NSW HEALTH

Clinical Excellence Commission

Evaluation: NSW Chronic Care Collaborative February – November 2004

Final Report June 2005

Evaluation: NSW Chronic Care Collaborative, February – November 2004

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Suggested citation:
Schofield WN, Sindhusake D, Lai YY, Guo Y, Campbell D and Rubin GE, (2005).
Evaluation: NSW Chronic Care Collaborative, February – November 2004. Centre
for Health Services Research at Westmead, Sydney West Area Health Service and
University of Sydney School of Public Health, Sydney, Australia.

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SHPN (HSPI) 050103
ISBN 0 7347 3838 2

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August 2005

Acknowledgements

We are grateful to the Clinical Excellence Commission and NSW Department of Health for entrusting us with the evaluation of the NSW Chronic Care Collaborative and to Lorraine Acheson, Melanie McKinnon and Barbara Lay of the Clinical Excellence Commission for their willingness to provide answers to our many questions. The evaluation of team progress would not have been possible if Chronic Care Collaborative team coordinators had not regularly sent data to the Clinical Excellence Commission and we appreciate the amount of work this involved and express our thanks to them and to the members of the teams. We would like especially to thank all of those team members who took part in focus group meetings, or who were interviewed, and apologise if some points which they stressed as important have not been included in this report. We plead time and space, not lack of interest. We acknowledge with respect the concern for improving the care of patients with chronic illness, and the commitment to doing something about it, which was strongly evident at all of the many sites which we visited in urban and rural NSW.

Lorna Thomas, Margaret Murphy and Carol Hobor provided administrative support. We are grateful to them for their cheerful efficiency in keeping things running smoothly, and to the agency audio typists who transcribed the recorded material.

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Executive Summary

This report is an evaluation of the NSW Chronic Care Collaborative, a breakthrough series initiative organised and led by the Clinical Excellence Commission and NSW Department of Health. The Collaborative involved 22 multidisciplinary teams from 18 NSW Area Health Services including Justice Health.

A breakthrough series collaborative is a short-term (usually 6 to 15 months) learning, implementing and auditing intervention. It brings together a large number of teams from hospitals and other health facilities to learn together and then to work for focused improvements in their own service.

The purpose of the NSW Chronic Care Collaborative was to enhance the implementation of the clinical service frameworks developed as part of the NSW Chronic Care Program. The focus of the Collaborative was on improving the diagnosis and management of heart failure and chronic obstructive pulmonary disease.

The NSW Chronic Care Collaborative took place between February and November 2004. The Collaborative orientation session was held in February and the four subsequent learning sessions from April to November 2004.

Near the end of this period the Centre for Health Services Research at Westmead was contracted to evaluate the NSW Chronic Care Collaborative using data, mostly already collected, from a variety of sources. These data included:

- audit data sent by teams each month to the Clinical Excellence Commission
- survey conducted by the Centre for Health Services Research
- questionnaires completed by team members at learning sessions
- monthly self assessment scale completed by teams
- NSW hospital inpatients data for 2003 and 2004
- recorded and transcribed qualitative data from six focus group meetings and 26 semi-structured interviews with team members.

The main findings from the evaluation are presented in this executive summary. A breakthrough series collaborative is not a research project. The evaluation data was collected during the implementation of the Collaborative in many, diverse sites. The purpose of collecting the data was to provide timely feedback to the 22 Collaborative teams and senior clinicians and managers on progress during the Collaborative as well as to assist in the development or modification of planned interventions. Consequently, these data will not measure what would be expected in a research project. This report considered possible threats to the validity of the data and concluded that the main findings were robust.

Survey at final learning session

At the final learning session of the NSW Chronic Care Collaborative team members answered a survey on their perception of the effectiveness of the Collaborative in terms of patient care, their own learning, team organisation and support and on the spread and sustainability of improvements.

- 94 per cent of team members said that the NSW Chronic Care Collaborative had improved their understanding of the principles of chronic care management and their knowledge of the diagnosis and management of heart failure and chronic obstructive pulmonary disease. The majority (89 per cent) were confident in their ability to plan future clinical practice improvements.
- 85 per cent of team members agreed that the Chronic Care Collaborative had resulted in improved patient care. 62 per cent said that this improvement would be sustained, with another 36 per cent unsure. Less than 2 per cent expressed certainty that the improvements would not be sustained.
- Almost all respondents (92 per cent) said that they had learnt the importance of efficient communications and that improvements in communications achieved by the Chronic Care Collaborative would be sustained.
- A substantial majority (89 per cent) thought that extra resources would be needed to sustain the improvements they had achieved and 89 per cent

said that effort and time beyond the normal call of duty were needed for a collaborative to succeed.

- In general, the survey found positive responses to a range of questions on the Collaborative, on support from the Clinical Excellence Commission and management, on intended teamwork in the future, on rapport and communications. The exception was a question asking if improvements initiated by their team had received support from senior clinicians not in the team with 37 per cent agreeing and 7 per cent strongly agreeing.

Audits by Chronic Care Collaborative teams

Following breakthrough series methodology, teams obtained feedback on their progress during the Collaborative by monthly (sometimes bi-monthly) audits made in the community (for example, in a general practice or allied health setting), in the emergency department, or at discharge from hospital. Some teams did not conduct audits in all three settings.

The team audits were sent to the Clinical Excellence Commission showing the percentages of patients receiving a particular intervention each month (for example, dose titration of angiotensin converting enzyme [ACE] inhibitors, referral to a rehabilitation program). These data were pooled and analysed for this evaluation. Run charts were computed for inspection. These were statistically tested by fitting linear trends across the eight months of the Collaborative (April to November 2004).

The Collaborative interventions were grouped into two 'bundles' drawn from the NSW Clinical Service Frameworks:

- diagnostic bundle which included taking a focused clinical history, physical examination and echocardiography or spirometry, as appropriate, and was audited only in the community setting
- management bundle which included a wide range of treatment and management interventions appropriate for either heart failure or chronic obstructive pulmonary disease and was audited in three settings in the community, in the emergency department and at discharge from hospital.

Heart failure

The following results show the effect of the Collaborative overall and not that of individual teams.

