Quality improvement report

A laboratory based intervention to improve appropriateness of lipid tests and audit cholesterol lowering in primary care

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Abstract

Problem A need exists to reduce inequalities in lipid testing, to provide relevant, individual, patient based interpretation for users, and to audit lipid lowering in primary care.

Design Model to compare laboratory activity between different general practices; construction of computer based strategies to define the lipid tests to be done and to interpret results for primary and secondary coronary prevention patients; introduction of the strategies into routine use; monitoring of any change after the intervention; and investigation of the potential of the strategies to produce audit data for primary care groups.

Background and setting Hospital clinical laboratory serving 22 general practices covering 150 000 patients in Bishop Auckland area County Durham.

Key measurements for improvement Reduction in differences in testing for the different serum lipids in coronary prevention. Production of usable audit data for the primary care groups involved.

Strategies for change Four different categories of coronary prevention patient, with, for each category, the defined lipid tests to be done and advice to be given (based on the results), using the computer based strategies.

Effects of change Standardised test activity and the qualitative profile of the tests performed changed significantly. The strategies were readily adopted (median use 78%) within six months of introduction.

Lessons learnt Computer based strategies can correct qualitative and quantitative differences in test requesting, provide interpretative guidance in accordance with national guidelines, and offer a cost effective model to monitor results of cholesterol lowering in general practice.

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Details of the strategies are available on the BMJ's website

Introduction

The national service framework for preventing coronary heart disease in high risk patients[1] lays down targets and milestones for implementing coronary disease prevention strategies outlined in the joint British recommendations.[2] The framework advocates risk estimation through one of various instruments.[3–9] It acknowledges the existence of inequalities in preventive practice among practitioners (recently highlighted in the *BMJ*[10 11]) and recommends detailed audit of service provision and results through electronic data collection. This process is demanding on resources, requires pooling of individual general practice databases, and does not provide a specific means of implementing the framework.

Pathology laboratories already have a large database of patient information and test results and are located between primary and secondary care in the clinical management process. Traditionally laboratories perform the tests requested, whether or not these necessarily comply with regional or national guidelines. Different mechanisms have been described to change doctors' use of pathology tests,[12–14] among which laboratory centred initiatives such as changing the request form are most successful.[15] Guidelines alone are the least successful.[16] These do, however, involve a transfer of decision making about which test to conduct from the doctor (in this case the general practitioner) to the laboratory, and they therefore challenge historical boundaries of decision making.

Background

We have found from our own catchment area that the number and type of requests (requesting activity) for a selection of 28 common pathology tests differ greatly between general practices, and that differences in activity between practices remain consistent over time.[17]

These differences are not affected by adjusting for demographic features of the practice lists or for other qualitative differences between the practices, and we have concluded that these predominantly reflect differences in clinical practice.[18]

The tests used by our general practitioners in coronary prevention range from measuring only total cholesterol concentration to measuring all the standard parameters (total and low and high density lipoprotein cholesterol concentrations and triglycerides concentrations) in every request for lipid testing. Standardised high density lipoprotein cholesterol requests in our district ranged from 2 to 270 per 1000

practice patients a year, and the proportion of requests for high density lipoprotein tests (as a percentage of the requests for total cholesterol) ranged from 5% to 93% between general practices in 1998. The national service framework, however, recommends that high density lipoprotein cholesterol concentration be measured in the assessment of all primary prevention patients. Similarly, the risk assessment tools require triglyceride measurements for these to be used validly. Measurement of these parameters therefore constitutes a minimum requirement to follow the framework, and these are being performed inconsistently between the practices we serve.[17]

We conducted our study in the catchment area of the Bishop Auckland Hospital (serving 22 general practices and 150 000 patients). The laboratory performs about 30 000 serum total cholesterol tests a year.

Strategy for change

We set out to design a strategy to reduce inequalities in laboratory tests used to investigate and monitor cholesterol lowering and to provide comparative audit data for our two primary care groups. We conducted a before and after cohort study lasting 18 months. During the preintervention period (October 1998 to June 1999) we recorded baseline data every three months. The same data were recorded during the post-intervention period (July 1999 to March 2000).

Design

Until June 1999 our clinical laboratory's test request form offered measurements of *(a)* total cholesterol concentration, *(b)* total cholesterol and triglycerides concentrations, or *(c)* total cholesterol, triglycerides, and high and low density lipoprotein cholesterol concentrations.

We designed computer based strategies for lipid testing and interpretation based on national guidelines available at the time.[19 20] Copies of the strategies (updated to take account of the national service framework) are available on the *BMJ*'s website (bmj.com). Feedback was obtained from primary care groups' coronary prevention or clinical governance lead doctors and coronary prevention nurse specialists.

