Using the general practice EMR for improving blood pressure medication adherence

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Abstract. Purpose. Analysis of practice electronic medical records (EMRs) demonstrated widespread antihypertensive medication adherence problems in a Pacific-led general practice serving a predominantly Pacific (majority Samoan) caseload in suburban New Zealand. Adherence was quantified in terms of medication possession ratio (MPR, percent of days covered by medication supply) from the practice’s prescribing data. We studied the effectiveness of general practice staff follow-up guided by EMR data to improve medication adherence.

Methods. A framework for identification of suboptimal long-term condition management from routinely-collected EMR data, the ChronoMedIt (Chronological Medical Audit) tool, was applied to data of two Pacific-led general practices to identify patients with low MPR. One practice undertook intervention, the other provided usual care. A cohort was based on MPR<80% for antihypertensive medication in a baseline 6-month period. At the intervention practice a team was established to provide reminders and motivation for these patients and discuss their specific needs for assistance to improve adherence for 12 months. MPR and systolic blood pressure (SBP) was collected at baseline and for last six months of intervention based on practice EMRs; national claims data provided assessment of MPR based on dispensing. Nursing notes were analysed, and patient and provider focus groups were conducted.

Results. Of the 252 intervention patients with MPR<80% initially, MPR improved 12.0% (p=0.0002) and systolic blood pressure was 3.5mmHg lower (p=0.07) as compared to the control cohort. MPR from national claims data improved by 11.5% (p=0.0001) as compared to the control. Patients welcomed the approach as caring and useful. Providers felt the approach worthy of wider deployment but that it required dedicated staffing.

Discussion and Conclusions. Systematic follow-up of patients with demonstrated poor medication possession appears effective in the context of a Pacific-led general practice serving a largely Pacific caseload. It was possible to exploit the EMR database to identify patients with low antihypertensive medication possession and to raise their level of medication possession significantly. The measured effect on systolic BP was only marginally significant, leaving open the question of the precise value of the intervention in terms of morbidity and mortality. The intervention was found to be feasible and was met with good acceptance from the intervention patients, who appreciated the concern reflected in the follow-up effort. The intervention practice is continuing use of ChronoMedIt to guide long-term condition management with extension to cholesterol and blood sugar.

Keywords. Medication Adherence, Electronic Prescribing, General Practice, Pacific Islander, Quality Audit Tools
Introduction

Although blood pressure (BP) lowering medications are effective in reducing cardiovascular risk and renal disease when taken as directed, low adherence to prescribed regimens threatens their effectiveness. Long-term adherence with medications for chronic diseases is low, particularly among lower socio-economic groups [1]. Illustrative of the size of the problem in a subsidized medical system, a Swedish study found satisfactory refill adherence for thiazide diuretics at 55%, ACE-inhibitors at 59% and selective beta-blocking agents at 66% [2]. A systematic approach to identifying non-adherent patients and reliably offering intervention is needed. We take particular interest in Pacific adherence to antihypertensive medication as this group has a greater cardiovascular disease risk than European New Zealanders [3].

Our research has focused on use of Electronic Medical Records (EMRs) to examine quality of long-term condition management in general (particularly adherence to long-term medications) and to provide specific, actionable information that practices can use to improve quality of care. New Zealand (NZ) ranks well for IT use in General Practice medicine[4]; individual practices have ready access to their prescribing records and can potentially use these to be more aware of their patients’ adherence. While prescriptions provide an indirect measure of adherence (as compared to dispensing or consumption), we find 93% of prescriptions for long-term medication to be matched within a week by a dispense record in NZ national claims data [5].

Herein we present methods and findings on our intervention aimed at improving the adherence to antihypertensives for Pacific people. We used the practice EMR to detect a sustained pattern of low medication adherence and then had a designated team of practice staff follow up with the identified patients over a 12-month period. We aimed to assess whether medication adherence and blood pressure control improved as compared to a control cohort at a similar practice providing usual care.

1. Methods

Our ChronoMedIt (Chronological Medical Audit) tool provides a general framework for identification of suboptimal long-term condition management from routinely-collected EMR data. Criteria of interest are composed from concepts in a long-term condition management ontology to parameterize a query against a data extract from the EMR [6]. We use Medication Possession Ratio (MPR) – percent of days a patient is in supply of a medication – as our adherence measure, and choose the common threshold of MPR<80% [7] as defining poor/low adherence (Figure 1 shows a ChonoMedIt timeline graph for an example case). We model that a patient is ‘in supply’ if issued a prescription that provides supply on a given day when dispensed on the day prescribed and taken as directed. We consider a patient adherent on a given day if they have any antihypertensive supply (ignoring partial non-compliance to combination therapy with multiple types of pills) and disregard stockpiles. (The ‘no stockpiles’ assumption fits NZ better than Australia where patients can reach a ‘safety net’ threshold.)