- Diagnostic bundle: for heart failure there were significant improvements between April and November 2004 for the use of the full bundle of diagnostic interventions in the community ($P<0.001$).
- Management bundle: for heart failure there were significant improvements between April and November 2004 for use of the full bundle of management interventions in the community ($P<0.02$), at discharge ($P<0.001$), but not in the emergency department ($P<0.10$).
- Individual items in the heart failure diagnostic bundle (used in the community) that showed improvement were focused clinical history ($P<0.004$), physical examination ($P<0.002$) but not echocardiography ($P<0.11$).
- Many of the individual items in the heart failure management bundle showed a significant linear improvement across the months April to November 2004.
- In the community, there were significant improvements for ACE inhibitors ($P<0.004$), after hours contact ($P<0.001$), influenza immunization ($P<0.009$), and smoking cessation ($P<0.01$).
- In the emergency department there were significant improvements in the use of beta blockers ($P<0.02$) and dose titration ($P<0.001$).
- At discharge, there were significant results for baseline investigations ($P<0.002$), ACE inhibitors ($P<0.01$), dose titration ($P<0.003$, influenza immunisation ($P<0.02$), pneumococcal immunization ($P<0.03$), use of beta blockers ($P<0.01$), schedule of general practitioner review ($P<0.004$), after hours contact ($P<0.02$) and smoking cessation ($P<0.001$). Self-management support approached significance ($P<0.07$).
- For heart failure Collaborative teams, referral to a rehabilitation program and discussion of advanced care directives (end stage planning) were not significant in any setting.

Chronic obstructive pulmonary disease

The following results show the effect of the Collaborative overall and not that of individual teams.

- Diagnostic bundle: for chronic obstructive pulmonary disease there were significant improvements between April and November 2004 for the use of the full bundle of diagnostic interventions in the community ($P<0.009$).
- Management bundle: for chronic obstructive pulmonary disease there were significant improvements between April and November 2004 for use of the full bundle of management interventions in the community ($P<0.001$), at discharge ($P<0.001$), and in the emergency department ($P<0.001$).
- The only individual item in the chronic obstructive pulmonary disease diagnostic bundle that improved significantly was the use of spirometry ($P<0.05$), with focused clinical history ($P<0.32$) and physical examination ($P<0.46$) not significant.
- Teams were less successful with individual items in the chronic obstructive pulmonary disease management bundle than was the case for heart failure, with only schedule of a general practitioner review improving significantly in the community ($P<0.05$) and rehabilitation program ($P<0.001$) and after hours contact ($P<0.006$) improving significantly at discharge
- From the data it could be seen that for chronic obstructive pulmonary disease levels of provision for some management bundle interventions were already high at baseline with less room for improvement than for heart failure.

Advance care directives

- There were no significant improvements in discussion of advanced care directives (end stage planning) in the community ($P=0.76$), in the emergency department ($P=0.96$) or at discharge ($P=0.85$).

Orientation session and learning sessions

As part of the breakthrough series procedure Chronic Care Collaborative team members attended an orientation session and four learning sessions in Sydney. Questionnaires were completed by participants at the start and at the end of these sessions and were analysed. These questionnaires, developed by the Clinical Excellence Commission, varied in style and content from session to session. They were anonymous. Topics covered included feedback on the session itself and information of the team's status and progress with the Chronic Care Collaborative.

- The orientation session was highly successful with team members reporting major improvements in their understanding of Chronic Care Collaborative methodology and what was required of them
- At subsequent learning sessions team members mostly scored their understanding and knowledge of the care of patients with chronic illness and of Chronic Care Collaborative methodology higher when asked at the end of the session than they did when asked at the start
- At learning sessions three and four team members were asked about the support they had received. There were substantial minorities (up to 48 per cent) who reported only 'some' or 'none' support from their executive sponsor, mentor, organisation, other teams and the Clinical Excellence Commission. The majority reported these sources of support as 'good' or 'high'
- Questions on the usefulness of the content of the learning sessions provided feedback for the organisers. Team reports and workshops were the most favoured content.

Team self-assessment on a breakthrough series scale

Each of the 22 NSW Chronic Care Collaborative teams completed a monthly assessment of their progress. They used a breakthrough series 0-5 scale that listed milestones:

- commencing at '1.0 forming team'
- ending at '5.0 outstanding sustainable results'.

The Clinical Excellence Commission staff also scored teams each month on the same scale. From the data sheets it could be seen that some teams treated this measure as a check list (and scored items out of sequence) and not as a progressive scale.

- Teams ranked themselves on average at 2.3 when the Chronic Care Collaborative commenced and on average at 4.3 at the conclusion eight months later.
- The ranking made by the Clinical Excellence Commission staff was almost identical to that made by the team itself. This assessment was not independent as it was made by the Clinical Excellence Commission staff after they had seen the team's own assessment.

Analysis of NSW Department of Health Inpatient Statistics data

NSW public hospital admitted data for the period 1 January 2003 to 31 December 2004 (N=2.7 million hospital episodes) were screened and analysed for comparison between 2003 (the year before the Collaborative) and 2004 (the year of the Collaborative). A tentative indicator of degree of involvement in the Chronic Care Collaborative (fully involved, no involvement) was added to these data.

- Heart failure admissions expressed as a percentage of all NSW admissions were significantly less for October, November and December in 2004 than for the same months in 2003 ($P<0.017$ or less at each month).
- Chronic obstructive pulmonary disease admissions expressed as a percentage of all NSW admissions were significantly less in November ($P<0.003$) and December 2004 ($P<0.001$) than for the same months in 2003, but in May and October there were significant differences in the opposite direction.
- For heart failure admissions expressed as a percentage of all NSW admissions in November and December 2004 there were fewer admissions for the fully involved hospitals/ facilities than for those not involved. This was also the case in April before any effect could be expected from the Chronic Care Collaborative. There was no significant difference in November and December 2004 after the April difference was allowed for.
- For chronic obstructive pulmonary disease admissions expressed as a percentage of all NSW admissions for July, August, September, October, November and December 2004 there were significantly fewer admissions for the fully involved hospitals/ facilities than for those not involved (ranging from $P<0.0001$ to $P<0.004$).
- Similar analyses for length of stay, emergency (unplanned) admissions and re-admissions within 28 days produced conflicting results and for some comparisons the not involved facilities did better than the involved. These data need more extensive analyses.