The laboratory request form was changed and the test options were replaced by a box in which users would enter a code for one of four categories of patient: primary coronary prevention, not receiving lipid lowering drugs; primary coronary prevention, receiving lipid lowering drugs; secondary coronary prevention, not receiving lipid lowering drugs; secondary coronary prevention, receiving lipid lowering drugs.

The amended request form was piloted successfully in two general practices and introduced definitively in July 1999. Practitioners could choose not to select one of the four strategies (patient categories) and instead enter the desired lipid tests in the "other tests" section of the laboratory request form.

Analysis and interpretation

We measured adoption of the strategy by comparing the numbers of strategy requests to the total number of requests for any lipid test during the same period for each practice.

Standardised test activities and the types of test performed were expressed as the ratio of requests for high density lipoprotein cholesterol or triglycerides concentrations to the number of total cholesterol concentration tests performed.

We obtained outcome and activity audit data by extracting the lipid test activity and results from the laboratory database, using only the most recent result on each patient. We then audited these results against the target levels used at the time—for example, total cholesterol <4.8 mmol/l for secondary prevention. The percentages of patients in each practice who had reached this target who were receiving drug treatment were then expressed as comparative histograms.

Differences in individual practices between the before and after proportions of tests performed (ratios of high density lipoprotein cholesterol and triglyceride tests to total cholesterol tests) were compared by the paired Student's t test. We compared rankings of practices between the two periods using the Pearson rank correlation coefficient.

Key measures for improvement

The primary aim of the strategies was to reduce the large qualitative differences in tests requested by the general practices. These were measured from *(a)* the ratio of high density lipoprotein cholesterol measurements to total cholesterol measurements before and after the intervention and *(b)* the ratio of triglyceride measurements to total cholesterol measurements before and after the intervention.

The secondary aim was to produce usable audit data for our two primary care groups. We examined the two categories of patients receiving lipid lowering drugs and calculated *(a)* the proportions of patients whose most recent total cholesterol concentration had reached the target figure and *(b)* the standardised number of lipid requests per 1000 patients in a practice for patients who were classified as receiving lipid lowering drugs.

These data could not be compared before and after the intervention as the different categories of patients cannot be accurately defined from conventional "clinical details" written on standard laboratory request forms.

Effects of changes

Because of seasonal differences in testing activity, changes were examined in the same period (October to December) before and after the intervention. Seventy eight per cent of requests used the strategy in the October to December period after it was introduced (general practice range 0-95%). Two of the 22 practices did not adopt it. Feedback from individual practitioners, primary care group lead doctors, and coronary prevention nurses was positive. We amended the strategies after publication of the national service framework.

Test activity

The intervention had no measurable effect on the numbers of requests for measurements of total cholesterol or triglyceride concentrations. The extrapolated annual number of high density lipoprotein cholesterol

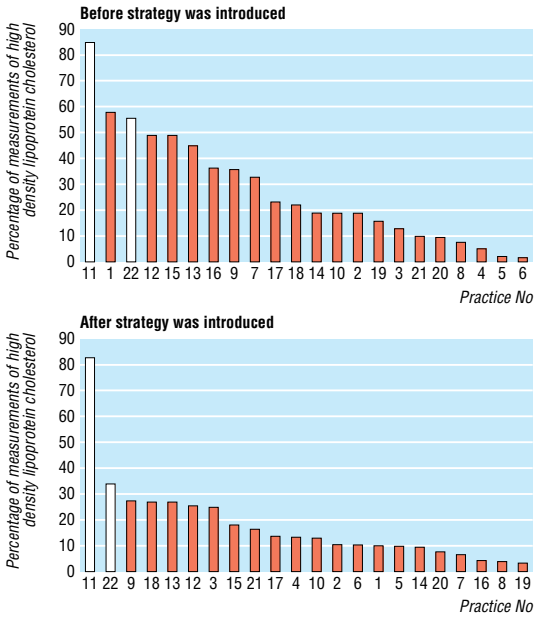

Fig 1 Measurements of high density lipoprotein cholesterol (as percentages of total cholesterol measurements) for 22 general practices before and after the strategy was introduced. Practices 11 and 22 did not adopt the strategy

measurements fell by 44% in the first six months after intervention ($P<0.0001$), compared with a three year historical annual rise of 35%. The marked inter-practice differences in total requesting activity were reduced, and the ranking of practices against each other changed profoundly (correlation coefficient $r=0.21$, no identifiable relation between before and after rankings, compared with $r=0.68$, $P<0.01$ between two sequential baseline periods[17]). No significant changes in ranking were seen in any of the other pathology tests we monitor. This isolated finding among the group of 28 tests was also significant ($P<0.01$).

Test types

The ratios of numbers of high density lipoprotein cholesterol tests to total cholesterol tests performed changed from a highly skewed distribution (mean 24% (SD 17%, median 18%, range 2-58)) before intervention to a near normal distribution (mean 14% (7%, 13%, range 4-27)) after intervention (fig 1). The corresponding figures for triglycerides changed from 46% (SD 26%, median 88%, range 4-98) to 50% (13%, 43%, range 18-71).

