Clinical audit of diabetes management can improve the quality of care in a resource-limited primary care setting

INDIRA GOVENDER1, RODNEY EHRlich1, UNITA VAN VUUREN2, ELMA DE VRIES1,2, MOSEDI NAMANE1, ANGELA DE SA2, KATY MURIE2, ARINA SCHLEMMER2,3, STRINI GOVENDER3, ABDUL ISAACS2 AND ROB MARTELL2

1School of Public Health and Family Medicine, University of Cape Town, Cape Town, Western Cape, South Africa, 2District Health Services and Programmes, Provincial Government of Western Cape, Cape Town, Western Cape, South Africa, and 3Division of Family Medicine and Primary Care, Stellenbosch University, Cape Town, Western Cape, South Africa

Address reprint requests to: Dr Indira Govender, School of Public Health and Family Medicine, Falmouth Building, Faculty of Health Sciences, University of Cape Town, Observatory, Cape Town, Western Cape 7925, South Africa. Tel: +27-21-4066300; E-mail: indira.govender@gmail.com

Accepted for publication 27 September 2012

Abstract

Objective. To determine whether clinical audit improved the performance of diabetic clinical processes in the health district in which it was implemented.

Design. Patient folders were systematically sampled annually for review.

Setting. Primary health-care facilities in the Metro health district of the Western Cape Province in South Africa.

Participants. Health-care workers involved in diabetes management.

Intervention. Clinical audit and feedback.

Main Outcome Measure. The Skillings–Mack test was applied to median values of pooled audit results for nine diabetic clinical processes to measure whether there were statistically significant differences between annual audits performed in 2005, 2007, 2008 and 2009. Descriptive statistics were used to illustrate the order of values per process.

Results. A total of 40 community health centres participated in the baseline audit of 2005 that decreased to 30 in 2009. Except for two routine processes, baseline medians for six out of nine processes were below 50%. Pooled audit results showed statistically significant improvements in seven out of nine clinical processes.

Conclusions. The findings indicate an association between the application of clinical audit and quality improvement in resource-limited settings. Co-interventions introduced after the baseline audit are likely to have contributed to improved outcomes. In addition, support from the relevant government health programmes and commitment of managers and frontline staff contributed to the audit’s success.

Keywords: clinical audit, quality improvement, primary health care, low-resource setting, Skillings–Mack test statistic

Introduction

Health services in South Africa are divided into a public and private sector and as a result, so is the quality of care in the services [1]. In 2001, the national policy on Quality in Health Care for South Africa described the problems in the public sector, currently serving 85% of the population, as a ‘lack of resources, poor delivery systems and variable quality of clinical diagnosis and treatment’ [1]. Ten years later, the national Minister of Health stated that quality of care in the public sector is ‘ever in the minds and on the lips of our people’ and reiterated as a priority quality improvement in health services as one of the key actions for improving the health profile of all South Africans [2].

The Western Cape Province is one of the nine provinces in South Africa, consisting of six health districts: five rural and the Metro district. Community health centres are primary health-care (PHC) facilities located in all eight sub
districts of the Metro and run by the Provincial authority known as Metro District Health Services (MDHS). In 2005, following the introduction of clinical governance, the MDHS embarked on a quality improvement project using clinical audit as a means of operationalizing the concepts of quality of care in primary health care.

Although there is no universal definition of clinical audit, the MDHS adopted the one endorsed by Copeland [3] as ‘a quality improvement process that seeks to improve the patient care and outcomes through systematic review of care against explicit criteria and the implementation of change’ [3]. An abbreviated version of the Quality in Health Care policy document states that one of the causes of poor quality of care in South Africa is health professionals with ‘erroneous, outdated or no information skills’ and describes clinical audit, amongst other methods, as an instrument for service providers to monitor quality [4]. Although the majority of evidence in support of routine clinical audit as a quality improvement tool comes from well-resourced countries [5–8], evidence from developing countries is mostly in research form [9–12]. Obstacles to clinical audit and quality improvement in the public sector of developing countries include resource constraints that result in the practice being perceived as a non-priority, and in negative responses from health-care workers (HCWs) [13, 14]. South Africa, however, is one of a few developing countries with an institutionalized national maternal, infant and child mortality audit [15].

