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The effect of electronic reminders on the recording of diagnoses in primary care: A quasi-experimental before and after study

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Abstract

Objectives: This study examined whether using electronic reminders leads to an increase in the rate of diagnosis recordings in the electronic health record system following visits to a general practitioner. The impact of electronic reminders was studied in the primary health care of a Finnish city. **Methods:** This observational quasi-experimental study based on a before-and-after design was carried out by installing an electronic reminder to improve the recording of diagnoses in the computerized electronic health record system. The quantity of the recorded diagnoses was observed before and after the intervention. The effect of this intervention on the distribution of different diagnoses was also studied. **Results:** Before intervention, 33%–46% of visits (to general practitioners/month) had recorded diagnose in the primary health care units. After 4 years, the recording rate had risen to 87%–95% ($p < 0.001$). The rate of change in the recording of diagnoses was highest during the first year of intervention and plateaued about 3.5 years after application reminders. In the present study, most of the visits concerned mild respiratory infections, elevated blood pressure, low back pain and type 2 diabetes. **Conclusion:** An electronic reminder is likely to improve the recording of diagnoses during the visits to general practitioners. The distribution of diagnoses was in line with former reports concerning diagnoses in Finnish primary care.

Keywords

Community health centers, medical informatics, primary health care, practice management, quality improvement, diagnosis

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Introduction

In primary health care, the recording of diagnoses is needed to ensure treatment actions, planning activities and management of resources.[1–3] Financial incentives to individual general practitioners (GPs)[4] or to multidisciplinary care teams[5] are reported to be effective in increasing the recording of diagnoses in primary care.

In the primary health care of Vantaa, the basic frequency of recording disease diagnoses was about 40%, which was considered insufficient. A higher frequency of recorded diagnoses was deemed necessary for planning activities and managing the resources of primary care. In a quite similar neighboring city, Espoo, it had been possible to increase the frequency of recording diagnoses from 55% of all visits to GPs to a level of 90% by using financial group bonuses for primary care teams.[5] Vantaa had no resources for such financial incentives. Since electronic reminders have also been shown to be effective in modifying the work practices of GPs,[6] the administration of Vantaa primary health care installed an electronic reminder into the electronic health record system to improve the recording of diagnoses by the care teams in one of its regions, called Hakunila-Länsimäki. This was enhanced with superior–subordinate or development discussions with the GPs. In this small-scale pilot study, electronic reminders seemed to improve the recording of diagnoses.[7]

The aim of this study was to explore whether the electronic reminders within the electronic health record system

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increased the rate of recording disease diagnoses during GPs' visits. We also wanted to explore which diagnoses were recorded to find out whether the present intervention produced data which reflected the distribution of diagnoses in real clinical life in primary care.

Materials and methods

The present work is a retrospective longitudinal quasi-experimental study with a before-and-after design in the primary care of the fourth largest city of Finland. This study was performed in Vantaa city, where in 2008 there were about 200,000 inhabitants. As everywhere in Finland, primary care is non-profit and municipalities, which fund this activity with taxes, maintain it as well as the electronic health record systems. The GPs are officials, who are employed and directly governed by the municipal health administration.

The data of the Vantaa health center were obtained from the Graphic Finstar—electronic health record system (GFS, Logica LTD, Helsinki, Finland). GFS provided a specific place in the electronic health record where appropriate 10th version of International Classification of Diseases (ICD-10) diagnosis could be entered during the patients' visits to GPs. The system assisted the GP in finding a proper diagnosis code or allowed the doctor to use the right code for the desired diagnosis directly. The diagnose was always chosen and thereby decided by the GP. The GP's input was to give at least three first letters and/or numbers of his suggestion as a diagnose. Then the system guided to a menu of diagnoses, which contain those cues originated by the GP, who was then able to choose the diagnosis he considered to be the most appropriate one.

The report generator of the GFS-system provided monthly figures for the total number of GP visits, the number of recorded diagnoses and thus a percentage for the recording of diagnoses, without identifying individual GPs. This was the main measure for analysis in the present study.

In February 2008, an electronic reminder was installed into the GFS-system. After that time point, the reminders were always active until the end of our follow-up (December 2014). The GFS-system prompted the GP to enter a diagnosis every time he wanted to finish the visit. If he had recorded diagnose already in former enters to the data of that visit (e.g. the diagnose of the visit was already recorded), the system did not remind the GP any more. If the doctor did not mark a diagnosis on the patient chart, 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" and recording the diagnose. 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 diagnose was not recorded at this second exit, the doctor was able to leave the report without getting a new reminder, for example, despite not marking the diagnose. The follow-up period started from February 2003 and ended in December 2014.

This study was carried out directly from the patient register without identifying the patients or GPs. The register keepers (the health authorities of Vantaa) and the scientific ethical board of Vantaa City (TUTKE) granted permission (VD/8059/13.00.00/2016) to carry out the study.