Audit data

Audit data were collected for the categories of patients who were receiving treatment. Overall, 45% of secondary prevention patients receiving treatment had reached a total cholesterol target of 4.8 mmol/l. The percentages of patients who had reached this target ranged from 0% to 65% (median 42%) across the general practices (fig 2); the corresponding figures for primary prevention patients (but with a total cholesterol target of 6.0 mmol/l) were 55% to 100% (66%).

Conclusion

Lessons learnt

General practice activity changed to near normal distribution of testing for high density lipoprotein cholesterol and triglycerides in all practices that used the strategy but remained at the extreme of the distribution in the two practices that did not. None of these changes was mirrored in any of the other pathology tests we monitor. We conclude that the changes are due directly to the intervention.

As highlighted recently in *Bandolier*, decision-support mechanisms offer potential for significant improvements in the appropriate use of laboratory testing.[21] A laboratory intervention targeted on primary care also offers several advantages in the context of lipid lowering: *(a)* targeted management advice standardised to follow national guidelines and a practical means to assist implementation of the national service framework; *(b)* the ability to establish a register of primary and secondary prevention patients, at minimal cost, and to audit information on use of tests and on outcome measures; *(c)* flexibility, as strategies may be adapted easily to take account of changes in guidelines; *(d)* data may be extracted regularly on a routine basis. These types of strategies should be compatible with most laboratory computing systems.

Next steps

The national service framework's testing recommendations allow the estimation of the numbers of tests that may be expected in the different patient categories from published prevalence data and the establishment of "activity bands" in which practices might be expected to lie. Similarly, comparison of relative success rates on treatment may be valuable to primary care groups as an outcome indicator, provided that these figures are interpreted with appropriate caution. Confounding variables such as initiatives in a practice to identify or treat patients, or differences in primary and secondary prevention case mix between practices could influence "success" rates in a given audit period.

Management of lipid lowering in the context of coronary risk reduction requires the right tests to be done in the right people; results to be correctly interpreted; clinicians to use these results with appropriate risk assessments to identify and treat the right people; and good audit data to be available to monitor success.

The long term success of laboratory initiatives in helping to achieve some of these aims will depend on

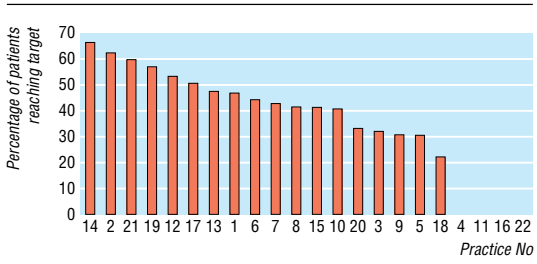

Fig 2 Percentages of secondary coronary prevention patients not receiving lipid lowering drugs in whom a total cholesterol concentration of 4.8 mmol/l (target defined at the time of the study) was reached. Practices 11 and 22 did not adopt the strategy

Key learning points

- The national service framework for preventing coronary heart disease recognises inequalities in preventive care and sets improvement targets
- Laboratories can help to reduce testing inequalities by using strategies for lipid testing that define the tests performed and provide management advice for general practices
- The same system can provide activity and outcome results for primary care groups
- Exploiting these opportunities needs collaboration between laboratory consultants, primary care groups, and trusts

continuing collaboration between primary care groups and laboratories to maximise use of existing databases, identify opportunities for improvement, and develop these opportunities. We are currently examining options for this with our primary care groups in this and other areas of medical practice.

W Longmire set up the strategies in the laboratory computer system; S Richardson presented activity data and typed the manuscript; Dr R Gorton and Dr M J Galloway helped in obtaining funding; and Dr D Chinn gave methodological and statistical advice. We thank our primary care group colleagues in the Sedgefield and the Dales primary care groups for their support in implementing this project.

Contributors: WSAS designed the study, wrote the strategies, liaised with primary care groups and prepared the manuscript; he is also the guarantor for the paper. RL created spreadsheets and prepared and presented outcome data. EW created spreadsheets, presented outcome data, and prepared the manuscript.