In 2005, the MDHS chose diabetes management as the initial audit topic after a regional Burden of Disease study reported that cardiovascular disease (CVD) was the leading cause of death amongst men and women in the province [16]. Diabetes is an independent risk factor for CVD, and the consequences of poor care, such as premature blindness and amputations, are believed to be disproportionately prevalent in the population of the Metro district [17]. In addition, the audit decision was motivated by the availability of good evidence to inform target standards for diabetes management [17].

The development of the original audit tool has been described by Martell and De Vries [17]. The focus of the first audit was limited to basic diabetic clinical processes only and, over the following years, increased to include structural and outcome elements (2007) and additional clinical processes (2008) related to diabetes management. In 2009, an integrated audit tool was implemented to assess the management of five chronic conditions, including diabetes mellitus, but the same audit methods were employed and core diabetic process elements from the original tool were retained. Because the audit cycle involves action plans to achieve the target standards, one would expect subsequent audits to show a gradual improvement in the quality of care.

The aim of this study, carried out at the request of the Provincial Department of Health, was to evaluate the trend in the performance of clinical processes for patients with diabetes.

Methods

The audit and feedback intervention

The intervention was a form of ‘self-audit’ intended to promote a sense of responsibility amongst HCWs and empower them to take action in improving the quality of care in low-resource settings. The individuals responsible for sampling the folders and performing the audit were either a senior doctor or PHC nurse from the chronic care team of each participating facility. Training workshops were held prior to the audit each year to ensure that HCWs responsible for data collection were competent in the procedure. Because clinical governance is considered a core function of Family Medicine doctors in the CHC, they were required to champion the audit in their respective sub districts. After each round of the annual audit, the participating facilities received reports that graphically depicted their results, and to complete the audit cycle, chronic care teams had to formulate and commit to an action plan to improve the quality of care based on their facility results.

Population and sampling strategy

According to routine health information, between April 2008 and March 2009, there were 3 725 339 PHC visits by an estimated Metro district population of 3.2 million people older than 5 years to district CHCs [18]. During this period, a reported total of 8117 new diabetes mellitus cases were put on treatment at the CHCs and, although the figure fluctuated throughout the year, in March 2009 17 855 diabetes mellitus clients were reported to be recorded in the register [18].

All CHCs in the district rendering a chronic care service were instructed to participate in the first audit in 2005. On any day during the month of February, in every year that the audit was done, the designated doctor or nurse had to systematically sample 20 diabetic folders from the total number of patients attending the diabetic clinic that day and conduct a folder review. This meant dividing the number of diabetic patient folders by 20 and sampling every 5th folder. Smaller facilities with clinics attending to fewer than 30 patients a day were allowed to audit every diabetic folder until the target was reached. A sampled folder qualified for the folder review, if the patient had been attending the clinic for at least 1 year and had at least two chronic care visits in the previous year.

Whereas the sampling method remained unchanged from the inception of the project, in 2009 after three cycles of audit, the target sample size of 20 diabetic folders per facility was reduced to 10. This reduction was done to accommodate the implementation of the larger integrated audit tool of five chronic diseases that included diabetes. Table 1 lists the number of CHCs per health sub district that comprise the Metro district and the number of CHCs that submitted results during each year of the audit.
Table 1 Health sub districts in the Metro district that submitted audit results

<table>
<thead>
<tr>
<th>Sub districts</th>
<th>Number of facilities submitted results in 2005a</th>
<th>Number of facilities that submitted results in 2007</th>
<th>Number of facilities that submitted results in 2008</th>
<th>Number of facilities that submitted results in 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern</td>
<td>5</td>
<td>5</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Khayelitsha</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Mitchells Plain</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Klipfontein</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Tygerberg</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>Northern</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Southern</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Western</td>
<td>7</td>
<td>7</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>42</td>
<td>40</td>
<td>30</td>
<td>29</td>
</tr>
</tbody>
</table>

*Most facilities submitted results in 2005 due to an extended period of data collection, and the majority of facilities continued to submit in time during subsequent years.

