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Research paper

Use of interval based quality indicators in blood pressure management to enhance quality of pay for performance incentives: comparison to two indicators from the Quality and Outcomes Framework

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ABSTRACT

Background Pay for performance incentives are becoming increasingly popular, but are typically based on only a single point-in-time measurement as an indicator of chronic condition management.

Aims To determine the association between three time-interval based indicators of suboptimal blood pressure (BP) control and two point-in-time indicators from the UK Quality and Outcomes Framework (QOF): BP5 (the percentage of patients with hypertension in whom the last BP in the previous nine months was $\leq$150/90) and DM12 (the percentage of patients with diabetes in whom the last BP in the previous 15 months was $\leq$145/85).

Methods We extracted classification data and BP measurements from four New Zealand general practices with 4260 to 6130 enrolled patients. Data were analysed for three indicators with respect to a nine-month evaluation period for patients with

hypertension and a 15-month period for patients with diabetes: (1) two or more consistently high BP measurements spaced over ≥90 days, (2) a high BP measurement followed by a lapse of >120 days in BP measurement and (3) no BP measurement for >180 days.

Results For the four practices, 65–81% of the patients satisfied BP5 and 59–68% of patients satisfied DM12. Of the hypertension patients satisfying BP5, 31% (95% CI: 28–33%) failed at least one of the three interval based indicators; 42% (95% CI: 39–46%) of the diabetes patients satisfying DM12 failed at least one of the three interval based indicators.

Conclusion Considering only a point-in-time controlled BP measurement provides an incomplete view of the quality of BP management in patients with hypertension or diabetes over a period of time.

Keywords: clinical audit, long-term care, patient outcome assessment, QOF, quality indicators

How this fits in with quality in primary care

What do we know?
Performance indicators for control of blood pressure (BP) in hypertension and diabetes used in the UK QOF and other pay for performance schemes use point-in-time indicators.

What does this paper add?
Time-interval indicators of BP control are shown to be feasible and may provide a more complete, valid and reliable assessment of quality of care than point-in-time indicators.

Introduction

Hypertension, or high BP, is a chronic condition with a significant contribution towards increased cardiovascular disease (CVD) risk. It is a leading cause of death worldwide, resulting in over 1.9 million annual deaths (42% of all deaths) in the European Union (EU) with an overall CVD related cost burden of €169 billion per year to the EU economy.[1] Despite various efforts to control BP to below recommended limits, only 41.9% of the treated patients with hypertension are reported to have controlled BP.[2] High BP has been suggested as the most important risk factor for CVD: it has been reported that controlling all hypertensive patients to a systolic BP of ≤140 mmHg would yield a reduction of 28 to 44% in stroke and 20 to 35% in ischaemic heart disease, a total of 125 600 events saved a year in the UK alone.[3] Similarly to hypertension, patients with diabetes are at an increased risk of CVD as well as increased risk of eye damage and renal disease.[4]

The medical community generally accepts that following well developed, evidence-based clinical practice guidelines improves the quality of care received by patients along with the many other benefits that guidelines provide.[5] Although no guideline can be expected to apply to all individuals in a general practice setting, it is the nature of evidence-based guidelines (such as the widely accepted seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC7)[6] and more localised ones such as the New Zealand (NZ) Guidelines Group's Assessment and Management of Cardiovascular Risk[7] and the guidelines produced by the National Institute for Health and Clinical Excellence (NICE) in the UK[4]) that close adherence to the guideline recommendations will minimise CVD risk and improve clinical outcomes in the population. Together with guidelines, quality indicators are often used to provide feedback to clinicians and give an indication of the quality of the patient care delivered. Quality indicators have been devised to measure and document performance in order to motivate clinicians (and hence their organisations) to improve care through the use of common measures.

There have been several national level attempts to develop primary care quality indicators, most notably from Canada,[8] NZ,[9] Denmark[10] and the UK.[11] The QOF in the UK[11] is perhaps the world's single largest attempt to improve the quality of primary care wherein 'with one mighty leap, the NHS vault(ed) over anything being attempted in the United States, the previous leader in quality improvement initiatives'.[12] The QOF is essentially a set of clinical indicators across four domains – clinical, organisational, additional services and patient experience[11] – that have been designed with the intention of improving the quality of service provided to patients. Each indicator is allocated a number of points and GP practices are awarded points according to how well the practice has performed, and

are subsequently paid according to how many points they have scored. The indicators are usually updated on an annual basis.

