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RESEARCH ARTICLE

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The effect on the patient flow in a local health care after implementing reverse triage in a primary care emergency department: a longitudinal follow-up study

Timo Kauppila[a], Katri Seppänen[b], Juho Mattila[c] and Johanna Kaartinen[c]

[a]Department of General Practice and Primary Health Care, Clinicum of Faculty of Medicine, Helsinki, Finland; [b]Department of Primary Health Care Laboratory Services, Helsinki University Central Hospital, Laboratory Services (HUSLAB), Helsinki, Finland; [c]Department of Emergency Medicine, Helsinki University Hospital, Helsinki, Finland

ABSTRACT

Objective: Reverse triage means that patients who are not considered to be in need of medical services are not placed on the doctor's list in an emergency department (ED) but are sent, after face-to-face evaluation by a triage nurse, to a more appropriate health care unit. It is not known how an abrupt application of such reverse triage in a combined primary care ED alters the demand for doctors' services in collaborative parts of the health care system.
Design: An observational study.
Setting: Register-based retrospective quasi-experimental longitudinal follow-up study based on a before–after setting in a Finnish city.
Subjects: Patients who consulted different doctors in a local health care unit.
Main outcome measures: Numbers of monthly visits to different doctor groups in public and private primary care, and numbers of monthly referrals to secondary care ED from different sources of primary care were recorded before and after abrupt implementation of the reverse triage.
Results: The beginning of reverse triage decreased the number of patient visits to a primary ED doctor without increasing mortality. Simultaneously, there was an increase in doctor visits in the adjacent secondary care ED and local private sector. The number of patients who came to secondary care ED without a referral or with a referral from the private sector increased.
Conclusions: The data suggested that the reverse triage causes redistribution of the use of doctors' services rather than a true decrease in the use of these services.

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Emergency department; primary care; patient grouping; reverse triage

Introduction

Overcrowding of emergency departments (EDs) compromises both patient-perceived outcomes [1–3] and clinical outcomes [2–5] of care. There are three main solutions to ED overcrowding: increased resources, demand management, and operations research [6]. In order to provide immediate treatment for those patients in overcrowded primary care EDs who need it the most, a face-to-face triage system [7–9] based on the letters from A to E for assessing the urgency of patients' treatment needs was developed in Finland. The ABCDE-triage is subjectively administered by ED nurses in a face-to-face situation with the patient. The letters evaluate the patient's treatment needs as follows: A (patient directly to secondary care), B (to be examined within 10 min), C (to be examined within 1 h), D (to be examined within 2 h) and E (no need for immediate treatment) [7,8]. It was combined with public guidance related to the proper use of EDs [7,8].

Out-of-hours services in Finnish health centres are run by primary care staff and general practitioners (GPs), while the EDs of the secondary care hospitals are run by different medical specialists. Primary care EDs were increasingly incorporated into secondary care EDs due to centralization at the end of the 20th century, constituting 'combined emergency departments' [7]. In these EDs, GPs are responsible for the initial assessment and treatment. Due to difficulties in recruiting GPs into the public health system, the situation in Finnish primary care has recently deteriorated, access to public

CONTACT Timo Kauppila timo.kauppila@fimnet.fi, timo.kauppila@helsinki.fi Department of General Practice and Primary Health Care, Clinicum of Faculty of Medicine, (Tukholmankatu 8B), Helsinki, SF-00014 University of Helsinki, Finland

daytime services has worsened and EDs are forced to support the inadequate daytime services in primary and secondary care [7–9,13]. This has led to overuse of primary care EDs [7–9,13] and they may also have been considered as an extra public service for those who, for various reasons [10], are not willing or able to use daytime services. As a complementary, profit-driven system there is a well-equipped but expensive private primary health care system which it is not equally available for all Finnish citizens [11].