Focus group meetings and semi-structured interviews

Six focus groups meetings and 26 individual or small group interviews were conducted with team members at both rural and urban sites. Each of these was recorded and the recordings were transcribed and analysed using ethnographic methods. Team members taking part included physicians, general practitioners, nurses, directors of nursing, nurse unit managers, cardiologists, consumers, nurse educators, dieticians, physiotherapists, pharmacists, social workers, managers of hospitals, managers of services, planners, administrative and executive staff, Aboriginal liaison officers, care coordinators, emergency department staff, Division of General Practice staff.

- With almost no exceptions, those taking part described improvements in patient care, and in many cases also patient quality of life as a consequence of Chronic Care Collaborative interventions. There was a belief that heart failure and chronic obstructive pulmonary disease admissions had been reduced, which was sometimes coupled with a doubt that this would 'show' in the data. There was mention of improved contact with carers, but this was mostly not the case.
- There was a widely held belief that the Chronic Care Collaborative interventions for patients with chronic illness were needed and that good progress had been made, often despite difficulties. It was said that the Chronic Care Collaborative had made a start, but more was needed, particularly in terms of support to maintain improvements from senior management.

- Lack of input from hospital medical staff was a frequently stated disappointment, although there were notable exceptions for some teams (the minority). Lack of support, sometimes opposition, from medical staff was reported at district and base hospitals and also at major referral hospitals, but in all three settings there were also reports of excellent support and collaboration by medical staff. Cardiologists, respiratory physicians, and generalists were amongst those interviewed who reported positive commitment to the Chronic Care Collaborative interventions and to team collaboration.
- Some teams experienced difficulties in obtaining general practitioner involvement. Others had very active general practitioner team members, some of whom were interviewed or took part in focus group meetings. Teams described difficulties in engaging general practitioners on a wider front than in their own team. Successful involvements were said to be based on individuals rather than systems. It was suggested that collaboration could best be developed starting from the Division of General Practice rather than from the Area Health Service.
- Some teams said that they were 'nurse driven' with no input from other nominal team members or from their own executive. Others had strong executive support and management members were key players in some teams.
- Most teams valued the monthly audits, after initial difficulties accessing information and with the audit form were overcome, but it was also said to be a time-consuming, stressful burden that took staff away from other essential activities. Some teams found the audits 'proscriptive' and said working to fulfill audit requirements diverted effort from other duties, and that effort to achieve some objectives led to failure on others (for example, heart failure objectives at the expense of chronic obstructive pulmonary disease objectives and vice versa). It was also said (major urban hospital) that the audit form was set up in a way that meant that 100 per cent could not be achieved for some interventions and that this grew to be very discouraging as the Collaborative progressed.
- Examples were given of spread of Chronic Care Collaborative improvements to other chronic diseases and to other hospitals/ facilities. Sustainability was frequently mentioned as an objective, but many team members expressed doubts about long-term sustainability without additional, or redeployed, resources. This was particularly the case for rehabilitation programs. Less frequent problems for sustainability included doubt that dose titration would be maintained in a major hospital with regular changes in junior staff.

Further key findings from qualitative analysis of the focus group and interview data are included in the main body of this report. These are discursive and not suitable for brief presentation without loss of the detail sought by use of qualitative methodology. If the qualitative data were reduced to survey type analysis, the findings would not differ to any extent from those presented above for the survey, audit and learning session results, but much would be lost, including a good deal of subjective material on successes, but especially on problems and difficulties.

1 Background

In 2000-2001 the NSW Department of Health embarked on the NSW Chronic Care Program to improve the care of people with chronic and complex conditions, to improve their quality of life and that of their family and carers, and to reduce crisis situations and unplanned and avoidable hospital admissions.[1]

Phase one of the NSW Chronic Care Program (2000-2003) focused on the priority health areas of respiratory disease, cardiovascular disease, and cancer. Statewide initiatives included the development of clinical service frameworks and the distribution of *My Health Record*, a patient held record. In addition, 60 local priority health care programs were established in 18 Area Health Services across the state. An interim assessment of these programs indicated substantial reduction in emergency department presentations and hospital admissions and readmissions avoided, and enhanced patient satisfaction and quality of life.[1]

Phase two of the NSW Chronic Care Program (2003-2006) was established to extend the initiatives and lessons learned in phase one. A key activity of this phase was the NSW Chronic Care Collaborative which was established jointly with the Clinical Excellence Commission, formerly the Institute for Clinical Excellence. Its objective was to enhance implementation of the clinical service frameworks for chronic respiratory disease and heart failure developed in Phase 1. The chosen methodology of the Chronic Care Collaborative was that of the breakthrough series developed at the Institute for Health Care Improvement, Boston, USA, to help health care organisations make 'breakthrough' improvements in quality while reducing costs.[2] The breakthrough series is intended to help organisations close the gap between what is known and what is undertaken by creating a structure in which providers of a service can learn from each other and from recognised experts in areas where improvements are needed and can be made.

A breakthrough series collaborative is a short term (6- to 15-month) learning system that brings together a large number of teams from hospitals or community based health services to seek improvement in a focused topic area. Since 1995, the Institute for Health Care Improvement has sponsored 50 such collaborative projects on several dozen topics involving over 2,000 teams from 1,000 health care organisations. Collaboratives range in size from 12 to 160 teams. Using orientation sessions and regular group learning sessions with quality improvement methods, teams have achieved dramatic results, for example, waiting times have been reduced by 50 per cent, intensive care unit costs reduced by 25 per cent, and hospitalisations for patients with congestive cardiac failure reduced by 50 per cent. In addition, the Institute for Health Care Improvement has trained over 600 people in the breakthrough series methods resulting in hundreds of collaborative initiatives throughout the world including Australia and NSW.

The NSW Chronic Care Collaborative was established in early 2004 as a breakthrough series initiative aimed at improving the care of, and outcomes for, patients with heart failure and chronic obstructive pulmonary disease. Specifically teams were asked to implement components of diagnostic and management 'bundles' of care drawn from the NSW Clinical Service Frameworks for heart failure and chronic respiratory disease.[3,4] During the period evaluated (February to November 2004) for this report 22 teams from 18 Area Health Services have participated in the NSW Chronic Care Collaborative.