It is interesting to note that most of the widely adopted quality indicators use the presence of a single point-in-time measurement to determine whether or not a given indicator is satisfied. For example, two important QOF indicators with the highest point allocations under 'Hypertension' and 'Diabetes mellitus' are BP5, 'The percentage of patients with hypertension in whom the last blood pressure (measured in the previous 9 months) is 150/90 or less' and DM12, 'The percentage of patients with diabetes in whom the last blood pressure (measured in the previous 15 months) is 145/85 or less', with 57 and 18 points allocated respectively.[11] Both of these use the notion of the 'last BP' being controlled, and herein we set out to discuss three of the quality indicators we have developed as part of our previous and ongoing research,[13,14] which have a strong association to temporal intervals (an *evaluation period*) rather than focusing on a single measurement at one point in time. The QOF's BP5 and DM12 suggest that its framers saw relevance in 9 months and 15 months as appropriate evaluation periods (and, we acknowledge, in this sense BP5 and DM12 are at least partially interval based). In this paper we discuss the relevance of three interval based indicators to BP5 and DM12 and demonstrate some important issues that need to be considered when formulating indicators attached to financial incentives. We illustrate the use of our indicators using routinely collected data from four general practices in NZ.

Methods

Related previous work: development of interval based indicators

We collaborated with a NZ general medical practice based in the Auckland suburbs that has a largely Pacific caseload. The first stage of the study was the development of a set of explicit audit indicators to identify hypertensive patients who needed following up. The presence of other conditions – notably diabetes, asthma and renal impairment – complicates the treatment of hypertension, and therefore such 'comorbid' conditions featured in the audit indicators. The researchers had a series of iterative discussions with an expert clinical panel from the practice during which recommendations, particularly those from the NICE guidelines[4] and local hypertension guidelines,[7] were considered. The key findings of these discussions were eight explicit indicators of quality improvement opportunities that the expert panel deemed the most important and relevant to the practice. The development and evaluation of these indicators has been reported elsewhere.[13] The three time-interval based indicators relevant to the present context (with thresholds modified to match BP5) are:

- patients classified with hypertension with two or more consistently high BP measurements (>150/90 mmHg) over 90 days or more where either (i) the last of these high BPs was within the evaluation period or (ii) with no subsequently 'controlled' BP ($\leq$150/90 mmHg) measurement after the consistently high BPs
- patients classified with hypertension with a BP measurement of >150/90 mmHg followed by a gap of >120 days in BP measurements extending into the evaluation period
- patients classified with hypertension with a lapse in BP measurement of >180 days extending into the evaluation period.

We refer to these respectively as the 'consistently high BP' indicator, the 'high BP-then-lapse' indicator and the 'no BP measurement' indicator. 'Evaluation period' refers to the period of interest; in the context of BP5, it will be nine months (since the QOF specifies that the BPs relevant to the BP5 indicator should have been measured during the previous nine months). Also, we use data for the six-month period prior to the evaluation period as a 'run-in' period, so that adverse outcomes that should have been managed during the evaluation period can be accurately accounted for. Specific details on the importance of this period have been reported elsewhere.[14] Similarly, within the context of DM12, the above indicators refer to patients classified with diabetes (instead of hypertension) with a BP threshold of 145/85 mmHg (instead of 150/90 mmHg), and the evaluation period is 15 months (to mirror the BP timeframe of DM12).

Setting

Four general medical practices in suburban Auckland or the nearby Hamilton/Waikato area were opportunistically selected for participation – the Pacific practice with which we had collaborated earlier, another largely Pacific practice and two practices of typical NZ demographic distribution (largely European).

Protocol

The study protocol was approved under the New Zealand Northern X Regional Ethics Committee as protocol NTX/09/100/EXP. Patient confidentiality was protected by withholding any identifying patient details (including name, address and National Health Index number) from the university based researchers. However, a practice-specific patient identifier was

provided to the researchers (e.g. 'M004162') so that the clinicians working for the practices could still identify the patients for clinical follow-up on their cases if required. Our protocol was to extract data for 24 months prior to the date of extraction, with the exception of classifications (coded using Read Clinical Codes[15]), which are relevant for an indefinite time with respect to chronic illness and hence were extracted for the previous five years.

