al. 2006; Bäckström and Mjörndal 2006; Smits et al. 2008).

Since it was not possible to change either the social security arrangements for occupational diseases or the registry system itself and since there were no means to supply financial incentives or accreditation points to reporting OPs, we chose to focus on attention, information and feedback to improve reporting behaviour. The key objective of the intervention is behavioural change: potential reporters should start reporting and should report more often.

Programs aimed at changing (health) behaviour are often based on psychological models and theories such as the health belief model, the theory of reasoned action and the theory of planned behaviour. In these models, a person is considered to make decisions on a rational basis: people will change their behaviour as soon as they are convinced that they can execute the change and that they will benefit from it. A psychological model that looks upon behavioural change as a process in time, influenced by many factors, is the stages of change model or Trans Theoretical Model (TTM). Since the aimed ODs reporting behaviour has to be maintained for a long time and is influenced by many determinants, this model may provide a suitable theoretical base for the hypotheses of this study. TTM, introduced in the early 1980s (Prochaska and Diclemente 1984), distinguishes between several stages of behaviour. The first stage being precontemplation, in which there is no awareness of a problem and an individual does not consider a change in behaviour in the next 6 months. The second stage is contemplation, in which the individual does consider a change in behaviour, followed by a preparative stage, in which the individual makes cognitive preparations for a change in behaviour. In the action stage, the individual initiates a change in behaviour, and in the maintenance stage he or she performs the behaviour for a longer period of time. Also relapse can occur. Each stage is influenced by its own relevant stage-specific factors, like decisional balance that reflects the weighing of the importance of pro's and con's of a behaviour (precontemplation) or self-efficacy that reflects the situation-specific confidence people have in coping with a behaviour related situation (contemplation). Stage-specific interventions should match these stage-specific factors in order to produce progress through the stages. (Dijkstra et al. 1998, 2006; Gebhardt and Maes 2001; de Vet et al. 2005, 2007).

Our first hypothesis is that supplying OPs, identified as precontemplators or contemplators, with personally addressed, stage-matched information on why and how to

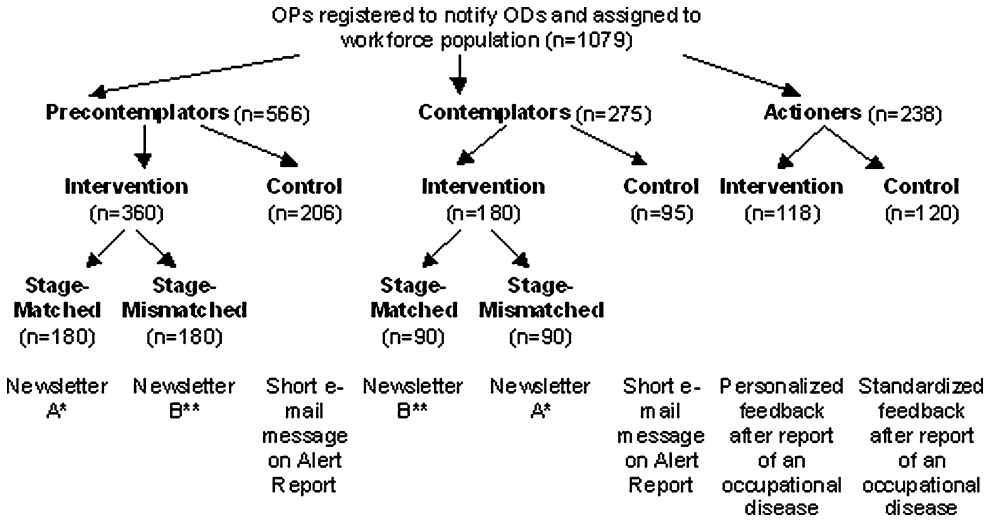

Fig. 1 Flow of participants and interventions. *Newsletter A: personally addressed electronic newsletter with specific information on reporting ODs, stressing in particular pros and cons of reporting occupational diseases. **Newsletter B: personally addressed electronic newsletter with specific information on reporting ODs with self-efficacy enhancing information on how to report, where to find information, guidelines, offer to participate in a workshop on reporting occupational diseases

report occupational diseases, will persuade more OPs to report (more) occupational diseases to the national registry. Our second hypothesis is that supplying OPs, identified as actioners, with personalized feedback on notification will persuade OPs to report more occupational diseases to the national registry.

