





Comparing the effectiveness of competition as a method of reminding primary oral health care dentists to record diagnoses with two alternative methods used to enhance the recording of diagnoses in primary health care

Jouko Kallio^{a,b}, Anna Maria Heikkinen ^{c,d}, Tuomo Lehtovuori ^b, Marko Raina ^e, Lasse Suominen^b and Timo Kauppila ^a

^aDepartment of Public Health, University of Helsinki, Helsinki, Finland; ^bSocial and health bureau, Espoo, Finland; ^cDepartment of Oral and Maxillofacial Diseases, Head and Neck Center, University of Helsinki, Helsinki, Finland; ^dDepartment of Oral and Maxillofacial Diseases, Helsingin yliopisto, Tampere, Finland; ^eSocial and health bureau, Vantaa, Finland

ABSTRACT

The purpose of this study was to investigate whether competition is an effective method to remind primary oral health care dentists to record diagnoses (RRD). The effectiveness of competition was examined in comparison with financial group bonuses (FGBs) and electronic reminders (ERs) of the electronic health record, together with superior-subordinate or development discussions. Putative differences in the diagnosis recording cultures of Finnish public health care physicians and dentists were studied. This was a retrospective quasi-experimental observational study in which the effects of the interventions on the rate of recording diagnoses were identified using a general linear regression model and proportions of visits with recorded diagnoses. The rate of increase in the recording of diagnoses in dentists was $0.995 \pm 0.273\%/month$ (mean \pm SEM) after the implementation of RRDs and this did not differ from that obtained after starting FGBs ($0.919 \pm 0.130\%/month$) or ERs with superior-subordinate or development discussions ($1.562 \pm 0.277\%/month$) in physicians. As the rates of increase did not differ none of the applied methods seemed to be more effective than the others when trying to influence the behaviour of primary health care clinicians. Altogether, public primary health care physicians were more active than respective primary oral health care dentists to record diagnoses.

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Introduction

There is ample of evidence that various interventions, such as electronic reminders in the health record [1,2], financial bonuses to clinicians [3–5] and directing attention by reminding clinicians to perform desired actions [6,7] may alter their behaviour in the way desired. However, head-to-head comparisons about the efficacy between these types of interventions have not been performed by using the same measurement.

Improving the recording of diagnoses of acute and chronic diseases might theoretically serve as one of the most important factors in planning activities, managing resources and implementing treatment plans, as well as corresponding actions [8–11]. Recording of diagnostic terms provides valuable data for targeting proper treatments of diseases making primary health care more effective [11,12,13]. It promotes diagnostic thinking and thereby enhances rational judgment of treatment options which then may lead to better treatment outcomes and increase patient safety and it facilitates the

use of computer-based clinical decision support systems [13]. Recording diagnoses allows for the aggregation and secondary analyses of clinical data to support downstream analyses for quality improvement and epidemiological assessments [14]. Therefore, recording rate of diagnoses could serve as a useful measure when comparing the efficacies of different interventions to change the activity of primary health care clinicians. In an earlier study [15] was found that measures were well recorded during visits to dentists. This was not the case with diagnose.

The public primary health care and oral health care systems of the cities of Espoo and Vantaa attempted to develop various methods to prompt physicians and dentists to record diagnoses. Three different methods were found to be successful. Among the public primary oral health care dentists of Espoo, a competition to remind them to record diagnoses (RRD) seemed to enhance this activity [16]. Even after this intervention

CONTACT Jouko Kallio  jouko.kallio@espoo.fi; jouko.kallio@finnet.fi  Department of Public Health, University of Helsinki, P.O. Box 20 (Tukholmankatu 8 B), Helsinki 00014 Finland

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itself was ceased the increase in recording diagnoses was maintained at a higher level than before any intervention was applied [16]. However, as there was no control group in this study, it was not sure whether there was an intervention effect of the RRD, or whether there was just a natural change in the behaviour of primary oral health care dentists that favoured recording diagnoses and that RRD were just accidentally applied at the time this change appeared.