Data extraction

Following our data extraction protocol, we queried the computerised patient management systems from each of the four practices for the 24-month period from 1 April 2007 to 31 March 2009 and processed the results using a Microsoft SQL Server database with Structured Query Language (SQL) queries for our three time-interval based indicators, as well as BP5 and DM12. Our evaluation periods were defined to be nine months for the hypertension cohort and 15 months for the diabetes cohort, both periods ending on 31 March 2009. We used a six-month run in period (prior to the start of the given evaluation period) in both cases. Only funded patients enrolled at the practices were included (all NZ citizens and permanent residents can be enrolled with one Primary Healthcare Organisation, which is funded for management of that person; each general practice is associated with a Primary Healthcare Organisation).

Results

The details of the four datasets extracted from the practices' electronic medical records are shown in Table 1.

Table 2 and Table 3 show the numbers of patients with hypertension and diabetes respectively, satisfying each of their relevant quality indicators.

Table 4 shows the number of patients who satisfied the relevant QOF indicator, but also failed any of the three interval based indicators. In total across the four practices, 31% (95% CI: 28–33%) of hypertension patients satisfying BP5 failed at least one of the interval based indicators and 42% (95% CI: 39–46%) of the diabetes patients satisfying DM12 failed at least one of the interval based indicators.

Comparing consistently high BP with BP5 and DM12

Having consistently high BPs is an indication of a patient 'taking too long' to reach target BP levels; these

Table 1 Summary of the four data sets for funded and enrolled patients

	Practice 1	Practice 2	Practice 3	Practice 4
Funded patients	5454	4424	4260	6130
Patients with classifications	4422	3700	3718	5121
Hypertension	602	511	674	542
Diabetes	514	419	189	158
BP measurements	11 977	11 637	9986	9453
Age (years)				
<30	2949	2383	1948	2688
30–44	1149	826	817	1276
45–59	838	706	741	1414
60–74	399	396	462	577
75+	119	113	292	175
Gender				
Female	2748	2216	2440	3245
Male	2706	2208	1820	2885
Ethnicity				
Maori	459	301	795	560
Pacific Island	4140	3970	94	59
European	154	41	3002	4917
Asian	161	32	212	431
Other	540	80	157	163

Table 2 Patients with hypertension satisfying different quality indicators

	Practice 1 ($n = 602$)	Practice 2 ($n = 511$)	Practice 3 ($n = 674$)	Practice 4 ($n = 542$)
Failing BP5	206 (34%)	181 (35%)	125 (19%)	167 (31%)
'Consistently high BP'	38 (6%)	43 (8%)	29 (4%)	16 (3%)
'High BP then lapse'	111 (18%)	66 (13%)	40 (6%)	68 (13%)
'No BP measurement'	236 (39%)	178 (35%)	115 (17%)	273 (50%)

Table 3 Patients with diabetes satisfying different quality indicators

	Practice 1 ($n = 514$)	Practice 2 ($n = 419$)	Practice 3 ($n = 189$)	Practice 4 ($n = 158$)
Failing DM12	196 (38%)	173 (41%)	69 (32%)	56 (35%)
'Consistently high BP'	57 (11%)	30 (7%)	9 (5%)	5 (3%)
'High BP then lapse'	147 (29%)	70 (17%)	21 (11%)	32 (20%)
'No BP measurement'	260 (51%)	144 (34%)	46 (24%)	90 (57%)

Table 4 Patients satisfying a QOF indicator (BP5/DM12), but failing one of the three indicators of interest

	Practice 1	Practice 2	Practice 3	Practice 4
'Consistently high BP' or 'High BP then lapse' or 'No BP measurement', given BP5	149/396 = 38%	96/330 = 29%	76/549 = 14%	183/375 = 49%
'Consistently high BP' or 'High BP then lapse' or 'No BP measurement', given DM12	172/318 = 54%	76/246 = 31%	29/129 = 22%	59/102 = 58%