Table 2 Median values that were achieved per diabetic clinical process in the Metro district, 2005, 2007–2009

<table>
<thead>
<tr>
<th>Year (number of participating facilities)</th>
<th>2005</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(30)</td>
<td>(30)</td>
<td>(29)</td>
<td>(30)</td>
</tr>
</tbody>
</table>

1. Mean number of diabetic visits per year

- 1.5
- 3.8
- 3.9
- 4.3
- 3.7

Diabetic clinical processes

<table>
<thead>
<tr>
<th>Diabetic clinical processes</th>
<th>Median percentage of patient folders per process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight recorded at each visit</td>
<td>59.5</td>
</tr>
<tr>
<td>BP recorded at each visit</td>
<td>93</td>
</tr>
<tr>
<td>Annual foot examination recorded</td>
<td>30</td>
</tr>
<tr>
<td>Annual urine protein test recorded</td>
<td>95</td>
</tr>
<tr>
<td>Annual retinal screening recorded</td>
<td>15</td>
</tr>
<tr>
<td>Annual serum cholesterol recorded</td>
<td>0</td>
</tr>
<tr>
<td>Annual serum creatinine recorded</td>
<td>5</td>
</tr>
<tr>
<td>Annual diet education recorded</td>
<td>47.5</td>
</tr>
<tr>
<td>Annual exercise advice recorded</td>
<td>37.5</td>
</tr>
</tbody>
</table>

Statistical analysis

An exploratory data analysis revealed that indicator data were non-normally distributed and warranted the application of the Skilling–Mack (SM) test statistic. The SM test is a non-parametric, general Friedman-type statistic used to compare treatment effects in randomized block designs [15]. The Friedman test is the non-parametric equivalent of the analysis of variance test used to compare the means of more than two samples, and either test would have been applicable had the data set been balanced, that is, retaining the same number of facilities each year. Use of the SM test was appropriate because the data were unbalanced and incomplete due to arbitrary non-response from some facilities or incomplete information on the submitted documents. The test was applied to the pooled Metro district results of the clinical processes for each year of auditing (2005, 2007, 2008 and 2009). Effects were represented by the process results and blocks by the 4 years. The SM test was used to assess the statistical significance of difference in results by year, whereas descriptive statistics and box plots were used to illustrate the trend of these changes. Simulated P-values were used to determine whether the difference between median values obtained each year was statistically significant at the \( \alpha = 0.05 \) level, as the P-values from the chi-squared approximation normally used are considered too conservative, especially for...
type-I errors [15]. All data were entered into the Stata/IC version 10.1 program (Copyright 1984–2009), in which all analyses were performed.

**Ethics**

Ethical approval was initially granted in 2005 by the University of Cape Town Research Ethics Committee and an extension was granted in 2008 and in May 2010 to continue auditing and to publish this evaluation.

**Results**

Forty CHCs out of a total of 42 in the Metro district submitted results after the first audit in 2005. In subsequent years, this number dropped to an average of 30 CHCs. All of the eight sub districts were represented by at least one facility every year, except in 2009, when none of the CHCs in the Eastern sub district submitted audit results. The mean number of chronic visits a year by diabetic patients was four. Because the distribution of the data for clinical processes was initially skewed to the left and over time shifted to the right, median values were used to measure the audit results each year, which are listed in Table 2.

The range of results submitted by participating facilities each year is also graphically represented as a series of box plots in Fig. 1. A wide range implies that facility scores on a particular indicator were spread across high and low values, and a narrow range means that most facilities achieved similar scores for an indicator.