As mentioned before, there were two more interventions which successfully prompted public primary health care clinicians to record diagnoses. First, financial group bonuses (FGBs) enhanced the recording of diagnoses in public primary care teams in Espoo [17]. Second, electronic reminders (ERs) of the electronic health record (EHR) with superior-subordinate or development discussions achieved the same with public primary health care physicians in Vantaa [18]. FGBs are typical rewards [17]. ERs in EHRs with superior-subordinate or development discussions resemble enforcement-based methods [18]. As a method, RRD represents guiding the attention of the actors to the desired activity [16].

There were thus two study questions in this study. First, an attempt was made to study the RRD method truly effective in enhancing the recording of diagnoses by public oral health care dentists. Second, to compare the efficacy of the three presently described interventions to change actions of public primary health care clinicians, it was explored whether the effect of these three interventions on the change rate of recording diagnoses differed.

Materials and methods

Setting and design

This retrospective quasi-experimental study was performed in the Finnish cities of Espoo and Vantaa. In Espoo, there were 230,000 inhabitants at the time of FGB intervention and 240,000 at the time of RRD intervention. In Vantaa, there were 210,000 inhabitants at the time of the ER intervention. All the clinicians participating in this study were officials, who were employed and directly governed by the municipal health administration. The public primary health care physicians and dentists were under the same governance in Espoo. The primary care of Vantaa city was chosen as a control because it resembles Espoo in its location, demography, and number of inhabitants (about 200,000 inhabitants, located neighbouring Helsinki, the capital of Finland).

Data acquisition

In all interventions, the data of the study's health centres were obtained from EHR systems (Graphic Finstar® in Vantaa and Effica® in Espoo; Tieto LTD, Helsinki, Finland). They both provided a specific place in the EHR where appropriate ICD-10 diagnoses could be entered during the patients' visits to offices of clinicians. This tool was similar in both physicians and dentists. The clinicians' input was to give at least the three first letters and/or numbers of his suggested diagnosis. Then the system guided to a menu of diagnoses which contained those cues originated by the clinician, who was then able to choose the diagnosis he considered to be the most appropriate one. No ethical approval was required because this study was made directly by computer from the patient register without identifying the patients (<https://rekisteritutkimus.wordpress.com/luvat-ja-tietosuoja/>) and the register keeper (the health authorities of Espoo and Vantaa 23.8.2016) granted permission to carry out the study. When identifying the possible effect of RRD, the years before, during and after the intervention were followed. When comparing the three different interventions to enhance the recording of diagnoses, the first year of intervention was chosen as the follow-up time because it was known from the former studies [16–18] that the effects of the present interventions on the rate of recording diagnoses were at their greatest precisely during this period after their implementation.

Interventions

The three interventions are described in detail in former articles [16–18]. First, in the intervention reminding public primary oral health care dentists in Espoo to record diagnoses (RRD), there were 21 communal oral care teams. The number of dentists varied from 2 to 12 per team (about 120 dentists). There was the same number of dental nurses (including dental hygienists) supporting the work of dentists in these teams, too. To commit the staff to the change in function, a competition was announced on 1.1.2009. The exact nature of the reward was not revealed to the clinicians, and it was promised solely to the team with the highest percentage of visits with a recorded diagnosis after a follow-up of one year [16]. This intervention persisted only for one year.

Secondly, in the FGB intervention, Espoo public primary health care had 23 care teams. There were 6–8 physicians and 6–8 nurses per team (about 160 physicians). In order to obtain the group bonus, it was

necessary for teams to record diagnoses for doctor visits at a significantly higher rate than before the intervention. In practice, this meant that to get a group bonus a care team had to take care that diagnoses were recorded in more than 75% of all doctor visits of that team [17]. FGBs for recording diagnoses were initially started on 1.3.2005 and finally ceased in the end of year 2010 [17].