The obtained data were analyzed by comparing the recording of diagnoses during similar periods before and after the installation of the electronic reminder into the electronic health record system of primary health care in Vantaa. The comparisons between the follow-up years were performed by using parametric one-way repeated-measures analysis of variance (RM-ANOVA) with suitable corrections (Bonferroni) for multiple comparisons when following the development of the studied units as a function of time. The rate of change in diagnosis marking was analyzed by using a general linear model of regression analysis, which allowed us to detect the mean change in the rate of marking diagnoses (%/month) and its standard error of mean (SEM) before and after the intervention (GLM procedure of SigmaPlot 10.0 Statistical Software, Systat Software Inc., Richmond, CA, USA). These rates were then compared with t-test.[8–10]

Results

Effect of the electronic reminder

The rate of change in the recording of diagnoses increased after the intervention ($p < 0.001$, Figure 1a, Table 1). This rate was highest during the first year after the intervention, while being still significantly higher in the second, third and fourth post-intervention years than before the intervention. In the fifth post-intervention year, this rate decreased slightly when compared with the pre-intervention rate but subsequently it started to increase (Table 1).

The percentage for recording diagnoses in the units increased statistically significantly by 125% after the application of electronic reminders ($p < 0.001$, RM-ANOVA, Figure 1b). A constant 90% level of recording of diagnoses was reached in 4 years. It remained at about this level during the 7 years of follow-up after the implementation of electronic reminders.

Distribution of diagnoses

Altogether, 1,200 different diagnosis terms were used during the year 2014 by Vantaa GPs. A total of 200,738 diagnoses were recorded. The distribution of the most used diagnoses in 2014 is described in Table 2. Most of the visits concerned mild respiratory infections, elevated blood pressure, low back pain, musculoskeletal pains in limbs and type II diabetes.

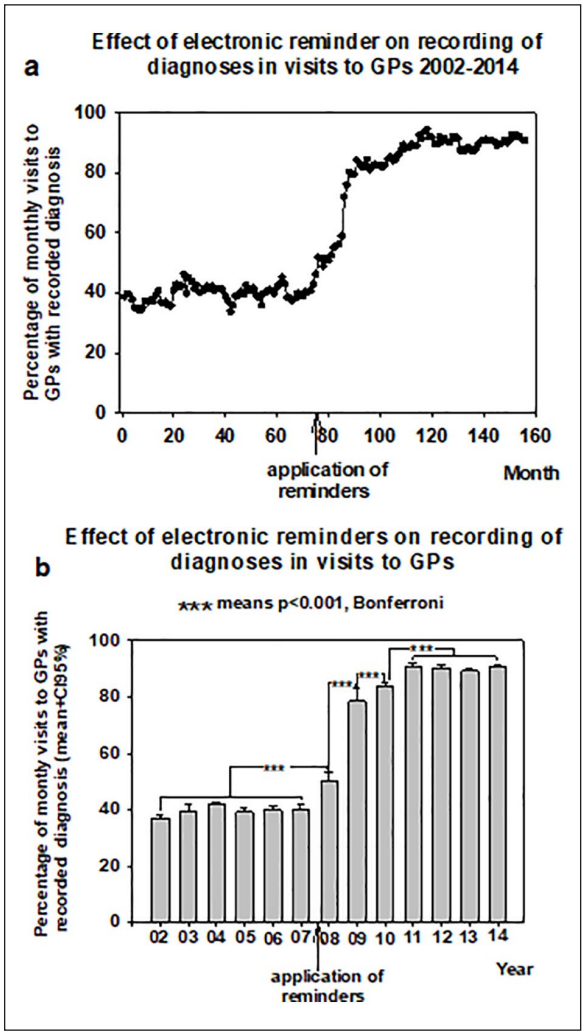

Figure 1. (a) Percentage of monthly GP visits with recorded diagnoses before and after introducing electronic reminder in February 2008. (b) Percentage of GP visits with recorded diagnoses before and after introducing electronic reminders. Means (bars) and upper 95% CI (brackets) are shown.
***$p < 0.001$ (Bonferroni).

Table 1. Rate (mean ± SEM) of change in recording diagnoses.

Period	Mean ± SEM (%/month)
Before intervention (2002–January 2008)	0.035 ± 0.014
First year after intervention	1.141 ± 0.157***
Second year after intervention	0.732 ± 0.209***
Third year after intervention	0.583 ± 0.092***
Fourth year after intervention	0.366 ± 0.149***
Fifth year after intervention	–0.20 ± 0.149***
Sixth year after intervention	0.285 ± 0.093***
Seventh year after intervention	0.196 ± 0.09**

SEM: standard error of mean.
**$p < 0.01$, ***$p < 0.001$, "before vs after intervention," t-test.

Table 2. Distribution of the diagnoses set by GPs in 2014.