Both the intervention and control practice are Pacific-led and have predominantly Pacific (majority Samoan) caseload. Both are located in metropolitan Auckland and have the same brand of EMR system. Antihypertensive MPR was calculated for the ‘baseline’ six-month period 1 July to 31 December 2008 from the prescribing data of the control and intervention practices with antihypertensive MPR<80% defining the
focus of interest. Patients were also required to be 20 years of age or over, enrolled with the practice and to have had at least one antihypertensive prescription during the baseline period or the six months previously (indicating the physician’s intention to have a patient on a BP lowering medication).

Intervention was conducted by two general practice staff, themselves of Pacific ethnicity, dedicated 20-hours-per-week each to the task of follow-up and support for the intervention patients commencing in May 2009 and persisting through May 2010. The staff made initial contact by telephone, or home visit when telephone failed. They met with the patient (at the patient’s home if necessary) and discussed their specific needs for assistance to improve adherence (e.g. education, family involvement, transport, welfare assistance). The patients were encouraged to prioritize their chronic condition management. Eligibility for additional support services was reviewed. Patients were actively followed up with reminders about one week before their next quarterly appointment for review and medication re-prescription was due. The staff devised assistive materials, including calendars to help patients track care activities. The staff kept notes of these intervention activities in the EMR system and posted automated reminders in the system to coordinate their workflow.

Outcome was measured by the antihypertensive MPR and blood pressure measurements from the practice EMRs in the period 1 December 2009 to 31 May 2010 (second 6 months of intervention, ‘outcome period’). Age and gender were used as covariates in multiple linear regression of patient outcome (difference of baseline and outcome period) by intervention/control group membership of patients for MPR and systolic BP using the SAS GLM module. Ethnicity was not included as a covariate since most patients were Pacific. MPR could be zero if the EMR showed no antihypertensives in a given period. BPs were not taken explicitly as part of the protocol, but any available in the EMR were used – taking the mean if multiple were available, and omitting from the BP regression analysis cases with BP missing in either the baseline or outcome periods. National pharmaceutical reimbursement data was extracted for all patients (the relevant antihypertensive medications are subsidized under NZ’s Pharmaceutical Schedule). This provided a parallel MPR assessment based on dispensing, rather than prescribing only. Nursing notes were analyzed with attention

![Figure 1. ChronoMedIt timeline graph for a patient with MPR<80% on two-agent antihypertensive therapy.](image)
to effort in making initial contact with patients. One focus group each of intervention patients and practice staff was convened in the middle of the intervention period. Thematic analysis of focus group notes was undertaken. Two of the authors present at a focus group independently noted major emergent themes, with common themes being abstracted from the notes by a third author not present at the session.

2. Results

252 patients at the intervention practice and 227 patients at the control practice had baseline MPR<80% as well as meeting the other inclusion criteria. Figure 2 graphs the MPR distribution-based on EMR prescribing data in the baseline and outcome periods for the intervention and control cohorts. Multiple regression estimates the intervention effect on MPR as 12.07% (p=0.0002) with gender and age effects not significant. As can be seen, MPR improves for both groups (from a mean of 49.80% to 68.05% in the intervention group and 52.59% to 59.07% in the control group).

![Figure 2](image.png)

Figure 2. Histogram of MPR based on EMR prescribing data in baseline and outcome periods for intervention and control cohorts.

Multiple regression estimates the intervention effect on systolic BP as 3.48mmHg with marginal significance (p=0.0651) and gender and age effects not significant. Mean systolic BP improved from 137.6mmHg to 135.9mmHg in the intervention group and rose from 135.2mmHg to 137.0mmHg in the control. Due to missing BPs in one or both periods 75 cases were omitted from regression analysis from each group (i.e. N = 177 for the intervention and N = 152 for the control). Dispensing data showed mean MPR improving from 49.81% to 60.14% in the intervention group and dropping from 45.63% to 44.59% in the control. Multiple regression estimates the intervention effect on dispensing MPR as 11.54% (p=.0001) with gender and age effects not significant.