patients therefore need to be actively managed. To fail this indicator, it is required to have at least two uncontrolled BP measurements occurring during a period of 90 days with either (i) the last of these high BPs measured during the evaluation period or (ii) with no subsequent 'controlled' BP measurement after the consistently high BPs (the last high BP would occur during the run in period in this case). If a particular patient satisfied this indicator due to scenario (ii) it would mean that the patient had not had their BP measured during the entire evaluation period. These cases are important as these patients have had consistently high BPs, but their BP has not been measured since the run in period. With respect to diabetes patients, the NICE guideline (recommendation R64[4]) suggests monitoring BP every one to two months, and intensifying therapy, if the patient is on medication, until BP is consistently below 140/80 mmHg; therefore failing this indicator (despite the slight variation in BP thresholds) does not meet guideline recommendations either. Data from Table 2 and Table 3 indicate that prevalence of consistently high BP (in the sense of our interval based indicator, i.e. repeatedly measured and recorded) is not very high ($\leq$8% for the hypertension cohort and $\leq$11% for the diabetes cohort for a given practice).

Comparing high BP then lapse with BP5 and DM12

A patient having a high BP and then a long lapse in measurement is an indication of 'taking too long to check whether the patient has reached target BP'. This has been particularly documented in the QOF justification for DM12, which suggests that high BP in people with diabetes should be treated aggressively with lifestyle modification and drug therapy,[11] and also in the NICE guidelines (recommendation R61[4]), where repeated BP measurements are suggested every two months if BP is higher than 140/80 mmHg. Therefore, diabetic patients with an uncontrolled BP who have not had their BP measured for a significant period of time (at least 120 days in our case) should be actively recalled and managed by the practice. Actively managing patients can be viewed as a more 'aggressive' approach as opposed to evaluating a diabetic patient's last BP. With respect to this indicator, a patient with hypertension may have had an uncontrolled BP measurement just under nine months prior to end of the evaluation period (or just under 15 months in the case of a diabetic patient), and a second 'controlled' BP towards the end of the evaluation period, thereby also satisfying BP5 or DM12. However, this type of management may not necessarily demonstrate optimal BP control worthy of an incentive for a practice.

Table 2 and Table 3 indicate that prevalence of high BP followed by lapse is higher than that of consistently high BP ($\leq$18% for the hypertension cohort and $\leq$29% for the diabetes cohort for a given practice).

Comparing no BP measurement with BP5 and DM12

The NICE guidelines recommend (recommendation R71[4]) monitoring every four to six months of the BP of a person who has attained and consistently remained at his or her BP target, and checking for possible adverse effects of antihypertensive therapy – including the risks from unnecessarily low BP. If no BP measurement is taken, this recommendation is not achieved. Identifying these patients would allow proactive recall and management. Compared to the other two indicators, this had the highest prevalence in the four practices, ranging from 17% to 57%.

Discussion

This paper used data from four general practices in NZ to illustrate the importance of time-interval based considerations for clinical audit indicators, as compared to two key QOF indicators of BP management (BP5 and DM12) that focus on last BP measurement at only one point in time. Having a controlled last BP measurement is naturally an important indicator; however, we found that there was also room for practices to actively identify patients in whom BP was not measured or controlled in a timely fashion, and that this was not entirely captured by final BP alone. In particular we found gaps on our interval based measures of the order of 30% for hypertension patients satisfying BP5, and of the order of 40% for diabetes patients satisfying DM12. Our interval based measures related closely to the NICE guidelines.

Our findings indicate that the four participating practices would have performed well on QOF indicators BP5 and DM12, with observed rates comparable to ranges reported by other researchers. Standing *et al* reported that satisfaction of BP5 in the UK was 83% in 2005[16] and our practices' results were in the range of 65 to 81%; similarly, another UK based study reported that ranges of satisfaction of DM12 gradually rose from 44.3% in 2002 to 70.7% in 2007[17] while our DM12 satisfaction rates were in the range of 59 to 68%. Control of BP has improved in the UK[18,19] since the QOF was introduced in 2004, and the lack of a similar scheme in NZ may be a contributory factor to the slightly lower rates of compliance with BP5 and DM12. Our analysis shows patients failing at least one of the three indicators of interest while satisfying BP5 or DM12. All four practices achieved rates over 65% and would qualify (if they were British practices) for most of the 57 points allocated and receive financial incentives for managing hypertension; however, 14–49% of these patients also satisfied at least one of the three interval-based indicators of suboptimal BP management. Similarly, all four practices have achieved a rate $\geq$59% for DM12 and would receive almost all the 18 QOF points. Despite being eligible for nearly the maximum financial incentives for DM12, 22–58% of the patients satisfying DM12 also failed at least one of the three interval-based indicators. Our results indicate that considering other aspects of BP control is important to ensure optimal BP control. If financial incentives are to be attached to quality indicators related to BP control, the indicators should be reliable for the quality of BP management throughout the period in question.