Team members attended an orientation session in February 2004 and four learning sessions in Sydney from April to November 2004. They completed four action periods with 'Plan, Do, Study, Act' (PDSA) quality improvement cycles in between the learning sessions.

During the closing weeks of the NSW Chronic Care Collaborative the Centre for Health Services Research at Westmead was contracted to undertake an evaluation of what had been accomplished. This virtually post hoc and independent evaluation was undertaken between November 2004 and April 2005.

2 Objectives of the evaluation

The objective of the evaluation was to measure the success and, as far as possible in the short-term, the sustainability of the changes introduced by the 22 Collaborative teams under guidance from the project leadership at NSW Department of Health and the Clinical Excellence Commission.

In general terms the evaluators were asked to report on:

- the extent to which the aims of the Collaborative were achieved by the NSW teams
- the impact of the Collaborative on communication and cooperation between services within the Area Health Service
- the role of the Collaborative in improving participants' ability to plan, implement and achieve health care improvement
- lessons learned through the Collaborative to facilitate improvements in other areas of health service delivery in NSW.

The evaluators were asked to use quantified methods (analysis of data held by the Clinical Excellence Commission and NSW Department of Health, and a survey to be designed and analysed by the evaluators) and qualitative methods (semi-structured interviews and focus group meetings with team members to be conducted and analysed by the evaluators).

Restated in practical terms the objectives were to:

- assess the level of improvement in the completion of the diagnostic and management bundles by NSW Chronic Care Collaborative teams. The 'bundles' were collections of the interventions to be introduced by the teams, such as the use of spirometry at diagnosis for patients with chronic obstructive pulmonary disease, and the prescription and titration of ACE inhibitors for patients with heart failure
- make a similar assessment of the individual items in each bundle and identify successful interventions and those which were less, or not at all, successful
- identify facilitators and barriers to changes introduced by the Chronic Care Collaborative teams
- assess the sustainability of improvements in chronic care made by the teams
- assess the perceived effectiveness and acceptability of the Collaborative methodology to team members
- assess team members' perceived ability to plan, introduce and achieve clinical practice improvements
- evaluate changes in perceived ability to engage patients and carers
- evaluate the impact of the Collaborative on communication and cooperation between services
- analyse inpatient data provided by NSW Department of Health from the Health Information Exchange to establish a before-collaborative baseline and to compare this to post-collaborative data (when available) on length of stay, unplanned admissions and readmissions for patients with chronic obstructive pulmonary disease and heart failure.

Organisation of this report

This report brings together results from analysis of data from a variety of sources including data collected using both quantitative and qualitative methods. To aid readers each source of information for the evaluation is organised into a separate section or chapter. Each section includes a brief introduction for that section, an account of the methods used, results with tabular and statistical analysis as appropriate, and a summary outline of the results for that section. These findings are then brought together in a single executive summary.

In an evaluation conducted so soon after the completion of an intervention, project effects are not likely to be seen in the limited quantitative data available, and even if they are seen the issue of sustainability will be left open. There are also problems with the accuracy and completeness of much of the quantitative data. For example, the monthly audit undertaken by each team is an important component of the breakthrough series methodology for that team. It does not follow, however, that data from these audits will mix and provide means for a statewide evaluation. For this reason the evaluation included the collection of qualitative data. These data were obtained from focus group meetings and interviews with team members. These form an important component of the evaluation. It seems unlikely that the Collaborative interventions will be sustained, if the team members believe otherwise. Their ideas on what might assist, and what might hinder, sustainability will be based on very recent practical experience. How far team member perceptions will match what actually is the case, remains to be seen in the longer term than is possible for the present evaluation.

3 Literature review

Chronic diseases are usually characterised by complex causality, multiple risk factors, a prolonged course of illness, functional impairment or disability and in most cases, the unlikelihood of cure.[5] The incidence and burden of chronic illness is high and increasing in Australia and internationally.[6] Currently chronic illness is responsible for 60 per cent of the global disease burden and is increasing such that by the year 2020, developed countries such as Australia can expect that 80 per cent of their disease burden will be attributed to chronic illness.[7] In NSW in 2000-2001, the NSW Department of Health launched the NSW Chronic Care Program aiming to improve the quality of care for people with chronic and complex conditions.[1] In 2004 the Department and the Clinical Excellence Commission together implemented the NSW Chronic Care Collaborative aimed at improving care and outcomes for patients with chronic illness. The chosen methodology was that of the breakthrough series collaborative developed in the USA by the Institute for Health Care Improvement to facilitate the improvement of services.[2] In this review recent quality improvement studies, including breakthrough series that establish the soundness of this methodology, and illustrate its use both overseas and in Australia, are outlined.

Many studies have shown that using quality improvement methods in health care can increase collaboration and teamwork among health care providers, improve the processes of care, assist in the implementation of evidence based guidelines and thereby improve outcomes. In 1996, Wagner and colleagues proposed a model of evidence-based, planned care for patients with chronic illness.[8] This model had the following components:

- care guidelines based on clinical epidemiologic evidence of improvement in outcomes rather than on expert opinion
- practice redesign, or planned improvements in the organisation of practice, to better meet the needs of the patients with chronic illness
- patient self management and behaviour change with techniques to help patients become more active participants in their care
- continuing personalised medical education, with attempts to make expertise available for primary care through the development of specifically trained local experts, or through collaborative care (where specialists and generalists manage patients together in the primary care setting)
- information about the patients, their care, and their outcomes through registries and reminder systems. They reported that the challenge was how to organise these components into an integrated system of chronic illness care.[8]

The use of quality improvement methods has been widespread in all areas of health care.[9] The breakthrough series methodology adopted by NSW Department of Health for the Chronic Care Collaborative brings together a large number of multidisciplinary teams from participating hospitals and facilities to make focused improvements in health care.[2] To date, the Institute for Health care Improvement has sponsored 50 breakthrough series collaborative projects on various topics that have involved over 2,000 teams from 1,000 health care organisations. The size of these collaboratives varied from 12 to 160 teams. Results have been positive and include:

- waiting times reduced by 50 per cent
- intensive care unit costs reduced by 25 per cent
- reduction in hospitalisations for patients with congestive cardiac failure by 50 per cent

In addition, the Institute for Health Care Improvement has trained over 600 people in the breakthrough series methods for hundreds of collaborative initiatives throughout the world including Australia and NSW.