The 2005 baseline median for six out of nine clinical processes, except for those considered to be routine such as BP checks and urine dipstick tests, was below 50%. There was a relatively small increase in the median proportion of patient folders with a recorded weight at each visit, within a wide range of results every year, that was not statistically significant when compared with baseline (Table 3). In contrast, the increase in median proportion of annual foot examinations, also within a wide range every year, was statistically significant probably reflecting the large difference in median values between 2007 and 2008 for annual foot exams. The median proportion of recorded BP readings at each visit was relatively high at baseline and improved further by considerably narrowing the range of results in 2009. Audit results for the annual urinary protein test showed a narrower range over the years, but not much change in the median value since baseline. Results for the annual retinal screen, serum cholesterol and serum creatinine showed statistically significant improvements over the years and are illustrated by the box plots as increases in both range and median proportions. Despite persistent variability in annual diet education and exercise advice across the 4 years, the median proportions increased and these differences were statistically significant.

Table 3 lists the weighted sum of centred ranks, the SM statistic and the number (N) of facilities used in calculating this statistic. Unlike the box plots that are generated individually using results from every facility that submitted in a particular year, the SM statistic was calculated using only the facilities that submitted at least two results over 4 years. Performance on all indicators increased, and these changes were statistically significant with the exception of the
The evaluation found an increase in performance in eight out of nine clinical processes in the management of diabetes in 2005, 2007–2009 in PHC services in Cape Town. There were statistically significant changes in seven out of nine clinical processes. In contrast, the performance of two processes, retinal screening and foot examinations, declined from baseline to 2007. This decline has been attributed to organizational restructuring in the Metro that left health workers in some sub districts unsupported at the time. Nevertheless, as a result of the baseline audit, three interventions were introduced to assist health workers in improving the management of diabetic patients at CHCs. According to the Provincial Chronic Diseases programme coordinator, in 2006, a pharmaceutical company specializing in diabetes treatment gave the programme a donation to purchase monofilaments (U. Van Vuuren, oral communication). Along with monofilaments, each facility received the SEMDSA foot screening guidelines and training by an endocrinologist in detecting peripheral neuropathy. In 2007, a non-mydriatic mobile fundal camera was purchased following a grant from the World Diabetes Foundation and after successfully piloting at three facilities, the camera was extended to the remaining Metro CHCs in 2008 [19]. In addition, the grant allowed for the purchase of a second camera in 2009 and included funding for an ophthalmic staff nurse to manage the project. The roving camera and the ‘foot clinics’ that were established allowed facilities to meet the audit criteria of annual examinations of diabetic patients’ feet and retinas (U. Van Vuuren 2011, oral communication).

Between July 2007 and July 2008, the MDHS held a series of workshops for health workers at all levels: doctors, nurses, facility managers and health promoters responsible for diabetic care at the CHCs [20]. The intervention was a form of action research, called an appreciative inquiry (AI), and encouraged health workers to formulate local solutions for overcoming commonly reported systemic barriers to adequate diabetes management at PHC level. In a low-resource context, attending to skills and infrastructure shortages is a necessary component in improving the quality of clinical care [21]. Therefore, although not part of the audit and feedback cycle, the monofilaments, fundal camera and AI were adjunct interventions implemented to address the deficiencies highlighted in the baseline audit of 2005 and aimed at favourably influencing the outcome of subsequent audits.

The results of this study are consistent with the research that has found the relative effects of clinical audit to be larger when the baseline adherence to recommended practice is low [22]. Additionally, support from the relevant government health programme, in this case Chronic Diseases, is regarded as a strong factor in facilitating change [23]. The limited evidence from developing countries shows that audit and feedback can be an effective tool for improving quality

