Improving influenza vaccination coverage among high-risk patients: a role for computer-supported prevention strategy?

Hak E, Essen GA van, Stalman WAB, Melker RA de

Author affiliation:
Julius Center for General Practice and patient Oriented Research,
UMC Utrecht
Improving influenza vaccination coverage among high-risk patients: a role for computer-supported prevention strategy?

**Background** Worldwide, population-based influenza vaccination strategies are being developed to trace, immunize and monitor high-risk persons efficiently. Computerized prevention modules may facilitate such a strategy in general practice.

**Objectives** We established the applicability of a computerized influenza prevention module and specifically addressed improvement of immunization coverage in high-risk patients during two consecutive influenza vaccination rounds after introduction of the module.

**Methods** In this descriptive study, four computerized practices of the Utrecht General Practices Network, covering about 36,000 patients, participated. In 1995, all patients with high-risk diseases were traced by relevant tags, ICPC- and ATC-codes, using the module. According to changed Dutch immunization guidelines in 1996, healthy elderly people over 65 years were also traced. Demographical and medical data included age, high-risk disease and vaccine uptake.

**Results** In October 1995, 3871 high-risk patients were identified (11% of population); overall vaccination coverage was 68%. Over one-third of these patients had not been indicated before. In between the two vaccination rounds, 1104 previously unknown patients with high-risk diseases < 65 years were found by means of the module’s online status. In October 1996, 6889 persons, including 2308 healthy elderly, were indicated (19%), and vaccination coverage was 62%. Of 3477 patients whose high-risk diseases were documented in both vaccination rounds, an overall improvement of vaccination coverage from 71% in 1995 to 76% in 1996 was observed ($P<0.05$). Main improvements were found in elderly patients. Immunization rates were highest in those with more than one risk factor, lung or cardiac disease, and lowest in healthy elderly and patients under 65 years with lung, renal, or other diseases.

**Conclusion** Computerized prevention modules and CMRs may facilitate population-based prevention of influenza and the use should be further encouraged.

**Key words:** Computer, general practice, health promotion, influenza vaccination, prevention.

**Published as:** Hak E, Essen GA van, Stalman WAB, Melker RA de. Improving influenza vaccination coverage among high-risk patients: a role for computer-supported prevention strategy? *Fam Pract* 1998; 15:138-143

The yearly impact of influenza on morbidity and mortality may be considerable. Immunization against influenza is effective in reducing acute complications among high-risk patients and appeared to be cost-saving among the elderly in the North American setting. Influenza vaccination should also be regarded as one of the most cost-effective strategies compared with other preventive strategies such as hepatitis B vaccination, cervical or breast cancer screening. Therefore, immunization policies have been developed so that immunization coverage in high-risk patients can be improved.
A population-based strategy, in which the impact of preventive intervention programs can be optimized, should include tracing patients at risk, reminding by intermediaries (preferably in writing), efficiently performed preventive action(s) and monitoring patients’ compliance and complications. In countries in which primary health care is provided mainly by GPs who keep a record of the risk status of all listed patients, they are of utmost importance as intermediaries for such a strategy. GPs have medical information available on the majority of patients, which is essential for tracing and monitoring the target group. The exponential use of computerized medical records (CMRs) in countries as The Netherlands and the UK may be considered one of the major advances in recent years with regard to population-based prevention. In 1994, approximately 60 percent of Dutch general practices already used CMR. Developed classification systems for reporting diagnoses and medical treatment in primary care make CMRs a useful tool for search strategies and decision-making. In a recent study among a representative sample of Dutch GPs, we have shown that the use of CMRs was independently associated with a high influenza vaccination rate, apart from other organizational aspects such as sending postal reminders.

In 1995, a national health promotion campaign to enhance a population-based approach towards influenza vaccination among Dutch GPs was started by the Ministry of Health, the Dutch College of General Practitioners (DCGP) and the National Association of General Practitioners. One of the aims of the campaign is to reach an immunization coverage over 70 percent for high-risk individuals in 1997. As part of this campaign, software-providing companies were asked to develop a computerized prevention module that could support the organization of the immunization program in general practices.

We aimed to evaluate the applicability of a computerized influenza prevention module during two consecutive vaccination rounds from the introduction of the module in October 1995 until December 1996 in the Utrecht Network of General Practices. Preliminary results of the use of the influenza prevention module during the 1995 vaccination round indicated high usefulness with regard to the selection, invitation, vaccination and monitoring of high-risk patients. In order to gain more insights into the long-term effects of using a computer-supported prevention strategy, we specifically addressed the following research questions: (i) what was the influenza vaccination coverage in patients over and under 65 years of age of various risk-categories in 1995 and 1996; and (ii) did the immunization coverage of patients indicated in 1995 further improve in 1996?
Methods

Setting and Patients
The Utrecht Network of General Practices with six participating group practices was established in 1989 and since then all patient contacts have been registered using CMRs. Diagnoses have been classified using codes of the International Classification of Primary Care16 according to the ICHPPC-2 criteria.20 Medical drug prescriptions have been classified as well using the Anatomical Therapeutic Chemical (ATC) classification index.17 In our network the focus is on an intensive contact monitoring of patient diagnoses. During the study period October 1995-December 1996, we followed the organization of two vaccination rounds in four of six network practices with 15 GPs, covering a patient population of approximately 36 000.