Thirdly, the electronic health record intervention was performed in Vantaa, where there were about 110 public primary health care physicians. An ER was installed into the EHR system. The EHR-system prompted physicians to enter a diagnosis every time they wanted to finish recording the visit. If the diagnosis of the visit was already recorded, the system did not remind the clinician. If the doctor did not mark a diagnosis on the patient chart after a consultation, the computer asked at the end of the report "Are you going to finish the report without marking the diagnosis?" The doctor had then a possibility to close the report by answering "yes". If the doctor answered "no", the electronic health record system returned automatically back to the appropriate place to mark the diagnosis. If the diagnosis was then recorded, the electronic health record system allowed finishing the report without any further enquiries. If the diagnosis was not recorded at this second exit the doctor was able to leave the report without getting a new reminder, despite not marking the diagnose. This intervention was enhanced with superior-subordinate or development discussions with the physicians and started on 1.2.2008 and ceased when the GFS-system was changed to another in 2018 [18].

Main and secondary outcomes

The report generators of the EHR systems of the cities provided the total number of visits to physicians and dentists, the number of recorded diagnoses and thus a percentage for the recording of diagnoses for each individual professional. This allowed the calculation of a mean percentage of physician and dentist visits with marked diagnoses/month after the interventions. Rate of change of this percentage after the beginning of the intervention/follow-up period was the main measurement for the analysis in the present study. When comparing different interventions, rate changes in absolute values of visits with recorded diagnoses and all visits to dentists and physicians were also examined.

As a secondary measure, the total numbers of diagnoses and visits to the studied units and their rates of change were analysed. These percentages of the yearly physician and dentist visits with marked diagnoses

were examined during the year before starting the interventions, during the first year after launching the interventions and, finally, second year after launching the interventions.

Statistical methods

The rate of change in the monthly percentages of visits with recorded diagnoses after each intervention was compared by using a general linear model of regression analysis, which allowed us to identify the mean change in the rate of marking diagnoses (%/month) and its standard error of mean (SEM) before and after the intervention (GLM procedure, SigmaPlot 13.0, Systat Software Inc., Richmond, CA, USA) [18,19]. The putative significant change in this rate (increase or decrease) was then determined with t-test [18,19]. These rates were then compared with ANOVA followed by the Bonferroni-method. When identifying the possible effect of RRD, the years before, during and after the intervention were analysed. When comparing different interventions to enhance the recording of diagnoses, the first year after intervention was chosen as the follow-up time because it was known from the former studies [16–18] that the effects of the present interventions on the rate of recording diagnoses were at their greatest precisely during this period after their implementation. The comparisons in the absolute yearly percentages of visits with recorded diagnoses after, during and before each three interventions was performed with χ^2 -test.

Results

Although the rate of change in the proportions of visits with recorded of diagnoses ($0.182 \pm 0.0452\%$; mean \pm SEM) increased statistically significantly already before implementing RRD ($P < 0.01$, t-test) this increase was lower ($p < 0.01$; ANOVA) than that during the RRD intervention ($0.995 \pm 0.273\%$; Bonferroni $P < 0.05$). However, the rate of this change before intervention did not differ from the rate of the year after the intervention (0.752 ± 0.135 ; Figure 1).

All three interventions were able to increase the rate the rate of change in proportions of visits with recorded diagnoses ($p < 0.05$, t-test). This rate during RRD did not, however, differ from the respective rates after implementing FGBs ($0.919 \pm 0.130\%$ /month; mean \pm SEM) or ERs with superior-subordinate or development discussion ($1.562 \pm 0.277\%$ /month; Figure 2a, $P = 0.125$, ANOVA). Neither did the rate of change in absolute monthly numbers of recorded diagnoses during RRD (85 ± 49 diagnoses/month; mean \pm SEM) differ from