This leads to the following research questions:

- Do OPs identified as precontemplators or contemplators who received stage-matched information on the reporting of occupational diseases, report more occupational diseases than OPs identified as precontemplators or contemplators who received stage-mismatched or general information?
- Do reporting OPs identified as actioners who received personalized feedback on notification, report more occupational diseases than OPs identified as actioners who received standardized feedback?

Methods

Population

The participants were all OPs who are registered to notify occupational diseases (ODs) in the national registry and are assigned to a workforce population (information collected in May 2007). On these participants information on sex, employment status, work hours/week (divided into categories: $\leq$20 h/week (hw), 20.0–29.9 hw, 30.0–39.9 hw and $\geq$40 hw) and number of notifications in 2006 and 2007 was collected. The group of 1079 OPs was divided into three groups (November 27th 2007) according to their reporting behaviour in 2006 and 2007:

- Precontemplators: OPs (n = 566) who did not notify any occupational disease (OD) in 2006 and in 2007 until November 27th. We called them precontemplators because they did not report any OD in the last 2 years, so we assume that they do not consider reporting ODs in their daily practice.
- Contemplators: OPs (n = 275) who notified ODs in 2006 and 2007 until May 31st, but not between then and November 27th. We called them contemplators because they only stopped reporting the last 6 months, so we assume that they might consider reporting ODs in their daily practice.
- Actioners: OPs (n = 238) who notified ODs in 2006 and 2007 and notified at least one OD in the last 6 months. We called them actioners because they reported ODs on a regular basis in the last 2 years, so we assume that they actually report the ODs they encounter in their daily practice.

Design

Precontemplators and contemplators were randomly assigned to one of three interventions (Fig. 1): receiving stage-matched information, receiving stage-mismatched information or receiving general information (control group). Actioners were randomly assigned to the intervention group (receiving personalized feedback after reporting an OD) or control group (receiving standardized feedback after reporting an OD).

Intervention

Precontemplators and contemplators intervention

The intervention aimed at precontemplators and contemplators consisted of a personally addressed electronic newsletter with stage-matched or stage-mismatched information on why and how to report occupational diseases

sent on November 28th 2007. The expectation was that precontemplators would benefit most from information stressing in particular pros and cons of reporting occupational diseases, i.e. "stage-matched" in newsletter A. In contrast, the self-efficacy enhancing information in Newsletter B that is aimed at contemplators would prove detrimental for precontemplators by triggering defensive information processing, i.e. "stage-mismatched". Contemplators are expected to benefit most from self-efficacy enhancing information on how to report, where to find information, guidelines, offer to participate in a workshop on reporting occupational diseases, i.e. "stage-matched" in newsletter B. In contrast, outcome information that is aimed at precontemplators would be redundant and possibly inhibit information processing, i.e. "stage-mismatched" for contemplators in newsletter A. To address OPs personally, we mentioned the name of the participant in the newsletter and stated that according to data from the national registry he or she did not report any occupational disease in 2006 and 2007 until November 27th (precontemplators) or reported occupational diseases in 2006 and 2007 until May 31st but not since then (contemplators). All OPs in the control group received a short electronic message on November 28th 2007 with an announcement of the recently published Alert Report 2007.

Actioners intervention

The intervention aimed at the actioners was a personalized e-mail feedback after reporting an occupational disease supplying them with extra information such as a recent and potentially useful scientific article referring to the diagnosis notified. The actioners control group received the usual standardized feedback: an e-mail only stating that the notification was accepted.

Measurements

Outcome measures were the number of OPs reporting occupational diseases to the NCOD and the number of reported cases (=notifications) of occupational diseases in a 180-day period before (June 1st 2007–November 27th, 2007) and after the intervention (November 28th–May 25th 2008). These data, available at the NCOD, are an objective measure of the reporting performance of the OPs. A first comparison is made between the intervention groups (stage-matched and stage-mismatched) and the control group for precontemplators and contemplators, respectively. A second comparison is made between the precontemplators and contemplators (for both intervention groups and control groups, respectively). A third comparison is made between the intervention and control group within the group actioners.