Until 1994, all patients at risk for influenza, according to the guidelines of the DCGP,21 were given an influenza indication tag (IT) in the CMR only when GPs reminded themselves of indication criteria during the patient’s visit. Patients with chronic lung, heart and renal disease, with diabetes mellitus, chronic staphylococcal infection and other less frequent high-risk diseases were indicated. As of October 1996, individuals over 65 years of age without documented risk factor were added to the DCGP immunization guidelines.

Functions of the computerized influenza prevention module

1. Adjustment of the DCGP Standard Selection Set with relevant tags, ICPC-, ATC-codes registered in the previous 24 months, and a computerized search for potential patients. The criterion of age over 65 years was added to the Set in 1996 (see table 1).

2. Removing patients from the list who were wrongly selected.

3. Printing a postal reminder with name and address of the selected patients.

4. Registration of the vaccination (ICPC-code R44.1).

5. On-line indication possibility for giving the influenza indication tag (IT) during the year.

6. Graphical presentation of results of all activities.
Table 1. Tags, ICPC- and ATC-codes of the DCGP Standard Set of the influenza module

<table>
<thead>
<tr>
<th>Tag</th>
<th>relevant ICPC</th>
<th>possibly rel. ICPC</th>
<th>ATC</th>
</tr>
</thead>
<tbody>
<tr>
<td>CV (cardiovascular disease)</td>
<td>K74-K80, K82-84</td>
<td>K71, K73, K90, K93</td>
<td>C01, C02, C03, C07, B01</td>
</tr>
<tr>
<td>EN (endocarditis prophylaxis)</td>
<td>see CV</td>
<td>see CV</td>
<td></td>
</tr>
<tr>
<td>LO (chronic lung disease)</td>
<td>R84, R85, R91, R95, R96</td>
<td>R70, R82, R86, R89, R99</td>
<td>R03</td>
</tr>
<tr>
<td>DM (diabetes mellitus)</td>
<td>T90</td>
<td></td>
<td>A10</td>
</tr>
<tr>
<td>RI (renal insufficiency)</td>
<td>U88, U99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>not applicable (other)</td>
<td>S10</td>
<td>B73, B74, B90, D81, L82, L85, N86, N87, N99, S99, T85, T86, T99</td>
<td>J01</td>
</tr>
<tr>
<td>IT (before 01/10/1995)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Age (65+, 1996)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

b Possibly relevant ICPC-codes: see footnote a.
c C01: cardiac therapy, C02: antihypertensives, C03: diuretics, C07: b-blocking agents, B01: antithrombotics, A10: drugs used in diabetes, R03: anti-asthmatics, J01: systemic antibacterials.

Computer-supported organization of the influenza vaccination

After installing the module in October 1995, a computerized search was carried out using the DCGP Standard Selection Set. All initially selected patients were automatically registered by a selection tag (ST). GPs were subsequently asked to go through the printed list to verify whether a patient was rightfully selected according to GP influenza immunization guidelines. Indicated patients were registered by an indication tag (IT) and were all sent a personal reminder for vaccination. Compliers were immunized during mass vaccination rounds in the first 2 weeks of November 1995 and registered in the CMRs. In 1996, the module was kept on-line and updated with regard to the changed guidelines in which healthy elderly (≥65 years) were indicated as well. A similar procedure for selection, reminding, vaccinating and monitoring was followed during the second vaccination round in 1996.
Data collection and analysis
We subdivided patients into under and over 65 years of age and constructed the following six high-risk categories according to the relevant tags, ICPC- or ATC-codes (see also table 1): patients with (i) cardiovascular disease; (ii) chronic lung disease; (iii) diabetes mellitus; (iv) renal disease; (v) other disease and (vi) more than one risk factor. We added the category healthy 65+ in the analyses concerning the second vaccination round. We used chi-square and paired proportion tests to test for statistical differences in categorical and ratio variables between two groups. Two-sided P-values <0.05 indicate statistical significance.

Results
In 1995, a total of 6287 of 36 132 patients (17%) listed in the practices were initially selected on the basis of the 1995 DCGP Standard Selection Set (see figure 1). More than half the patients (3249) were selected by an indication tag (IT) which was given manually in previous years. Others were selected by illness-specific tags (1197), medication (1141) and ICPC-codes alone (700).