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1 Department of Health. Preventing coronary heart disease in high risk patients. In: *National service framework for coronary heart disease*. London: Stationery Office, 2000:chapter 2. www.doh.gov.uk/nsf/coronary.htm (accessed 1 September 2001).
2 Working Party of the British Cardiac Society, British Hyperlipidaemia Association, and British Hypertension Society. Joint British recommendations on prevention of coronary heart disease in clinical practice. *Heart* 1998;80:S1-29.
3 Durrington P. Cardiac Risk assessor program, Manchester: 1999. Available from Professor P Durrington, Department of Medicine, Manchester Royal Infirmary, Oxford Road, Manchester M13 9WL, UK.
4 Durrington PN, Prais H, Bhatnagar D, France M, Crowley V, Khan J, et al. Indications for cholesterol-lowering medication: comparison of risk-assessment methods. *Lancet* 1999;353:278-81.
5 Wallis EJ, Ramsay LE, Ul Haq I, Ghanramani P, Jackson PR, Rowland-Yeo K. Coronary and cardiovascular risk estimation for primary prevention: validation of a new Sheffield table in the 1995 Scottish health survey population. *BMJ* 2000;320:671-6.
6 Hingorani AD, Vallance P. A simple computer program for guiding management of cardiovascular risk factors and prescribing. *BMJ* 1999;318:101-5.
7 Wood D, De Backer G, Faergeman O, Graham I, Mancia G, Pyörälä K, et al. Prevention of coronary heart disease in clinical practice. Second Joint Task Force of European and other Societies on Coronary Prevention. *Eur Heart J* 1998;19:1434-503.
8 Jackson R. Absolute 5-year risk of a cardiovascular event (newly diagnosed angina, MI, CHD, death, stroke or TIA.). 1997. http://cebm.jr2.ox.ac.uk/docs/prognosis.html (accessed 1 September 2001).
9 Anderson KM, Odell PM, Wilson PWF, Kannel WB. Cardiovascular disease risk profiles. *Am Heart J* 1990;121:293-8.
10 Monkman D. Treating dyslipidaemia in primary care. *BMJ* 2000;321:1299-300.
11 Primatesta P, Poulter NR. Lipid concentrations and the use of lipid lowering drugs: evidence from a national cross sectional survey. *BMJ* 2000;321:1322-5.
12 Van Walraven C, Goel V, Chan B. Effect of population-based interventions on laboratory utilisation. *JAMA* 1998;280:2028-33.
13 Van Walraven C, Naylor CD. Do we know what inappropriate laboratory utilization is? A systematic review of laboratory clinical audits. *JAMA* 1998;280:550-8.
14 Solomon DH, Hashimoto H, Daltroy L, Liang MH. Techniques to improve physicians' use of diagnostic tests. *JAMA* 1998;280:2020-7.
15 Using labs best. *Bandolier* 1999;6(1):4. www.jr2.ox.ac.uk/bandolier/band61/b61-4.html (accessed 8 October 2001).
16 Lundberg GD. Changing physician behavior in ordering tests [editorial]. *JAMA* 1998;280:2036.
17 Smellie WSA, Galloway MJ, Chinn D. Benchmarking general practice use of pathology services; a model for monitoring change. *J Clin Pathol* 2000;53:476-80.
18 Smellie WSA, Galloway MJ, Chinn D. Is clinical variability the major reason for differences in pathology requesting patterns in general practice? *J Clin Pathol* (in press).
19 Standing Medical Advisory Committee. *Statement on the use of statins*. London: NHS Executive, 1997. (EL(97)41.)
20 Management of hyperlipidaemia. *Drug Ther Bull* 1996;34:89-93.
21 Decision support for ordering blood tests in primary care. *Bandolier* 2001;8(5):3-4. www.jr2.ox.ac.uk/bandolier/band87/b87-3.html (accessed 8 October 2001).

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A memorable patient (and doctor)

Nothing said

I was undertaking my first surgical block of training in medical school. A group of us were shadowing a surgical senior house officer during his intake. The patient was a young woman who presented in a busy admissions department with abdominal pain.

The case was memorable because of the patient's resounding screaming and crying, which drowned out all the background noise. The medical students looked on anxiously, but the senior house officer was calm and unmoved. He examined the patient, ordered a urine test, and proceeded to the next case. I was confused. Surely the woman had something terribly wrong with her, but no words were spoken to either the patient or the students. I never did find out what was wrong with that woman.

What the case taught me, in retrospect, was that psychiatry is relevant to all medical disciplines. It may have been that the patient had emotional lability as part of an underlying mental illness, but such aspects of a case were rarely discussed during my medical training. Occasionally, or perhaps frequently, clinicians remarked glibly that a patient had "supratentorial overlay." A dismissive approach would then usually be adopted.

I hope that medical training has moved beyond this, otherwise students will remain in the dark, puzzled by the apparent cold and uncaring manner of some of those they are following and may wish to emulate in their chosen profession.

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We welcome articles up to 600 words on topics such as *A memorable patient, A paper that changed my practice, My most unfortunate mistake,* or any other piece conveying instruction, pathos, or humour. If possible the article should be supplied on a disk. Permission is needed from the patient or a relative if an identifiable patient is referred to. We also welcome contributions for "Endpieces," consisting of quotations of up to 80 words (but most are considerably shorter) from any source, ancient or modern, which have appealed to the reader.