Analysis

We used the Chi-square test to check for differences between the baseline characteristics (sex, employment status and work hours/week) of precontemplators, contemplators and actioners and to check whether randomisation was successful.

For precontemplators and contemplators, respectively we determined the percentage of reporting OPs and the mean number of notifications in each group in the 6 months after the intervention.

For actioners we determined the percentage of reporting OPs in each group and the mean number of notifications in the 6 months before and after the intervention.

To test whether stage-matched information had more effect than stage-mismatched or general information on the number and percentage of reporting OPs, we used the Chi-Square test. The non-parametric Mann–Whitney *U*-test was used to compare the mean number of notifications between groups. All analyses were performed in SPSS 16.0. *P*-values $\leq .05$ were considered statistically significant.

Results

Participants

A total of 1076 OPs were included in the study. Precontemplators (566) differed significantly from contemplators (273) as well as from actioners (237) on sex (more men) and employment status (more self-employed), but not on working hours per week. Contemplators did not differ significantly from actioners (Table 1).

To check whether randomisation was successful, we compared subgroups within each group on sex, employment status and working hours/week. We found no significant differences, except for contemplators on working hours per week, the percentage of OPs working >30 h/week was significantly higher in the control group.

Effect of intervention in precontemplators and contemplators

We tested in both precontemplators and contemplators the effect of personally addressed, stage-matched or stage-mismatched information on why and how to report occupational diseases on reporting ODs. The analyses showed that neither stage-matched nor stage-mismatched information did lead to a significant higher number of reporting OPs or a higher number of notifications when compared to the general information in the control group (Table 2). From the participants in precontemplation at baseline; 7.2, 7.8 and 5.8% started reporting after the stage-matched (SM),

Table 1 Comparison of precontemplators, contemplators and actioners at baseline for sex, employment status and work hours/week

	Precontemplators	Contemplators	Actioners	Total
Sex				
Male	361 (64%)*	151 (55%)	123 (52%)	635 (59%)
Female	180 (32%)	97 (36%)	74 (31%)	351 (33%)
Missing	25 (4%)	25 (9%)	40 (17%)	90 (8%)
Employment status				
OHS	429 (76%)	246 (91%)	213 (90%)	888 (83%)
Self-employed	103 (18%)*	17 (6%)	19 (8%)	139 (13%)
Self and OHS	32 (6%)	9 (3%)	5 (2%)	46 (4%)
Work hours/week				
<20	27 (5%)	6 (2%)	10 (4%)	43 (4%)
20.0–29.9	114 (20%)	55 (21%)	44 (19%)	213 (20%)
30.0–39.9	192 (35%)	109 (42%)	101 (44%)	402 (38%)
40+	221 (40%)	92 (35%)	76 (33%)	389 (38%)

* Significant $P < .0001$, precontemplators vs. contemplators and actioners

Table 2 Percentages (numbers) of OPs reporting occupational diseases and mean (SD) of notifications per group OP after stage-matched (SM), stage-mismatched intervention (SMM) or control intervention (short e-mail message on Alert Report)

Precontemplators	SM (n = 180)		SMM (n = 180)		Control (n = 206)	
	Before	After	Before	After	Before	After
Percentage (number) of OPs reporting	0 (0)	7.2 (13)	0 (0)	7.8 (14)	0 (0)	5.8 (12)
Mean (SD) of notifications	0 (0)	0.37 (2.434)	0 (0)	0.14 (0.644)	0 (0)	0.25 (1.951)
Contemplators	SM (n = 90)		SMM (n = 89)		Control (n = 94)	
	Before	After	Before	After	Before	After
Percentage (number) of OPs reporting	0 (0)	31.5 (28)	0 (0)	27.8 (25)	0 (0)	26.6 (25)
Mean (SD) of notifications	0 (0)	0.97 (2.187)	0 (0)	0.97 (2.989)	0 (0)	0.95 (2.894)

stage-mismatched (SMM) and control intervention (CON), respectively. From the participants in contemplation at baseline; 31.5 (SM), 27.8 (SMM) and 26.6% (CON) started reporting. There were no significant differences in the mean number of notifications per subgroup or per reporting OP. Although the distribution of notifications was very skewed towards zero, we could not use the median number of notifications, because it was zero in all groups.