Figure 1. The selection of the study populations. Absolute numbers (% of total population) are given

<table>
<thead>
<tr>
<th>Year</th>
<th>Total patient population (01/10/1995)</th>
<th>ST (initially selected by module)</th>
<th>IT (indicated 1995)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>N=36 132</td>
<td>N=6287 (17%)</td>
<td>N=3871 (11%)</td>
</tr>
<tr>
<td>1996</td>
<td>N=36 840</td>
<td>N=1104 (3%)</td>
<td>N=3477 (9%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IT (&lt;65 years, 1996 only)</td>
<td>healthy 65+ (1996 only)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N=1104 (3%)</td>
<td>N=2308 (7%)</td>
</tr>
</tbody>
</table>
After checking the selection list, 773 patients were found with an IT given in previous years, but who did not require a reminder in 1995, as disease status or doctor had changed during the year.

Almost two in three initially selected patients (3871/6287) were indeed indicated for vaccination by their GP, which equals 11% of the total patient population. In all, 1395 more high-risk patients (56% increase) were found in 1995 after first use of the module, compared with the previous year. Of all patients with high-risk medical conditions, 2122 (55%) appeared to be aged under 65 years (not shown in figure 1).

In 1996, 6889 persons (19% of the patient population) were indicated for vaccination. Most of the patients with high-risk disease who were previously indicated in 1995 (3477/3871) were again registered by an IT in 1996; the remaining 394 patients were moved out of the practice or their disease status was changed. After the introduction of the on-line status of the module, an additional 1104 patients with high-risk disease aged under 65 years were found in between the two vaccination rounds. In addition, 2308 elderly without documented high-risk disease were added to the indication list. Still, more than 40% of all indicated persons appeared to be aged under 65 years (not in figure 1).

In 1995 and 1996, overall immunization rates appeared to be 68% (n=3871) and 62% (n=6889), including for the first time the 2308 healthy elderly over 65s, respectively. In both years (1995 and 1996) these rates appeared to be highest in elderly patients with more than one risk factor (78% and 82%, respectively), lung (76% and 80%) and cardiac disease (72% and 72%). Uptake was lowest in patients aged under 65 years with lung (66% and 68%), renal (65% and 72%) or other diseases such as chronic staphylococcal infection (43% and 49%). In 1996, immunization rates of healthy elderly and newly indicated patients with high-risk disease aged under 65 years (n=1104) were 43% and 62%, respectively.

In order to establish possible improvement of the immunization coverage in high-risk patients after 2 years of calling up, we showed vaccination rates of patients with high-risk disease who could be followed during two consecutive vaccination rounds (1995 and 1996) by age and risk category (see table 2). The overall vaccination rate of this patient group was 71% in 1995 and improved by 5% on average to a level of 76% in 1996 (p<0.05). As similarly found in the separate year cohorts, mean vaccination rates were higher in patients aged over 65 years (76 and 83%) and rates improved more pronouncedly as well compared with patients under that age (67 and 70%). Highest statistically significant improvement in vaccine uptake was found in elderly patients with cardiac
disease (8%). In patients aged under 65 years with lung, renal or other diseases and diabetes mellitus, almost no improvement was observed.

### Discussion

Current information on immunization rates in various high-risk patient groups in Western countries is lacking due to incomplete registration of disease status, age and received vaccinations in primary care. This study showed that monitoring immunization rates in different disease and age categories is facilitated by using CMRs and a computerized influenza prevention module in general practice. In our network we found that about 70% of patients with high-risk disease were immunized in 1995 and vaccination coverage even improved in patients invited for the second time. The most significant improvement was found among the elderly, especially those at highest risk as