The ABCDE-triage was originally developed for the use of combined EDs and thus it differs from secondary care oriented triage systems for higher acuity patients [8,12]. In the original ABCDE-triage, a patient assessed as having no need for immediate treatment, e.g. a group E patient, was still allowed to stay in the ED until the more urgent patients had been examined and their treatment started [7]. As a demand management based solution to ED overcrowding [6], a stricter version of the ABCDE-triage was gradually applied and group E-patients were not placed on the doctor's list any longer, but were sent by a triage nurse to their own primary care health centre during office hours by giving the name, phone number and address of the facility, or given home care guidance, if needed [8,13]. This process of blocking non-urgent patients' access to doctors, known as reverse triage, has been developed as a tool for secondary care EDs to control patient flows in exceptional emergency situations [14,15]. It has been reported that similar systems have been implemented to reduce overcrowding of EDs even when exceptional crisis situations did not pertain [16,17].

In our former study, a gradually applied reverse triage system in primary care EDs was temporally associated with an increased workload of ED nurses without a change in the use of office-hour GPs or doctors in secondary care ED [13]. The use of the private sector increased [8] while the original ABCDE-triage, in which the E-group patients were allowed to stay in the ED until they were examined by a doctor, led to no such increase [7]. Because 'reverse triage was not applied immediately in the former studies' [8,13] we were not able to draw clear conclusions from the previous work regarding the actual effect of this intervention on the patient flows in the primary care ED studied, and in other parts of the local health care system.

In Peijas combined ED it was decided that the existing ABCDE-triage system [7] would be changed to reverse triage with immediate effect. This gave an opportunity to study how diverting low acuity patients from a primary care ED alters demand for doctor-driven health services in other parts of the health care system.

Methods

Setting

The present study was an observational and quasi experimental longitudinal follow-up study and it was based on a before-after setting. The study was performed in the city of Vantaa, Finland. Vantaa is the fourth largest city in Finland (205,000 inhabitants in 2008) and located just north of Helsinki, the capital city. In the present study, unselected primary care patients constituted the study population. Intervention was performed in the primary care ED. Secondary health care is also provided in the same facility, Peijas hospital. Therefore, the ED in Peijas is defined as a combined ED. This ED is equipped with out-of-hours laboratory and X-ray facilities.

Primary and secondary outcomes

The main outcomes were the numbers of monthly visits to the following providers of health care: GPs in primary care ED; GPs during office-hour services in public primary care; GPs in the private sector; doctors in Peijas hospital's secondary care ED [7,8,13]. We also recorded monthly numbers of referrals to Peijas secondary care ED and the origins of these referrals. Mortality rates were recorded in Vantaa to establish whether the present intervention represented any risk to general patient safety [18,19].

Data extraction

Data were obtained from the electronic health records of Vantaa primary care (Finstar-patient chart system) and Peijas secondary care ED (Helsinki University Central Hospital, HUCH; Musti- and Oberon-patient chart systems). KELA (The Social Insurance Institution of Finland) provided the respective data from the private primary health care doctors and Finnish Statistics provided monthly mortality data. The monthly numbers of referrals to Peijas secondary care ED were gathered from the Oberon-system. The number of referrals was not reliably available before March 2007 when the Oberon-system was introduced. The follow-up work consisted of collecting data from between January 2004 and December 2008. The main measure, the number of monthly visits to doctors in the ED, was scored before and after the intervention of the reverse triage [14,15] system which took place on 1.1.2008. Simultaneously, the number of monthly visits during office hours to doctors in Vantaa primary care and Peijas secondary care ED were scored before and after implementation of the intervention. No ethical

approval was required because this study was made directly from the patient register without identifying the patients. The register keeper (health authorities of Vantaa and HUCH) granted permission to conduct the study.