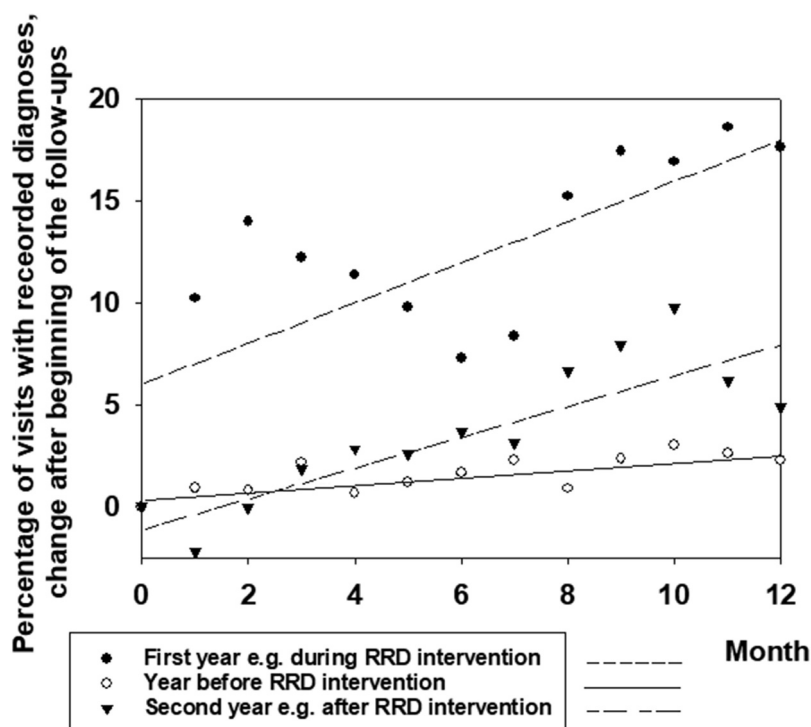


Figure 1. The rates of change in the proportions of visits with recorded diagnoses the year before, during the first year of the announcement of competition in recording diagnoses (RRD intervention) and the year after that intervention. Different dashed lines are used to clarify the change of rate slopes during these different time periods.

the respective rates after implementing FGBs (166 ± 190 diagnoses/month) or ERs with superior-subordinate or development discussion (266 ± 133 diagnoses/month; [Figure 2a](#)). There was no increase in the number of monthly visits in any of the studied units during the follow-up ([Figure 2c](#), $P = 0.649$)

The frequency of recording diagnoses was generally lower among public primary oral health care dentists than among public primary health care physicians ([Table 1](#)). All the studied interventions (RRD, FGBs and ERs) were able to increase the absolute proportion of visits with recorded diagnoses.

Discussion

The method to remind public primary oral health care dentists to record diagnoses (RRD) was specifically able to promote the rate of change of recording diagnoses. None of the studied interventions was superior in enhancing this rate of change. All the studied interventions increased the proportion of visits with recorded diagnoses. This proportion was generally smaller among public primary oral health care dentists than among public primary health care physicians.

The basic level of recording diagnoses was higher among physicians than dentists already before the implementation of the studied interventions. Unlike RRD, both ER and FGB interventions were continuously functioning for several years after the initiation year which was thus specifically examined in this study. This also explains higher proportions of recorded diagnoses during the second years after ER and FGB interventions. Of course, cultural differences might have played a role in the changes of rates of recording diagnosis. Possibly due to vast variation of these rates of change, we failed to observe any difference. Another explanation is that the rate of change in this particular subject we studied is actually quite stable in public primary care disregarding the chosen method of intervention. The present results may, however, reflect the general culture of the dental discipline [20]. Furthermore, the reward system of dentists has not generally been based on recording activity but on other measures than recording diagnoses and this may modify the actions of dentists [19,21]. Fortunately, the situation is changing. Nevertheless, the diagnoses may still be poorly recorded by dentists [22,23]. Thus, actions should be taken to prompt dentists to enhance the recording of dental diagnoses. Diagnosis recording should be