The Institute for Health Care Improvement has used the breakthrough series approach in diverse areas including asthma care, adverse drug events, caesarean section rates, neonatal and adult intensive care, adult cardiac surgery, and end of life care.10 An early and influential example of a breakthrough series collaborative was the Institute for Health Care Improvement caesarean section collaborative in 1995. It consisted of 28 health care organisations, aiming to safely decrease rates of caesarean section. Expert help was sought on change concepts and action plans were developed

for safely reducing caesarean delivery rates. The collaborative lasted 12 months and during that period, participants attended three 2-day learning sessions. They communicated with other participants using weekly conference calls and an Internet site. The Collaborative reported that 15 per cent of the participating teams safely reduced caesarean section rates by at least 30 per cent. An additional 50 per cent achieved reductions between 10 and 30 per cent.[11]

A further successful Institute for Health Care Improvement breakthrough series collaborative in 1996 involved 40 hospitals. It was set up to reduce adverse drug events-injuries related to the use, or non-use, of medications. A model for improvement was developed and taught to teams from participating hospitals who were coached to identify problem areas, and to develop changes in practice for rapid-cycle testing. During the 15-months of the collaborative eight categories of change were implemented by at least 7 hospitals with a success rate of 70 per cent. These changes included non-punitive reporting, ensuring documentation of allergy information, standardising medication administration times and implementing chemotherapy protocols. These successes were associated with strong leadership, effective processes and appropriate choice of interventions.[12] In a similar study Lynn et al have reported improvements in end of life care through using breakthrough series methods.[13]

Horbar et al in 2001 reported a further successful breakthrough series.[14] This concerned the quality and cost of neonatal intensive care. There were 10 self-selected neonatal intensive care units in the intervention group and the other 66 neonatal intensive care units served as the control group. During the 3-year period, the intervention group formed teams, received instruction in quality improvement and in obtaining performance data. They identified common improvement goals, and implemented potentially better practices. Six neonatal intensive care units of the intervention group focused on reducing the infection rate while the other 4 focused on chronic lung disease. The investigators reported a fall in infection rates from 22 to 17 per cent in the 6 neonatal intensive care units, and a decrease in the rate of supplemental oxygen at 36 weeks' adjusted gestation age from 43.5 per cent to 31.5 per cent in the 4 neonatal intensive care units over the 2-year period. The changes in the 10 intervention units were significantly larger than those observed in the 66 neonatal intensive care units not in the intervention.[14]

In the UK, the National Health Service Modernisation Agency reported that an extensive cancer collaborative had saved 400 years of cancer waiting times since it commenced in 2000.[15] Using breakthrough series methodology, the cancer collaborative involved nine cancer networks, covering a population of 14 million. In the first year of the project 4,400 changes were tested on 1,000 patients. Sixty five per cent of the projects showed a reduction of at least 50 per cent in the time to first treatment. Measurable improvements also included reduced waiting times for referrals from radiologists to chest physicians, reduced separate visits for bowel cancer patients, and reduced time to palliative care for cancer patients.[16] Also in the UK, a primary health care collaborative aiming at reducing delays between primary and secondary care reported a reduction in the risk of coronary heart disease by 34 per cent in the practices involved.[15] The UK National Health Service which sponsored these collaboratives has followed up on the findings by recommending strategies to reduce delays in a further 10 high impact areas.[17]

Not all studies using breakthrough series methodology have been successful. Landon et al have evaluated the effectiveness of a quality improvement collaborative for almost 10,000 HIV-infected patients.[18] For this project there were 44 interventions and 25 control clinics. The results were negative. There was no difference between intervention and control groups in the proportion of patients with a suppressed viral load, or in rates of appropriate screening tests and prophylaxis. The evaluators concluded that this quality improvement collaborative did not significantly affect the quality of care. The difficulty of randomization of groups for this trial was reported as a limitation of the study.

There is evidence that gains made in a collaborative can be lost after conclusion of the program. In 2002, 47 hospital emergency departments across mainland Australia participated in the National Institute of Clinical Studies Emergency Department Collaborative. The objective was to reduce time to analgesia for patients requiring pain relief. The average time to pain relief was 56-62 minutes and there was a small non-significant reduction in perceived time to relief during the first phase of the trial. This improvement was lost during the second phase of the project when pressure to maintain improvements was reduced.[19]

Studies closer in focus to the NSW Chronic Care Collaborative include the Oregon Diabetes Collaboratives aimed to improve glycemic control and reduce cardiovascular risk in all adult patients with diabetes. The participating teams adapted elements of the Chronic Care Model developed by Wagner and colleagues to enhance diabetes care in 18 primary care clinics serving 170,000 adults.[8] Interventions empowered patient self-management, supported care team decision making, redesigned office systems, and maximized use of available information technology. Diabetes was identified through pharmacy and diagnostic data and the target population ranged from 6,542 to 7,037 members. Trends in glycosylated hemoglobin (HbA1c) and low-density lipid (LDL) cholesterol were analyzed monthly throughout 1999 in both cohorts and serial cross-sections. During 12 months, mean HbA1c improved from 7.9 per cent to 7.5 per cent, and the proportion of patients with HbA1c levels < 8 per cent rose from 60.5 per cent to 68.3 per cent, and the proportion with HbA1c > 10 per cent fell from 10.3 per cent to 7.2 per cent. The LDL test rate rose from 47.4 per cent to 57.4 per cent, and mean LDL fell from 120 mg/dl to 116 mg/dl. The proportion with acceptable lipid control (LDL < 130 mg/dl, or < 100 mg/dl with coronary artery disease) rose from 48.9 per cent to 57.7 per cent. All changes were significant at $p < 0.01$ or less. The authors concluded that clinically significant population-based improvements in diabetes care were observed during a 1-year period using the multifaceted enhanced primary care strategy.[20]