The advantages of the use of quality indicators for tasks such as providing feedback for quality improvement initiatives and accreditation and regulation are well documented,[20,21] but associating these measures with financial incentives (i.e. 'pay for performance' schemes) has met with considerable debate.[22,23] The intended outcomes of such a scheme are explicit, yet the unintended consequences have been characterised as 'worrisome, unknown and, in many instances, unmeasurable'.[24] Being the largest pay for performance scheme, most expressed views and recent studies of pay

for performance schemes have been related to the QOF.[23,24] The QOF has met with criticism from various commentators, for instance, Mangin and Toop[24] argue that the QOF by its nature promotes simplicity over complexity and measurability over meaningfulness and that the QOF rewards GPs for what they had already achieved. They suggest that the impression that GPs performed much better than expected after the QOF implementation has reinforced the widely held perception that UK GPs will only do something worthwhile for additional money, which threatens public confidence in and respect for the profession. Fleetcroft *et al*[25] indicate that excessive exception reporting (a provision to exclude patients from the treatment indicated in a given indicator) and less than 100% maximum threshold targets (e.g. the minimum threshold to receive maximum incentive for CHD-10 indicator is 50%) in the QOF introduce an incentive ceiling, which substantially reduces the percentage of eligible patients that UK practices need to treat in order to receive maximum incentive payments for delivering that care. A more recent study indicates that there may be a growing trend in the UK towards GPs recording BP values just below rather than just above the cut-offs for qualifying for QOF incentives.[26]

Despite some of the scepticism, the use of QOF indicators has been associated with positive outcomes in some investigations, such as BP monitoring and control[18,19] and better and more equitable management of coronary heart disease across ethnic groups.[27] The QOF has been a bold initiative by the UK; developing quality indicators for performance measurement efforts (irrespective of whether they are linked to financial incentives) is an ongoing effort, and countries such as the USA and NZ are drawing upon lessons learnt from the QOF in an attempt to enhance their current primary care healthcare systems and processes.[28,29]

This study has several limitations. The cohorts in each practice with hypertension and diabetes respectively were relatively small. The four practices were selected opportunistically and therefore our results are not generalisable across a population. Also, we have not modelled the effect of any demographic details such as ethnicity, age and socioeconomic status of the patients. Practice 1 and Practice 2 have a largely Pacific (particularly Samoan) caseload while Practice 3 and Practice 4 have a largely European patient population. Maori and Pacific Islander populations in NZ have inherently higher CVD risk, all other factors being equal, than their European counterparts.[30] We have not examined differences in management and outcome with respect to ethnicity, which would require a larger and randomised sample. It is worth noting that the QOF has provision for exception reporting, and if the practices were in a UK setting some of the patients in our study populations might have been excluded via exception reporting.

We have contrasted the evaluation of clinical outcomes with respect to time intervals with point-in-time measurement. Several other studies have also proposed interval based indicators.[31,32] For example, a set of systematically developed primary care quality indicators for hypertension included the 'Percentage of patients with an average systolic blood pressure of greater than 160 mmHg and/or a diastolic blood pressure greater than 100 mmHg, as determined on at least three separate visits, who have a diagnosis of hypertension recorded'.[32] It has been shown that assessing BP control based on a single measurement and/or a single visit is unlikely to be reliable, but BP considerations over time results in significantly fewer patients achieving targets set forth by guidelines.[31] Our proposition, therefore, is that although current QOF indicators are important there is room to extend this framework to include indicators that consider BP measurements over time, and perhaps to consider introducing new indicators that need to be minimised as far as possible (e.g. the three interval based indicators discussed in this paper). Providing clinicians with lists of patients who satisfy such indicators may assist them to actively manage those patients and ultimately achieve and maintain satisfactory BP control.

Conclusions

Considering only point-in-time measurements, such as a patient's last BP measurement, may not be the most reliable approach to determining optimal BP control. New methods that consider sustained periods of measurement lapses and uncontrolled BP measurements, as opposed to a single point-in-time controlled BP measurement, have the potential to improve on (incentivised) indicators used for the quality of BP management.

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CONFLICTS OF INTEREST

None.

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