Receiving any type of information had significant more effect on reporting in contemplators as compared to precontemplators: 29.6 and 26.6% (contemplators) versus 7.5 and 5.8% (precontemplators) started reporting, respectively. The mean number of reported cases after intervention is also significantly higher in contemplators than in precontemplators (Table 3).

Table 3 Percentages of precontemplators and contemplators reporting occupational diseases and mean (SD) of notifications per group after receiving information

	Precontemplators	Contemplators
Percentage of reporting OPs		
Receiving stage-matched information	7.2	31.5*
Receiving stage-mismatched information	7.8	27.8*
Receiving general information	5.8	26.6*
Mean (SD) of notifications		
Receiving stage-matched information	0.37 (2.434)	0.97 (2.187)**
Receiving stage-mismatched information	0.14 (0.644)	0.97 (2.989)**
Receiving general information	0.25 (1.951)	0.95 (2.894)**

* $P < .0001$ (Chi square test)

** $P < .0001$ (Mann–Whitney test)

Effect of intervention in actioners

Only half (51%) of the OPs reporting at least one occupational disease after June 1st 2007 (actioners) reported occupational diseases in the 180 days after November 27th 2007 (Table 4). Because actioners only got their feedback, either personalized or standardized, after reporting, we analysed the results among those actioners that actually received feedback. Although the mean number of notifications

Table 4 Comparison of sum, mean and standard deviation of notifications during 180 days before and after the intervention in actioners who received personalized or standardized feedback on reporting

Actioners	Personalized feedback ($n = 57$)		Standardized feedback ($n = 64$)	
Period	Before	After	Before	After
Sum of notifications	220	264	353	363
Mean notifications (SD)	3.86 (2.949)	4.63 (5.678)	5.52 (6.203)	5.67 (5.736)

increased more in the intervention group than in the control group, the difference was not significant (Table 4).

Discussion

This study failed to support an effect of personally addressed, stage-matched information on why and how to report occupational diseases on reporting occupational diseases in the national registry in the Netherlands. Receiving any type of information affected reporting more in contemplators than in precontemplators. In actioners personalized feedback seemed to increase the number of notifications more than standardized feedback.

Strong points of this study are the randomized controlled design with relatively large intervention and control groups. This minimizes potential sources of bias such as selection bias or increases in reporting due to other reporting enhancing activities like education. Another strong point is the objective measurement of the performance of physicians before and after the intervention. Actual reporting behaviour is our primary outcome measure instead of self reported change in behaviour intention. Although changing actual reporting behaviour is the ultimate goal of our intervention, this outcome measure might have been too insensitive to evaluate the present intervention. If the intervention caused forward stage transition, moving OPs from no intention to report to considering or even planning to report, we would not know until the OP actually starts reporting.

Limitations must also be considered in interpreting the results of this study. One of the limitations is that we did not use a staging instrument to determine the stage of reporting behaviour of participating OPs at baseline. We assumed that OPs who did not notify any occupational disease in 2006 or 2007 could be identified as immotives or precontemplators and OPs who notified before June 1st 2007 but not afterwards, could be seen as contemplators or preparators. This might be a source of misclassification because precontemplators may already have the intention to report, contemplators may have lost this intention or be actually actioners that incidentally did not have anything to report. In this study, both stage-matched and stage-mismatched newsletters might in fact have been addressed to more mixed behavioural groups, weakening the influence of stage-matching. On the other hand, the results show that receiving any type of information affected reporting significantly more in contemplators than in precontemplators. This indicates that OPs may differ in regard to their reporting behaviour and that they might benefit from different interventions.

Another limitation of this study is that we used a single intervention in precontemplators and contemplators: a personalized newsletter was only sent once to the participants, without information on receipt, perusal and assessment of the contents. A single information intervention is likely to be inferior to a repetitive or multifaceted intervention. Regular targeted newsletters might be more effective when combined with other interventions like user-friendly reporting systems, accredited education and provision of feedback information.