In Australia, Scott et al have evaluated changes in quality of in-hospital care of patients with either acute coronary syndromes or congestive heart failure admitted to 9 public hospitals participating in a Queensland multisite quality improvement collaboration.[21] Before-and-after quality indicators were measured on representative patient samples between June 2001 and January 2003. Study participants were 1,524 patients discharged with a clinical diagnosis of acute coronary syndrome and 577 with congestive heart failure who met the study criteria. Compared with baseline, more patients with acute coronary syndrome in the post-intervention period received therapeutic heparin regimens (72 per cent v 84 per cent; $P < 0.001$), angiotensin-converting enzyme inhibitors (56 per cent v 64 per cent; $P = 0.02$), lipid-lowering agents (62 per cent v 72 per cent; $P < 0.001$), early use of coronary angiography (39 per cent v 52 per cent; $P < 0.001$), in-hospital cardiac counselling (43 per cent v 65 per cent; $P < 0.001$), and referral to cardiac rehabilitation (5 per cent v 15 per cent; $P < 0.001$). The numbers of patients with congestive heart failure receiving beta-blockers also increased (34 per cent v 52 per cent; $P < 0.001$), with fewer patients receiving deleterious agents (13 per cent v 23 per cent; $P < 0.04$). Same-cause 30-day readmission rate decreased from 7.2 per cent to 2.4 per cent ($P < 0.02$) in patients with congestive heart failure. The results show that in Australia quality-improvement interventions conducted as multi-site collaborations can improve in-hospital care of acute cardiac conditions within relatively short timeframes.

In another Australian study, the Clinical Support Systems Project a joint initiative of The Royal Australasian College of Physicians and the Commonwealth Department of Health and Ageing sought to assist the routine uptake of best evidence within clinical practice in 17 clinical sites across three Australian states using the principles of evidence based medicine and clinical practice improvement.[22] The key elements of the program were The Austin Bowel Cancer Consortium implementing the National Health and Medical Research Council guidelines for colorectal cancer care, the Brisbane Cardiac Consortium, the Monash University Consortium (implementing stroke management protocols), and Towards a Safer Culture Consortium which focused on the emergency management of acute coronary syndromes and stroke.[21, 23, 24, 25]

The Austin Consortium reported 5 key lessons.[23]

- the clinical encounter should be the site of change for putting evidence into practice rather than attempting to change individual clinicians
- evidence is relevant to all involved in the clinical encounter
- clinical decisions are made on the basis of both evidence and experience
- different clinical craft groups learn about evidence and how to incorporate it in practice in different ways and these styles of learning influence work cultures
- clinicians interpret and filter evidence through a series of work cultures. Knowledge of the patient as ‘person’ acts to filter the use of evidence.

The Monash University Consortium reported the following outcomes.[24]

- training and education are required as to the nature of evidence and the process of clinical practice improvement
- both leadership and management are required
- commitment of institutional administration to best practice is essential
- hospitals participating in the study reduced the average length of stay for stroke patients by 15 per cent and showed a sustained downward trend. The fall in length of stay was associated with adherence to clinical protocols.

The Monash Towards a Safer Culture project developed pathways for management of acute coronary syndrome and stroke management with standardized assessment of stroke severity and high risk stroke patients.[25] Key lessons reported to date were:

- a multidisciplinary and interdepartmental approach to managing patients is an effective way to achieve change
- sponsorship by the Royal Australian College of Physicians was an important strategy for engaging doctors.

Harrison et al studied the results of the NSW Blood Transfusion Collaborative, a project to reduce inappropriate red cell transfusion in 17 public and private hospitals in 11 Area Health Services in NSW.[26]

Using the breakthrough series methods of the Institute for Health Care Improvement participating institutions were able to achieve a 50 per cent reduction of inappropriate transfusions. The most effective intervention reported was the vetting of transfusion requests in accordance with the National Health and Medical Research Council guidelines.

A number of agencies worldwide are conducting sponsoring or facilitating collaboratives in a variety of areas. Examples include the UK National Health Service Modernisation Agency, the Australian National Institute for Clinical Studies, the US Institute for Health Care Improvement, the Victorian Department of Health and Human Services and the NSW Department of Health.[27, 28, 29, 30, 31]

The brief review above strongly supports the following hypotheses that are relevant to the NSW Chronic Care Collaborative and its evaluation in that:

- using quality improvement methods in health care, and specifically the breakthrough methodology, can increase collaboration and teamwork among health care providers
- breakthrough series methods can improve the processes of care, particularly the implementation of research based guidelines
- collaboratives can improve the outcomes of care through these mechanisms.

4 Survey of team members

4.1 Introduction

NSW Chronic Care Collaborative team members attending the fourth and last learning session in Sydney in November 2004 completed a questionnaire on what they perceived as successes and difficulties for their team and themselves. By then most team members at the learning session had participated in the Collaborative for at least 8 months. The questionnaire was designed and trialled at the Centre for Health Services Research at Westmead taking into account work for the National Health Service in the UK, Victoria-Australia and at the RAND Corporation in the U.S.[32, 33, 34] The content was designed to answer questions of interest to NSW Department of Health and the Clinical Excellence Commission. A draft version of the questionnaire was tested with health service staff uninvolved in the Collaborative. It was previewed and amended in discussion with the Chronic Care Collaborative Steering Committee.

4.2 Methods

4.2.1 Procedure

Copies of the questionnaire were distributed to Chronic Care Collaborative team members attending the fourth learning session in Sydney in November 2004. The schedule for the learning session allowed 15 minutes for completion of the questionnaire and the completed forms were collected immediately on conclusion of this period. The questionnaire was anonymous.

The questionnaire included 23 items and team members were asked to indicate their level of agreement with each item on a five point scale ranging from 'strongly agree' to 'strongly disagree'.

In addition, information was requested on:

- team location - rural or metropolitan
- team focus - heart failure, chronic obstructive pulmonary disease or both
- profession - management, medical, nursing or allied health
- mean years in current profession
- mean years in current position
- Collaborative team role - clinical leader, executive sponsor, project coordinator or team member
- month joined team - February-April, May-July or August-October 2004
- number of learning sessions attended.

4.2.2 Analysis

Tabular analysis was undertaken with results presented as the proportion of responses falling into the categories of agreement and disagreement with questionnaire items. Results were calculated for respondent perceptions overall and by subcategories. Differences between counts were tested using chi squared tests. Differences between mean values were tested using t-tests for independent groups. Factor analysis was used to explore relationships between items in the questionnaire and to reduce the data to a small number of factors mapping team members' perceptions. A generalised least squares method was used, followed by a varimax rotation.