| Table 3 Specific results of Skillings–Mack test comparing results per diabetic clinical process from 2005 baseline to 2007–2009, and simulated P-values |
|---------------------------------|--------|--------|--------|--------|----------------|----------------|
| Clinical process                | 2005   | 2007   | 2008   | 2009   | Skillings–Mack | Simulated P-value |
|                                | N     | WSCR   | N     | WSCR   | statistic      | P-value         |
| Percentage of weight recorded at each visit | 36   | -17.6  | 30   | -8.9   | 28             | 8.2             | 30   | 18.4   | 7.7   | 0.056 |
| Percentage of BP recorded at each visit | 36   | -28.8  | 30   | -2.8   | 28             | 9.7             | 30   | 22.0   | 13.2  | 0.000b |
| Percentage of annual feet examination recorded | 36   | -0.8   | 30   | -22.7  | 29             | 9.3             | 30   | 14.1   | 8.2   | 0.033b |
| Percentage of annual urine protein recorded | 35   | -1.5   | 30   | -16.1  | 29             | 13.4            | 30   | 4.2    | 4.7   | 0.104 |
| Percentage of annual retinal screening recorded | 36   | -5.6   | 30   | -24.7  | 29             | 12.7            | 30   | 17.5   | 11.3  | 0.003b |
| Percentage of annual serum cholesterol recorded | 36   | -28.7  | 30   | -28.2  | 27             | 15.4            | 27   | 41.5   | 36.5  | 0.000b |
| Percentage of annual serum creatinine recorded | 36   | -23.3  | 30   | -35.7  | 29             | 15.0            | 30   | 43.9   | 39.8  | 0.000b |
| Percentage of annual diet education recorded | 36   | -8.3   | 30   | -21.6  | 29             | -2.6            | 30   | 32.4   | 15.9  | 0.001b |
| Percentage of annual exercise advice recorded | 36   | 1.9    | 30   | -28.6  | 29             | -10.4           | 30   | 37.1   | 23.1  | 0.000b |

N, number of facilities.
A descriptive comparison tool that ranks the annual values per process derived from the SM test. Higher WSCR values imply better performance of a clinical process relative to other years.
Statistically significant at α = 0.05.
of care by boosting morale and empowering health workers to take action within restrictive circumstances, which is contingent on team work [9–11, 24]. However, these studies provide evidence of effectiveness in the short term or after a single intervention, and evidence of sustained behaviour change is scarce [12, 23].

There were a few limitations to this study. Firstly, the CHC response rate to the audit decreased by 25% from baseline as compared to 2009, caused mainly by facilities in two sub districts. Non-response was ascribed to the absence of a sub district Family Medicine specialist to drive the project and might have produced a selection bias towards better performance overall, if these facilities were consistently under-performers. This effect was not tested. If the project is to be successfully implemented in rural districts, for example, the programme will have to consider task shifting the role of audit champion in sub districts to another category of health worker. Secondly, the fact that facilities were asked to ‘self-audit’ creates the potential for documentation bias as there was no external validation and given the workload, internal verification was not a prerequisite. Despite a concerted effort each year to obtain outstanding forms and missing or illegible information from the participating CHCs, there were still data management problems. Indecipherable or missing information was excluded from the analysis and final reports. Even though the audit data collection relied on recorded clinical notes, as opposed to the directly observing practice, the former method is in keeping with studies of this nature and is a preferred method, if one is to avoid inappropriately influencing health worker behaviour [9]. On the other hand, using clinical notes led to the development and implementation of the MDHS Record Sheet, which has improved patient record keeping.

Conclusion

Overall, these findings support the proposition that quality improvement in resource-limited settings can be achieved through the application of clinical audit, with the support of relevant government health programmes and the commitment of health managers and frontline staff.

There are health service implications of improved quality of care at PHC level, if more patients are diagnosed and referred. Referral pathways to secondary and tertiary diabetic services, such as vascular or cataract surgery, would need to be strengthened to avoid potentially unethical practice associated with identifying patients in need, when these services are not accessible or available [19]. Until public sector services can be relied upon to meet this need, the Chronic Diseases programme might have to consider making use of service providers in the private and non-governmental sectors.

Because clinical audit is considered a complex intervention [21, 25], future evaluations should make use of qualitative information to determine what contextual factors contribute to audit success or failure at a local level such as within a sub district or facility. Finally, assessments of quality improvement should aim to go beyond the use of clinical processes and include information on clinical outcomes and patient satisfaction.

Acknowledgements

The author would like to thank Professor Bob Mash from the Division of Family Medicine and Primary Care at Stellenbosch University.

Funding

This study was funded by Dr Indira Govender.

References