Among the actioners group, a limitation is that actioners only received feedback after their first notification. Only 48.3% of the intervention group and 53.8% of the control group received feedback somewhere between November 28th 2007 and May 25th 2008. The actioners group is relatively small (238) and despite randomisation, actioners assigned to the control group reported significantly more ODs in the 180 days before November 27th 2007 than actioners assigned to the intervention group. The reporting behaviour in the control group stayed about the same in the follow-up period. Among the OPs receiving personalized feedback, including a scientific article closely related to the OD that was reported, the total and the mean number of notifications increased, although the differences between intervention and control group were not significant. This may be due to the relatively small group of actioners that ultimately could be analysed after receiving feedback. But the increase of reporting in the intervention group may also be a statistical regression to the mean.

Underreporting in mandatory surveillance schemes is widely recognized, and the causes are relatively well explored. But there is only limited evidence from controlled studies on what interventions could improve reporting. Education may have a positive effect. Smits et al. (2008) found that an active, multifaceted workshop on occupational diseases is moderately effective in increasing the number of physicians reporting occupational diseases. Although both knowledge and self-efficacy increased

significantly, only self-efficacy turned out to be a predictive factor for such reporting. Other studies found a positive effect of a distance-learning program with educational credits (Bracchi et al. 2005) and a targeted one-hour educational outreach visit (Figueiras et al. 2006) on reporting adverse drug reactions.

There is also some evidence that sending information and reminders can improve reporting. Brissette et al. (2006) evaluated the effects of different messages to promote complete and timely reporting of occupational lung diseases to the New York State Occupational Lung Disease Registry. They found that physicians receiving correspondence describing the legal obligation to report were more likely to report occupational lung diseases than those receiving a message describing only the public health benefits. On the other hand, stressing the public health benefits of reporting led to submittance of more complete reports. Studies in pharmacovigilance looking at the effects of sending regular reminders or newsletters showed similar results (McGettigan et al. 1997; Castel et al. 2003), but stressed that they may have only a temporal effect; when the information is withdrawn, reporting declines.

In this study, we used the transtheoretical model to justify the distinction of three groups of OPs based on their reporting behaviour and to design the intervention to match their supposed stage of behaviour. In the match-mismatch design no effect of stage-matching the information was found, although receiving any type of information had more effect in contemplators when compared to precontemplators. This is in line with some earlier match-mismatch studies on smoking cessation (Dijkstra et al. 1998; Quinlan and McCaul 2000) and fruit intake (de Vet et al. 2007). These studies also failed to support the superiority of stage-matching compared to stage-mismatching, although these interventions had significantly more effect in contemplators than in precontemplators. Two other studies strongly support the idea that individuals in contemplation, preparation, action or maintenance stages benefit more from any type of information than people in precontemplation stages (Dijkstra et al. 2006; Schüz et al. 2007).

Since this study indicates that receiving information may influence OPs in different ways, one of the implications for practice can be to identify these groups of OPs and develop different approaches to stimulate reporting. Developing a successful approach of OPs who have little or no intention to report warrants further research. Qualitative research to thoroughly assess their (lack of) motivation to report ODs, may shed light on potential barriers and enhancing factors, both on an individual and organisational level. Based on these results, an intervention and implementation strategy may be developed.

In this study, we found no significant differences between the OPs in the group of actioners that received personalized feedback when compared to OPs receiving standardized feedback. In a recent study in Sweden on reporting adverse drug reactions, the number of physicians reporting more than once in the 3-month period was significantly larger after extensive feedback, which included data from scientific research, than after the usual feedback (Wallerstedt et al. 2007). Recent findings from the Dutch Pharmacovigilance Centre Lareb also underpin the influence of this type of feedback: individual feedback on the reported adverse drug reaction with information from several sources including scientific literature was considered an important stimulus to report adverse drug reactions (Cornelissen et al. 2008). More research is needed to explore whether providing reporting OPs with personalized feedback can be a successful approach to maintain reporting behaviour.

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Conflict of Interest The authors declare that they have no conflict of interest.

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