Statistics

Since the original ABCDE-triage system, combined with public guidance on the proper use of EDs, had been introduced on 1.1.2004, the number of monthly patient visits was compared with that year. From the 1st January 2005 to 31st December 2007 constituted the pre-intervention period. The 1st January–31st December 2008, the year when the triage group E patients were no longer placed on the doctor's list and thus the reverse triage was finally applied, constituted the after-intervention period (Figure 1). The numbers of monthly visits were initially compared using descriptive statistical methods and aggregated data. Specifically, one-way repeated measures ANOVA followed by Bonferroni-test or, when parametric tests were not applicable, Friedmann test followed by Student-Newman Keuls-test were used for testing to exclude the effects of significant systematic monthly variation [7,8,13]. A paired *t*-test was used for paired comparisons. The ED visits were also evaluated by using analytic statistical methods (i.e. to look at data changes over time), with Statistical Process Control (SPC) tools (e.g. the XmR chart) [13,20]. Once the intervention was put in place, the performance of the dependent variable was compared to the baseline performance (1st January 2004 – 31st December 2007). The SPC tests were used to determine if the process performance demonstrated common cause or special cause variation [13,20]. Specifically, three statistical tests were applied to the data: (a) a shift in the data, demonstrated by 8 or more consecutive data points, above or below the mean centreline on the control chart, (b) a statistical trend in the data, which is defined as 6 consecutive data points constantly increasing or decreasing, not counting values that are repeated in the sequence and (c) a data point that exceeds the upper or lower control limits on the control chart (i.e. a data point that exceeds 3 sigma) [13,20].

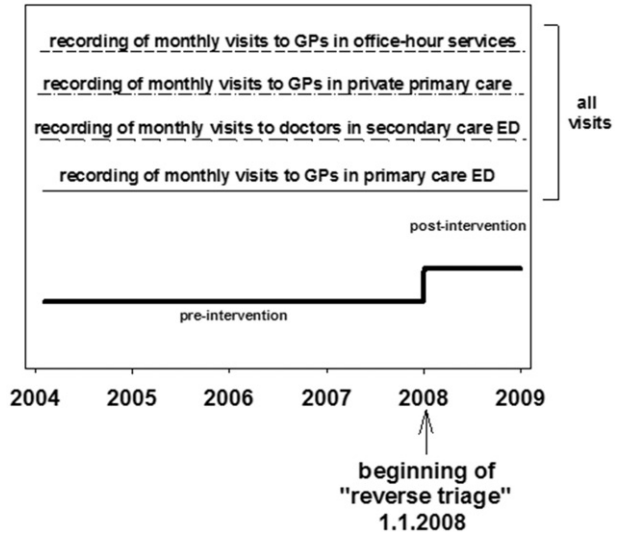

Figure 1. Flow chart of the study.

Results

Patient flows

Use of reverse triage was temporally associated with approximately a 25% decrease in the number of monthly visits to primary care ED doctors (One-way RM-ANOVA, $p < .001$, Figure 2). Although the number of monthly visits to GPs during public office hours did not alter ($p = .101$, Table 1), the total number of visits to public primary care GPs decreased after intervention ($p = .003$, Table 1). There was also an increase in monthly visits to private sector doctors ($p = .031$, Table 1). This meant 8585 more visits to GPs in private primary care in 2008 when compared with 2007.

Monthly visits to secondary care ED doctors in Peijas increased after the intervention ($p < .001$, Figure 3). After the beginning of the intervention, the monthly number of patients who visited doctors in the secondary care ED without referral increased by

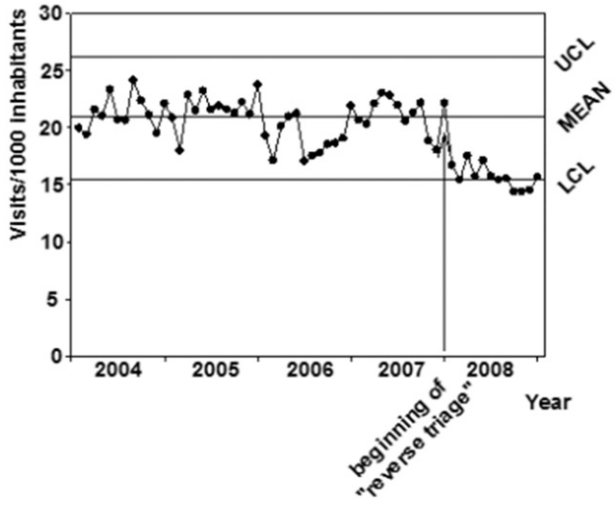

Figure 2. Effect of reverse triage on doctor visits in Peijas primary care ED. Data are shown before and after triage. Mean, UCL (mean $+3\sigma$) and LCL (mean -3σ) are shown. Note 8 or more consecutive data points below the mean centreline on the control chart as sign of a statically significant change after intervention.