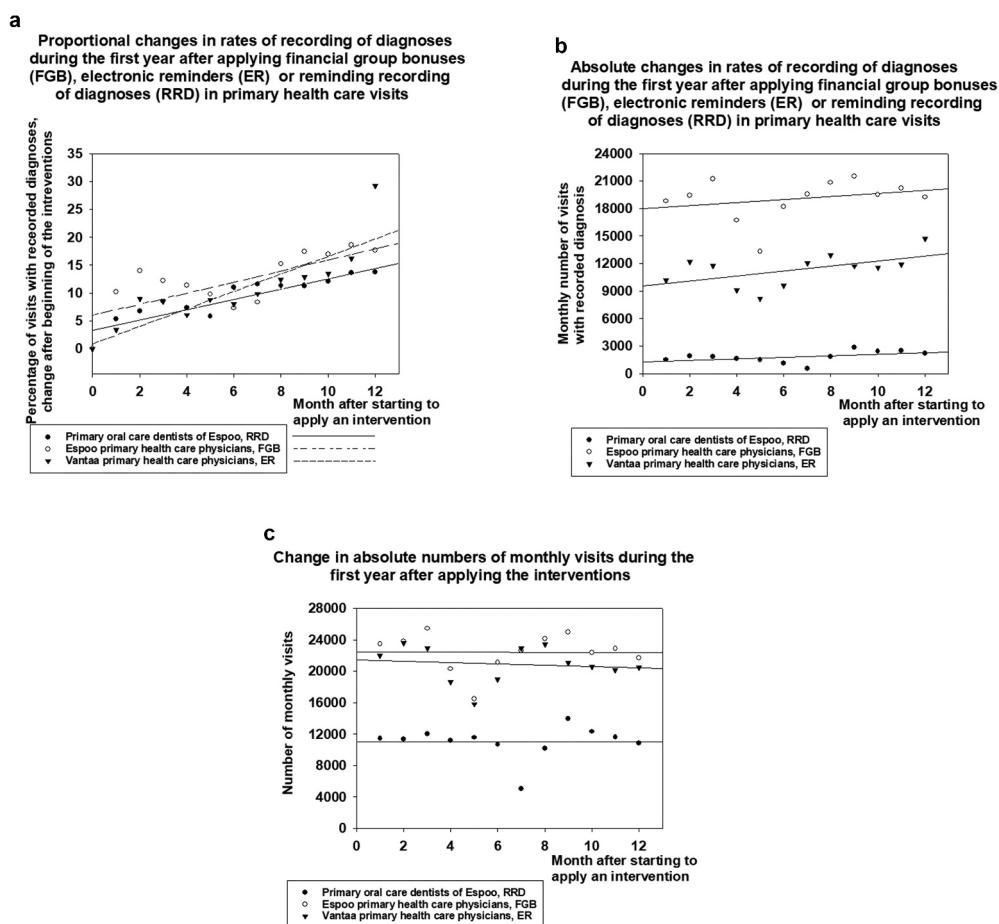


Figure 2. The rates of change in the recording of diagnoses during the first year after implementing the interventions. The three lines represent the mean rates in enhancement of recording of diagnoses due to different methods. In Figure 2a change in percentage of visits with recorded diagnosis. Different dashed lines are used to clarify the change of rate slopes of these three interventions. In Figure 2a change in absolute numbers of monthly visits with recorded diagnosis. In Figure 2c change in absolute numbers of monthly visits to clinicians.

nationally monitored, and it should be one of key indicators when evaluating clinical activity in primary oral health care.

RRD, ERs and FGBs seemed to be equally effective in increasing the proportional rate of recording diagnoses. There is ample of evidence that all three of the methods studied, electronic reminders in the health record [1,2], financial bonuses to clinicians [3,4] and directing attention by reminding clinicians to perform desired actions [6,7] may alter their behaviour in the way desired. To be more specific, at least financial incentives to the physicians, have been reported to increase the recording of diagnoses in the National Health Service of the UK [24]. Generally, the methods by which clinicians can be prompted to adhere to clinical recommendations have produced modest results with system-orientated outcomes rather than patient-orientated outcomes [6]. Head-to-head comparisons of the effects

of such single interventions have not been performed before by using the same measurement.