Nursing notes for the first 4.5 months of intervention show that telephone contact with intervention patients required a mean of 2.1 calls to make contact, yielding return visits in 87% of cases, and identifying a reason for non-visit (e.g. patient overseas) in a further 7% of cases. Staff resorted to a home visit in 12.5% of total cases, and took BP measurements as part of such visits. Only one patient rejected participation in the intervention program. The patient focus group was attended by 12 intervention patients; the provider group was attended by 13 clinical and administrative staff members. Table 1 shows themes emerging from analysis of focus group notes.
Table 1. Themes emerging from analysis of focus group notes

<table>
<thead>
<tr>
<th>Group</th>
<th>Theme</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient</td>
<td>Intervention perceived as chronic condition management generally (not specifically medication adherence)</td>
<td>Patients understand diet is a major issue and would like more advice and help with this. Patient perceive intervention in terms of preventing disease / events (e.g. preventing stroke)</td>
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<td></td>
<td>Positive and personal reaction to outreach</td>
<td>One patient said how good it was that “someone is thinking about me”. Patients appreciated the concern.</td>
</tr>
<tr>
<td></td>
<td>Different patients like, and believe they are effectively reached by, different modes of contact</td>
<td>Telephone is most accepted modality; with proponents and detractors for each of phone, SMS, letter and home visit. Some patients who owned cell phones admitted to not regularly keeping them charged. It’s difficult to find a one-size-fits-all time window for making contact to schedule an appointment – one week before end of medication supply appears to be a reasonable compromise.</td>
</tr>
<tr>
<td></td>
<td>Patients appreciate advance and committed appointment-making to fit in with their commitments</td>
<td>The intervention is worth wider deployment, but needs to be systematized for transfer to other settings.</td>
</tr>
<tr>
<td>Provider</td>
<td>Need for a dedicated team to carry out the intervention tasks</td>
<td>This could not fit on top of other staff commitments; the time available to the intervention team was about right to allow them to focus on the task</td>
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<tr>
<td></td>
<td>Needs to be more integrated with normal work and existing teams</td>
<td>No clear pathway for how this would happen</td>
</tr>
<tr>
<td></td>
<td>Not all patients needing chronic condition management were included</td>
<td>There are many patients outside of the MPR-based criteria that staff perceive as in need of better long-term condition management</td>
</tr>
<tr>
<td></td>
<td>Traditional medicine interferes with chronic condition management</td>
<td>Traditional beliefs are frequently at odds with patient acceptance of evidence based treatment regimens</td>
</tr>
<tr>
<td></td>
<td>Should be expanded to other practices</td>
<td>The intervention is worth wider deployment, but needs to be systematized for transfer to other settings</td>
</tr>
</tbody>
</table>

3. Discussion

The study illustrates use of routinely-collected general practice EMRs to identify patients with demonstrated patterns of poor adherence to BP lowering medication. Follow-up of patients over a 12-month period yielded significant improvement in their medication possession (both as measured from prescriptions and dispensing) as compared to a control group. The findings suggest that it is feasible to improve adherence to long-term medications in the setting of Pacific-led general practice.

It is noteworthy that the intervention was liked by patients. One could readily imagine pursuit by practice staff as unwelcome. Our focus group feedback indicates that the ideal timing and format for reminders varies widely; but the format of a telephone call one week prior to end of current medication supply, and the offer of a home visit, was broadly accepted by the intervention group. This was possibly aided by the alignment of Pacific ethnicity of intervention staff to that of the majority of the patients, and could owe in no small part to inter-personal skills of the individual staff.

The study was scaled as a feasibility study, not a definitive trial. Missing BP measures, and their high variance, contributed to only a marginally significant BP effect. Future evaluation efforts should employ a protocol that provides better variance control and completeness of BP collection as compared to reliance on those collected ambiently by the practice. Issues of organizational culture are undoubtedly important in successful scale-up of such an intervention: the provider focus group identified that issues emerged around staff acceptance of the resources being allocated to the intervention and the relationship of the activity to routine workflow.
It should be possible to replace some of the manual staff effort with automation, such as SMS reminders; although we believe the inter-personal approach may be essential for many patients, especially those who are not regular users of cell phones or internet. One possibility is the display of medication supply information as part of a Personal Health Record (PHR) – while this may seem a poor fit for patients with low adherence, promising scenarios emerge with PHR access by others (e.g. children of elderly patients). The practice is continuing use of ChronoMedIt to identify patients for adherence promotion (now with extension to cholesterol and blood sugar medications).

4. Conclusion

Systematic follow-up of patients with demonstrated poor medication possession appears effective in the context of a Pacific-led general practice serving a largely Pacific caseload. It was possible to exploit the EMR database to identify patients with low antihypertensive medication possession and to raise their level of medication possession significantly. The measured effect on systolic BP was toward reduction, but only marginally significant, leaving open the question of the precise value of the intervention in terms of morbidity and mortality. The intervention was found to be entirely feasible; it was met with good acceptance from the intervention patients, who appreciated the concern reflected in the follow-up effort. Such efforts that tie the EMR to improving long-term condition management should be explored more widely.

5. Acknowledgments

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References