Table 1. Effects of use of 'reverse triage on patient flows in different departments of health care system'.

Year	Visits to public office hour GPs mean (95%CI)	All visits to public GPs	Visits to private sector GPs	All visits to both secondary care ED doctors and primary care GPs
2004 (control)	87.9 (81.1–94.7)	109 (102–116)	20.2 (019–21.4)	137 (129–145)
2005	89.0 (79.2–98.8)	111 (101–121)	22.2 (21.3–23.1)	140 (129–151)
2006	90.4 (80.8–100)	110 (100–120)	22.7 (21–24.4)	139 (129–149)
2007	83.9 (73.7–94.1)	105 (95–115)	23.1 (19.9–26.3)	135 (123–147)
2008 (intervention)	83.8 (76.1–91.5)	100 (92–107)*	24.2 (22.6–25.8)*	132 (123–141)

Number of monthly visits/1000 inhabitants to GPs in Vantaa public primary care and private sector 2004–2008.
*Mean $P < .01$, Bonferroni-test vs. control year 2004.

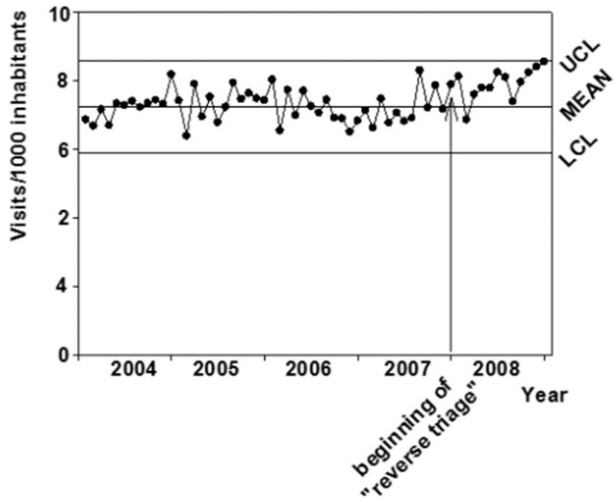

Figure 3. Effect of reverse triage on visits to doctors of secondary health care in Peijas ED. Data are shown before and after triage. Mean, UCL (mean $+3\sigma$) and LCL (mean -3σ) are shown. Note 8 or more consecutive data points above the mean centreline on the control chart as sign of a statically significant change after intervention.

about 20% (Friedmann-test, $p < .001$, Table 2(a)), while the number of referrals had already started to decrease a year before the intervention (One-way RM-ANOVA, $p < .001$, Table 2(a)). There was no statistically significant change ($p = .214$, Table 1) in the total amount of doctor visits during the intervention.

Referrals to secondary care ED

After the intervention, monthly numbers of emergency referrals made by private sector GPs to the secondary care ED increased by about 45% (paired *t*-test Table 2(b)). No increase was found in the respective values of those referrals made by public sector GPs (Table 2(b)).

Mortality

There was no change in the total mortality after the intervention ($p = .235$). The mortality of the oldest patients decreased ($p = .01$, Table 3).

Discussion

Suddenly diverting group E-patients was temporally associated with a decrease of about a quarter in the number of monthly visits to GPs in a primary care ED. The Number of visits to primary care GPs during office hours was unchanged during the follow-up. The number of doctor visits increased in the adjacent secondary care ED and in private primary care just after intervention. The total number of patients who were treated in public and private primary care and secondary care ED remained unchanged. The beginning of the intervention was not temporally associated with increased mortality.

Limitations of the study

Further outsourcing and organizational changes in the activities of Vantaa primary care after 2008 caused a shortened follow-up after the implementation of the ABCDE-triage, which constitutes a limitation of the study. Lack of data at individual patient level was the other major shortcoming because we were not able to study whether the patients were redistributed in such a way as was the intention of the health care providers, nor to detect smaller negative impacts than deaths. It would also have been highly useful to have the Oberon-system available already before 2007 since it would have allowed drawing more profound conclusions about the origins of the referrals to secondary care ED.