Limitations

Present kind of studies are technically difficult to perform and therefore this study has also several limitations. First, the cultures of recording diagnoses seemed to be very different in different disciplines. Basal level of recording diagnoses differed clearly between public primary health care dentists and physicians. Second, historical times of the interventions were different. This might have caused some “contamination” between groups as can be seen in the slightly increased rate of recording diagnoses in dentists before the RRD-intervention. Having a control group would have improved our study. Despite this putative “contamination” there was a detectable increase in recording rate

Table 1. Yearly proportions of visits with recorded diagnoses before during and second year after starting the studied interventions. Absolute values of visits with recorded diagnoses and all visits are presented in parentheses.

Intervention	Year just before the intervention % (visits with recorded diagnoses/all visits)	First year after launching the intervention % (visits with recorded diagnoses/all visits)	Second year after launching the intervention % (visits with recorded diagnoses/all visits)
Competition (RRD) (dentists)	2.4 (3251/133,012)	16.6 (21,907/132,202)***	24.6 (31,531/128,052) ***
Financial Group Bonus (FGB) (physicians)	61.7 (159,241/258,184)###	82.3 (219,796/266,910)***, ###	89.1 (233,783/262,288)***, ###
Electronic reminder (ER) (physicians)	40.2 (101,751/253,207) ###	50.1 (129,123/257,969)***, ###	78.2 (175,947/224,959)***, ###

*** stands for $p < 0.001$ year before interventions and ### for $p < 0.001$ vs. respective percentage of the value of RRD-intervention, χ^2 -test.

of diagnoses after implementing RRD. Nevertheless, by chance the situation in Espoo and Vantaa allowed us to run a quasi-experimental comparison of the effects of the three studied methods with very complete data.

The effects of different interventions to influence the behaviour of primary oral health care clinicians may vary depending on the task at which they are directed [6,7]. Maintaining appropriate patient documentation files, including recording diagnoses, is an essential component of medical practice, as well as of oral health settings. However, the recording of diagnoses in visits to primary health care clinicians may still be at an unsatisfactory level in primary health care [22,23,25]. The need of specific methods to ensure the recording of diagnoses may, of course, be indicative of a weakness in education and supervision. Better controlled clinical experiments in different clinical surroundings should be performed to compare efficacies of different interventions to modulate actions of primary care clinicians. Patient orientated outcomes should also be included in these future studies.

RRD was specifically able to promote the rate of change of recording diagnoses in dentists. Public primary health care physicians seem to be more eager to record diagnoses than primary oral health care dentists. Offering rewards (FBG), guiding attention (RRD) and an enforcement-based method (ER with feedback) seemed to have equal efficacy when trying to change the rate of recording diagnoses of public primary health care and oral health care clinicians.

Conclusions

RRD was truly an effective method to enhance recording of diagnoses in public oral primary care. Disregarding the method to enhance the rate of change in the rate of change (RRD, FGPs, ERs) in recording of diagnoses seemed to be quite stable in the public primary care. Public primary health care physicians were more active than respective primary oral health care dentists to record diagnoses.

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Disclosure statement

No potential conflict of interest was reported by the author(s).

Data availability statement

The data presented in this study are available on request from the corresponding author.

Ethics statement

This study was approved by municipal authorities of Espoo and Vantaa city 23.8.2016. The data from the Finstar and Effic databases were anonymized, with a null identification risk.

ORCID

Anna Maria Heikkinen  <http://orcid.org/0000-0003-3252-192X>

Tuomo Lehtovuori  <http://orcid.org/0000-0002-2917-1036>

Marko Raina  <http://orcid.org/0000-0002-0201-6271>

Timo Kauppila  <http://orcid.org/0000-0002-6155-0300>

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