4.3 Results

4.3.1 Respondent characteristics

A total of 140 questionnaires were completed (168 team members were registered to attend). Characteristics of the respondents are shown in Table 4.1.

Table 4.1 Descriptive characteristics of respondents (N=140)

Team location (%)	
Rural	54.7
Metropolitan	45.3
Team focus (%)	
Heart failure	22.1
Chronic obstructive pulmonary disease	32.1
Both	45.7
Profession (%)	
Management	28.6
Medical	6.4
Nursing	43.6
Allied Health	14.3
Consumer / carer	0.7
Other	6.4
Team role (%)	
Clinical leader	7.9
Executive sponsor	6.5
Project coordinator	18.7
Team member	66.9
Month joined team (%)	
February-April	79.0
May-July	14.5
Years in current profession (mean)	**19.7**
Years in current position (mean)	**5.1**

Over half (55 per cent) of the respondents worked in rural areas, and most were nursing professionals (44 per cent) or managers (29 per cent). Participants had been in their stated profession for a mean of 19.7 years (range 0 to 41 years) and in their current role for a mean of 5.1 years (range 0 to 28 years). Two-thirds (67 per cent) identified their role in relation to the Collaborative as a team member and the majority (79 per cent) had joined their Collaborative team between February and April 2004.

4.3.2. Perceived usefulness of the learning sessions

Most respondents (86 per cent) found the learning sessions useful, with 42 per cent finding them fairly useful and 44 per cent finding them very useful (Table 4.2).

Table 4.2 Perceived usefulness of the learning sessions

	Not at all useful %	A little useful %	Unsure %	Fairly useful %	Very useful %
How useful have you found the learning sessions? (N=137)[1]	0.7	8.0	5.8	41.6	43.8

1 N of respondents answering this question.

4.3.3 Perceived effectiveness of the Collaborative

Results for questions which related to the team members perception of the effectiveness of their team are included in this section. As can be seen from Table 4.3, most respondents agreed that the Collaborative had been effective. Notably 94 per cent felt that the Collaborative had improved their understanding of principles of chronic care management, their knowledge of chronic obstructive pulmonary disease and heart failure diagnosis and management (86 per cent), and their practical skills in managing patients with chronic disease (82 per cent). A large majority (85 per cent) felt the Collaborative had resulted in improved patient care and 76 per cent thought their department or facility had gained from the experience. In terms of the level of their own commitment and involvement, 89 per cent of respondents thought that much effort and much time, above the normal call of duty, was needed for a collaborative team to succeed.

Table 4.3 Perceived effectiveness of the Collaborative

Question[1] and N[2]	Strongly agree %	Agree %	Unsure %	Disagree %	Strongly Disagree %
2. My understanding of the principles of chronic care management has improved since I joined the Collaborative (N=140)	39.3	55.0	4.3	0.7	0.7
3. My knowledge of diagnosis and management of patients with heart failure or chronic obstructive pulmonary disease has improved through participation in the Collaborative (N=139)	33.8	51.8	9.4	4.3	0.7
23. The Collaborative has given us practical skills in the management of patients with chronic disease (N=139)	22.3	59.7	10.1	3.6	4.3
20. I have improved my ability to engage with patients and carers, and to benefit from what they have to say (N=138)	16.7	57.2	14.5	10.1	1.4
1. I am confident that the Collaborative has been effective in improving patient care (N=140)	27.1	57.9	13.6	1.4	0.0
5. In my opinion, our department/facility has gained significantly from the team's involvement in the Collaborative (N=140)	19.3	56.4	20.7	2.9	0.7
7. Much effort and much time, above the normal call of duty, is needed if a Collaborative team is to succeed (N=140)	50.7	37.9	4.3	7.1	0.0

1 Preceded by a number showing sequence in Questionnaire
2 N of respondents answering question.

4.3.4 Perceived team functioning and organisational support

This section includes items which related to perceptions on organisation, communications and support. These results are in Table 4.4.

Almost all respondents (92 per cent) said that their team had learnt the importance of efficient communications at all levels and 88 per cent agreed that communication skills which they had developed, both within and outside their team, would be sustained. Most respondents reported that all team members contributed to team decisions (78 per cent), and that they were pleased with the effectiveness of organisation within their team (76 per cent).

Responses to questions on support were less favourable. Only 43 per cent felt their initiatives had received support from senior clinicians. While 82 per cent felt that having an executive sponsor in the team was crucial for success, only 67 per cent thought that their team was 'well supported' by its executive sponsor.

More than three quarters of respondents (78 per cent) felt that support from the Clinical Excellence Commission was excellent in intention, with slightly fewer (68 per cent) agreeing that this support was excellent in practice.

Table 4.4 Perceived team functioning and organisational support

Question[1] and N[2]	Strongly agree %	Agree %	Unsure %	Disagree %	Strongly Disagree %
15. I am very pleased with the effectiveness of organisation within our team (N=139)	18.0	58.3	15.8	7.9	0.0
12. In our team everyone contributed when decisions were being made (N=139)	16.7	61.6	10.1	10.9	0.7
21. One of the most important things those of us in the team have learnt is the importance of establishing efficient communications at all levels (N=138)	46.4	45.7	5.8	2.2	0.0
22. We developed a rapport during the Collaborative, which made it easy to communicate within and outside the team. I won't lose this (N=139)	31.7	56.1	10.8	1.4	0.0
11. The improvements we initiated received support from senior clinicians who weren't in the team (N=137)	6.6	36.5	35.8	19.0	2.2
9. Our team was well supported by our Executive Sponsor (N=138)	25.4	41.3	19.6	8.0	5.8
10. In my opinion, having an Executive Sponsor in a team is crucial for success (N=138)	46.4	35.5	12.3	5.1	0.7
16. I would rank the organisational support our team has received from Clinical Excellence Commission as excellent as far as intention goes (N=140)	25.7	52.1	18.6	2.9	0.7
17. In practice the organisational support our team has received from Clinical Excellence Commission has been excellent (N=139)	18.7	48.9	28.8	3.6	0.0

1 Preceded by a number showing sequence in Questionnaire
2 N of respondents answering question.

4.3.5 Perceived sustainability and spread of change

Respondents agreed (78 per cent) that their team had already put into practice most of what had been learnt from the Collaborative, and 85 per cent expected their team to meet to plan wider use of what they had learnt, and 68 per cent had already taken part in team discussions of this.