Findings in relation to other studies

Suddenly diverting group E-patients, i.e. those patients that the triage nurse considered to be non-urgent, was temporally associated with a decrease in doctor visits in a primary care ED and this decrease was approximately at the same level as it was after gradual application of reverse triage [8,13] but less than applying only the ABCDE-triage combined with public guidance [7]. The use of reverse triage was reported to be associated with cost savings in the ED functions of a

primary care ED [9], which is in line with the hypothesis that diverting non-urgent patients is an effective method to reduce costs in EDs. [21].

In line with the previous studies [7,8], the number of visits to primary care GPs during office hours was unchanged after applying reverse triage. Thus, the decrease in patient visits to the GPs in the primary care ED of Peijas did not cause any overflow of patients in the office-hours GP practice [7,8]. This result suggests that EDs may also have 'customers of their own' and that those patients are not likely to use ordinary daytime primary health care services [7,8,10]. The patients might have decreased the frequency at which they see a doctor after being subjected to reverse triage because of increased awareness about what medical problems require a visit to an ED. It is not, however, certain that this awareness was acquired because the total number of the doctor visits in the whole system remained the same.

An increase in the use of the private sector was observed, as in a former study when the reverse triage was gradually applied in a primary care ED [8].

Table 2. Effects of use of 'reverse triage on frequency of sending patients to secondary care ED'.

(a) Monthly number of patients/1000 inhabitants coming to secondary care ED with or without a referral 2004–2008

Year	Without referral mean (95%CI)	With referral
2004 (control)	1.75 (16.4–1.87)	5.49 (5.33–5.65)
2005	1.66 (1.55–1.77)	5.68 (5.41–5.95)
2006	1.56 (1.47–1.65)	5.59 (5.31–5.87)
2007	2.21 (1.84–2.58)	5.05 (4.65–5.45)#
2008 (intervention)	2.91 (2.72–3.10)*	5.00 (4.86–5.14)#

In Finland, the situation is the same as reported from Greece: a higher level of income is associated with private health care utilisation [11,22]. However, both the public and private primary care refers patients to public secondary care, where the most difficult clinical cases are usually treated. There are earlier studies suggesting that there may be a correlation between public and private sectors with respect to the demand for health care and health care utilization [22,23]. One desired health service supplied by primary care ED might be emergency referrals to secondary care ED. After the present intervention, the number of these referrals from the private primary care increased considerably. No change in the numbers of emergency referrals to secondary care ED from the public primary care was seen. Thus the findings of the present study support the view that if the supply of public health care is considered to be restricted, or at unsatisfactory levels, patients may look for care from the private sector [8,23]. Although 'voting with their feet' is not necessarily always a sign of dissatisfaction with the health services they received [24], it is likely that at least a part of the patients diverted from a primary care ED were heading to private GPs instead of the public system to seek referrals to secondary care ED.

The number of doctor visits increased in the adjacent secondary care ED just after intervention. There was also a considerable increase (about 20%) in the proportion of such patients who did not have referrals (group A), suggesting that their clinical status or assessment might have altered after implementing the reverse triage. Already before the implementation of

Table 2.

(b) Number of monthly referrals to secondary ED and percentage of doctor visits leading to referrals to secondary care ED from public and private sectors of primary care in 2007 and 2008

	Public sector GPs		Private sector GPs	
Year	Number of monthly ED-referrals (mean ± SD)	Percentage of monthly doctor visits with an ED-referral	Number of monthly ED-referrals	Percentage of monthly doctor visits with an ED-referral
2007	521 ± 51	2.72 ± 0.62%	86 ± 15	0.63 ± 0.21%
2008 (intervention)	512 ± 18	2.76 ± 0.41%	127 ± 13***	0.86 ± 0.09%**

*Mean $P < .05$, Student–Newman–Keuls test vs. control year 2004.
#Mean $P < .05$, Bonferroni-test vs. year 2004.
**Mean $P < .01$.
***$P < .001$, paired t-test vs. previous year.

Table 3. Effects of use of "reverse triage "on monthly mortality(/1000 person) in various age groups.