Diagnosis	Total number	%	Diagnosis
J06	14,585	7.3	Upper respiratory infections, non-specific
M54	8976	4.5	Back pain
H66	6777	3.4	Otitis media
R10	6435	3.2	Gastric pain
I10	5813	2.9	Essential hypertension
M79	5092	2.5	Other soft tissue diseases and tendinoses
E11	4245	2.1	Diabetes, type 2
H10	3701	1.8	Diabetes type 1
J01	3593	1.8	Sinusitis
M17	3326	1.7	Osteoarthrosis of knee
J20	3321	1.7	Bronchitis
F32	2519	1.3	Depression
Z02	2493	1.2	Medical certifications
M75	2385	1.2	Soft tissue diseases of shoulder area
J45	2383	1.2	Asthma
R05	2156	1.1	Cough
R07	2150	1.1	Chest pain
F41	2063	1	Anxiety
Z04	1861	0.9	Examinations for various reasons
A09	1691	0.8	Other gastroenteritis and colitis of infectous and unspecified origin
R53	1615	0.8	Indisposition and tiredness
H60	1536	0.8	External otitis
L30	1516	0.8	Eczema, not defined
M30	1505	0.7	Vasculitis
M53	1499	0.7	Neck pain
R06	1438	0.7	Abnormal respiration
I48	1312	0.7	Atrial fibrillation
S93	1285	0.6	Ankle sprain
Z00	1268	0.6	General examination without a disease

GP: general practitioner.

Discussion

Application of an electronic reminder was temporally associated with improvement in the recording of diagnoses during the visits to GPs. Electronic reminders have been shown to be effective in modifying the work of GPs[6] but as far as we know, it has never been reported that they have been used for the present purpose. After 4 years of using the electronic reminder, the level of recording diagnoses reached a level of 90%. With financial incentives to the staff, this level of recording diagnoses was reached within 1.5 years[5] in very similar circumstances to those existing in Vantaa.

There was no decrease in the activity of recording diagnoses in the last years of follow-up. If an incentive is withdrawn in the primary care, this incentivized performance tends to return toward the pre-incentivized level.[11] Analogously to that,

when financial group bonuses for recording diagnoses were withdrawn from care teams in the neighboring city of Espoo, there was a decrease in the activity of recording diagnoses.[9] Yet, the rate of recording did not decrease although only electric reminder was used until the end of the follow-up of the present study. There was no other continuous surveillance or continuous reminding by the administration that diagnoses should be recorded in all areas of Vantaa.

The application of an electrical reminder to the GFS-system cost less than 10,000 euros as the sole investment for the city of Vantaa. However, financial incentives proved to be a far more expensive method in attempting to increase the recording of diagnoses, costing more than 50,000 euros/year.[5] Interestingly, just making the clinicians pay attention to recording diagnoses improved this activity in dental primary care.[10] Thus, the present results are in line with a former study suggesting that the commitment of the staff is at least equally important as financial incentives when improving the quality of clinical work.[12]

In the present study, most of the visits (Table 1) concerned mild respiratory infections, elevated blood pressure, low back pain and type 2 diabetes as in our former study performed in neighboring city.[5] Pärnänen et al.[13] reported that upper respiratory infections and otitis media, hypertension, musculoskeletal pains and diabetes were the most common reasons to visit a GP in a Finnish health center. Analogously, the most common reasons to visit a GP were reported to be musculoskeletal, respiratory and skin-related diseases followed by psychological, circulatory and metabolic disorders when the ICPC (International Classification for Primary Care)-system was used in a Finnish study.[14] Our data and the previous reports are in line with a Danish study using the same ICPC system.[15] Thus, the diagnoses recorded due to the present intervention seem to reflect the reality of clinical life in Scandinavian primary health care, and the present intervention seems to provide reliable data about the use of GP-services for administrative purposes. There was no sign of systemic overuse of any diagnostic category.

One strength of this study is that the present retrospective setting led to a situation where the participants were unaware of being studied. We cannot totally exclude secular trends as the main reason explaining the change in diagnoses recording. Yet, there were no other known major changes than use of electric reminders in the primary care of Vantaa which could have explained the observed change. Thus, the present result reflects real clinical activity.

The present results can be applied only to primary health care. Lack of data about individual doctors and their behavior is the major flaw of this study. Lack of these data inhibits us from drawing conclusions about whether there were doctors who did not respond to this intervention or whether there were doctors who regularly recorded inappropriate diagnoses despite the electronic reminders. At this point, it must also be recognized that despite the rate of recording diagnoses was increased, categorizing patients with diagnoses per se do not automatically lead to "better treatment" of these patients.[16]

Conclusion

Electronic reminders may provide an inexpensive and convenient method to intervene in clinical practices and encourage the completeness of diagnosis recording in primary health care. They may be effective primers for interventions of primary care.

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Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

Ethical approval for this study was obtained from the scientific ethical board of Vantaa City (TUTKE) which granted permission (VD/8059/13.00.00/2016) to carry out the study.

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Informed consent

Informed consent was not sought for the present study because this was retrospective register study authorized by the ethical scientific board of Vantaa City (TUTKE).

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