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac disease</td>
<td>≥ 65</td>
<td>711</td>
<td>515 (72)</td>
<td>566 (80)a</td>
<td>8b</td>
</tr>
<tr>
<td></td>
<td>&lt; 65</td>
<td>367</td>
<td>257 (70)</td>
<td>269 (73)</td>
<td>3</td>
</tr>
<tr>
<td>Lung disease</td>
<td>≥ 65</td>
<td>244</td>
<td>195 (80)a</td>
<td>210 (86)a</td>
<td>6b</td>
</tr>
<tr>
<td></td>
<td>&lt; 65</td>
<td>1024</td>
<td>663 (65)</td>
<td>685 (67)</td>
<td>2</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>≥ 65</td>
<td>136</td>
<td>97 (71)</td>
<td>107 (77)</td>
<td>6b</td>
</tr>
<tr>
<td></td>
<td>&lt; 65</td>
<td>174</td>
<td>123 (71)</td>
<td>127 (73)</td>
<td>2</td>
</tr>
<tr>
<td>Renal insufficiency</td>
<td>≥ 65</td>
<td>16</td>
<td>8 (50)</td>
<td>9 (56)</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>&lt; 65</td>
<td>18</td>
<td>13 (72)</td>
<td>11 (61)</td>
<td>-11</td>
</tr>
<tr>
<td>Other</td>
<td>≥ 65</td>
<td>25</td>
<td>14 (56)</td>
<td>19 (76)a</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>&lt; 65</td>
<td>59</td>
<td>29 (49)</td>
<td>30 (51)</td>
<td>2</td>
</tr>
<tr>
<td>&gt; 1 risk factors</td>
<td>≥ 65</td>
<td>500</td>
<td>409 (82)</td>
<td>435 (87)</td>
<td>5b</td>
</tr>
<tr>
<td></td>
<td>&lt; 65</td>
<td>203</td>
<td>158 (78)</td>
<td>167 (82)</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>≥ 65</td>
<td>1632</td>
<td>1238 (76)</td>
<td>1346 (83)a</td>
<td>7b</td>
</tr>
<tr>
<td></td>
<td>&lt; 65</td>
<td>1845</td>
<td>1243 (67)</td>
<td>1289 (70)</td>
<td>3b</td>
</tr>
<tr>
<td>all ages</td>
<td>≥ 65</td>
<td>3477</td>
<td>2481 (71)</td>
<td>2635 (76)</td>
<td>5b</td>
</tr>
</tbody>
</table>

a 265 versus <65, chi-square P < 0.05.
b 1995 versus 1996, paired proportion test P < 0.05.
chronic lung and cardiac patients. Lower immunization rates were observed in healthy elderly and patients under 65 years invited for the first time. This confirms earlier evidence by Hutchinson et al., who observed higher uptake after repeated reminding.

These results also demonstrate that a computer-supported search strategy may greatly enhance the first step of population-based prevention, namely, the selection of high-risk patients. After the introduction of the influenza prevention module in 1995, more than twice as many patients at risk could be identified compared with the previous years. As most of the patients were selected by the use of tags and medication, the search strategy used may be of equal benefit to GPs who do not make use of coded diagnoses. Also, the online function enhances an active attitude towards the identification and education of high-risk patients regarding this subject.

The proportion of 11 percent of patients with high-risk disease in 1995 is in accordance with other population-based studies carried out in The Netherlands, Owing to the inclusion of individuals aged over 65 years without documented high-risk disease in 1996, this proportion of indicated patients rose to 19% of the total practice population. For a full-time working Dutch GP with a mean number of 2350 patients listed, this means a considerable number of 445 patients to be reminded and immunized on average. We found that almost four out of ten these patients appeared to be aged under 65 years. Since most cost-effectiveness studies have been carried out among elderly populations, not much is known about health and economic benefits associated with immunizing younger adults with various high-risk diseases, and such studies are therefore urgently needed.

The present descriptive study was not intended to be representative for the Dutch GP population. The participating GPs are part of an academic network and are well trained in classifying their patients in CMRs. However, the patient population is comparable with the Dutch population. The advantage of such a setting is that it shows the ideal situation in which every GP who uses CMR and the influenza prevention module may reach immunization levels above 70%, and may be able to identify many, if not all, high-risk patients. Another limitation of the present study was the lack of a comparison group. No inferences can be made about this computerized prevention strategy being superior over another prevention strategy that already exists. However, we do believe that the high immunization coverage as observed in our study may not be reached easily without a highly sensitive search-and-monitoring facility.
In conclusion, the use of computerized prevention module may greatly facilitate population-based prevention of influenza. Advantages include an effective search for potential high-risk individuals, and automatic reminder and vaccination registration functions. The use CMRs and the influenza prevention module should therefore be encouraged on a larger scale.

Acknowledgements

We are indebted to F. Leffers, MSC, computer engineer, for help with the data collection and useful comments on the manuscript. This study was supported financially by the Dutch Council of the Sick Fund. We would like to thank the Utrecht Network of General Practices group: HAM Asbreuk, JG Blankestijn, JG Blommestein, JF Bolderink, MW van den Broek, GJA Daggelders, MEL van Dillen, WH Eizenga, MM de Groot, EFHM Henderickx, R Hirsch, HHG de Jong, JMA Juffermans, ME Numans HM Pieters, CD Rijkens, FH Rutten, BE van der Snoek, W Stalman, Y Stoutenbeek, L Truijens, NJ de Wit, WLG van Zijl.
References

15. Pringle M, Ward P, Chilvers C. Assessment of the completeness and accuracy of computer medical records in four practices committed to recording data on computer. *Br J Gen Pract* 1995;45:537-41