Year	Mortality in age group 0–19 years mean (95%CI)	Mortality in age group 20–64 years	Mortality in age group 64 years	Total mortality
2004 (control)	0.028 (0.012–0.044)	0.250 (0.220–0.280)	3.23 (2.89–3.56)	0.465 (0.425–0.505)
2005	0.040 (0.009–0.071)	0.259 (0.225–0.293)	3.11 (2.82–3.40)	0.474 (0.433–0.515)
2006	0.033 (0.012–0.055)	0.251 (0.208–0.294)	2.84 (2.54–3.14)	0.451 (0.415–0.487)
2007	0.016 (0.006–0.025)	0.231 (0.206–0.256)	3.07 (2.87–3.28)	0.473 (0.448–0.497)
2008 (intervention)	0.017 (0.006–0.028)	0.234 (0.206–0.262)	2.60 (2.30–2.89)*	0.430 (0.394–0.465)

*Mean $P < .01$, Bonferroni-test vs. control year 2004.

'reverse triage those who were most severely ill were directly handled in the secondary care ED' [7]. It might have been that the patients arrived at the secondary care ED in poorer condition than before applying the reverse triage. However, if the patients were in poorer condition, it is then strange that the mortality decreased, rather than increased, among the oldest people. Alternatively, organizational changes may conceivably have altered the way in which a patient was assessed into a triage group and even outweigh purely clinical evaluation – against the general idea that the clinical acuity of the patient is the main determinant of the assessment [reviewed by 12]. Yet our experience from this intervention was that reverse triage, in peace time, rather causes redistribution of the use of doctors' services than any decrease in that use: if one course (public primary care ED) was blocked the pressure moved to other suppliers of health services (private sector and secondary care ED).

Unselected, low acuity patients constitute a considerable portion of the target population of a combined ED [7,8]. It also remains to be studied whether real total cost savings in primary care are to be obtained with the present interventions. The present system may direct these patients to secondary care with expensive examinations that are out of proportion to their condition [25,26]. Therefore, it was not surprising to observe that the total number of patients who were treated in public and private primary care and secondary care ED remained unchanged. In line with that, the annual increase in the health costs per inhabitant in Vantaa city between 2007 and 2008 was almost double the increase between any of the preceding follow-up years of this study (http://www.kunnat.net/fi/asiantuntijapalvelut/soster/asiakasmaksut-talous-rahoitus/talous/sotekust/kust-annukset-vuonna-2013/Documents/Vantaa.pdf) although using 'reverse triage' 'reduced net costs in the primary care ED as originally planned' [9].

In military terms, reverse triage refers to treating those who are not seriously injured first to allow them to return to the battlefield sooner [14,15]. In civilian health care this means that the first health care professional meeting a patient assesses so-called mild health problems, treats them and discharges that patient immediately. According to the published data from the studied primary care ED (year 2008), 20% of the patients were triaged to group E and not directed to GPs after implementing reverse triage [27]. This study failed to show any life-threatening side-effects at the level of general public health if the present intervention was applied in a primary care ED and the secondary care ED was available. To our surprise, the beginning of reverse triage was actually temporally associated with decreased mortality in the oldest age group (>64 years). Mortality is a crude but definitive measure of safety in all levels of health care and public health, and it is not very sensitive to any primary care interventions [18,19].

Conclusions

The present reverse triage reduces non-urgent patient visits to doctors in primary care EDs but visits in the private sector and secondary care EDs may increase. Patients may seek referrals to secondary care EDs from the private sector. No increased mortality was observed but rather, decreased mortality among the oldest patients was observed. The reverse triage causes redistribution of the use of doctors' services rather than a true decrease in the use of these services.

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Ethical approval

According to the Finnish law of register-research, no ethical approval was required because this study was made directly by computer from the patient register in such a form that the researchers were not able to identify the patients. The register keeper (the health authorities of HUCH and Vantaa [23.8.2016]) permitted access to the data and granted permission to carry out the study.

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes on contributors

Timo Kauppila is a GP and scientist from the University of Helsinki.

Katri Seppänen is a manager of primary care services in the HUSLAB.

Juho Mattila is a finance manager in the HUS.

Johanna Kaartinen is a medical senior officer in the HUS.

ORCID

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

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