At an individual level a substantial majority (89 per cent) had confidence in their own ability to plan clinical practice improvements in the future. There was less certainty on the sustainability of improvements actually made during the Collaborative and 36 per cent of respondents were unsure as to whether the changes in patient care fostered by the team would be sustained. A substantial majority (89 per cent) thought that more resources would be needed if the improvements which had been made were to be sustained. Only 37 per cent thought it likely that clinical practice improvement methodology would spread because of the Collaborative, with another 26 per cent disagreeing or strongly disagreeing and 36 per cent unsure.

Table 4.5 Perceived sustainability and spread of change

Question[1] and N[2]	Strongly agree %	Agree %	Unsure %	Disagree %	Strongly Disagree %
6. I believe that the changes in patient care which our team has fostered will be sustained (N=138)	11.6	51.4	35.5	0.0	1.4
8. From my experience, more resources will be needed if Collaborative improvements are to be sustained (N=138)	55.0	34.3	7.1	3.6	0.0
4. Our team members have already put into practice most of what we have learnt about chronic disease from the Collaborative (N=139)	17.3	60.4	12.9	7.9	1.4
13. Our team has already discussed what we will do to spread learning from the Collaborative in the future (N=139)	7.9	60.4	19.4	10.8	1.4
14. I expect our team will meet to plan what we can do to aid wider use of learning from the Collaborative in our department/facility	18.0	66.9	14.4	0.7	0.0
19. I have confidence in my ability to help plan future clinical practice improvements (N=139)	22.3	66.9	9.4	1.4	0.0
18. I think it is unlikely that our work for this Collaborative will help spread clinical practice improvement methodology into the wider local Health Area context (N=139)	6.6	19.7	35.5	33.6	3.6

1 Preceded by a number showing sequence in Questionnaire
2 N of respondents answering question.

4.3.6 Comparisons between groups of team members

The results of analyses relating answers to the questions on the Collaborative were compared for sub-groups of respondents. These were team focus (heart failure, chronic obstructive pulmonary disease or both), profession of respondent, years of experience, role in team, time in team, learning session attendance, and rurality. Comparisons were made between all sub-groups and for every question and were tested for statistical significance. This section summarises this work and includes results only for those comparisons found to be statistically significant. Tables with details of these results are given in Appendix 4.

Team focus

Respondents who belonged to teams focusing on heart failure differed from those in teams with a chronic obstructive pulmonary disease or both heart failure and chronic obstructive pulmonary disease focus (Appendix table A4.1). Heart failure team members (68 per cent) were more likely to report support for their initiatives from senior clinicians than were chronic obstructive pulmonary disease teams (37 per cent) or teams doing both (35 per cent).

All teams reported a high level of intended support from the Clinical Excellence Commission, but this was more so for heart failure (94 per cent) than for chronic obstructive pulmonary disease (78 per cent) or teams doing both (70 per cent).

Respondents felt that their teams were less supported by the Clinical Excellence Commission in practice than was intended, with 87 per cent of respondents from heart failure teams agreeing that the support in practice had been excellent, with 64 per cent for chronic obstructive pulmonary disease and 60 per cent for teams doing both.

Profession of respondent

Management (100 per cent) and nursing (88 per cent) professionals were more likely to find the learning sessions useful than medical (67 per cent) or allied health (70 per cent) professionals (Appendix table A4.2). Medical (77 per cent) and allied health (85 per cent) professionals were more likely to agree that their ability to engage patients and carers had improved because of the Collaborative. Nurses agreed less so (56 per cent), but this could be because they already rated their ability as high, and were therefore less open to improvement.

Length of professional experience

Respondents who were unsure or disagreed with the statement that 'the improvements we initiated received support from senior clinicians who weren't in our team' (57 per cent of respondents) had significantly more professional experience (21.9 years) than respondents who agreed (17.1 years).

Length of time in the Collaborative team

There were many significant differences in the questionnaire responses related to how long the respondent had been a team member. These were mostly in the direction of a more positive response for those who had been involved from the start. The longer serving team members were more likely to have found the learning sessions useful (they had experienced more of them), organisation within their team effective, intended support from the Clinical Excellence Commission as excellent and to be more likely to have discussed or to be planning ahead for spread of Collaborative achievements. The longer serving teams were also more likely to agree that support had been received from senior clinicians not in the team (47.2 per cent) than those who had joined in May-July (26.3 per cent agreed) or in August-October (12.5 per cent agreed).

Number of learning sessions attended

Team members who had confidence in their ability to plan future clinical practice improvements had attended on average significantly more learning sessions than team members who said that they lacked this confidence. They also ranked the intended Clinical Excellence Commission support and the usefulness of learning sessions higher.

Rurality

There were no significant differences between members of rural and metropolitan teams in response to items in the questionnaire.

4.3.7 Factor analysis

Eight factors accounted for 66 per cent of the variance in responses to the 23 items in the questionnaire. The first factor extracted accounted for 21.4 per cent of the variance. This factor loaded on what might be termed 'team solidarity items' together with 'success' items. The team items were:

- team has already put much into practice
- pleased with effectiveness of team organisation
- everyone contributed to team decisions.

The success items were:

- The Collaborative has improved patient care
- Our Department has gained considerably from the Collaborative.

The second factor accounted for 9.3 per cent of the variance and loaded solely on the two questions on the Clinical Excellence Commission provisions and the effectiveness of these in practice.

The third factor (7.4 per cent) again isolated team aspects of the Collaboration (team learned the importance of communication, developed rapport) and related these to the acquisition of practical skills.

The fourth factor (6.9 per cent) loaded heavily on benefits from the Collaborative (my knowledge of diagnosis management has improved, my understanding of care management has improved) and to a lesser extent on improved ability to engage with patients. However, this factor loaded negatively on 'changes in patient care will be sustained'. This suggests that respondents who said that the Collaborative had led to improvements in their understanding of patient

care and communication skills and that this had led to improvements in patient care in practice, were not confident that these improvements would be sustained in the future.

Independent 't' tests were used to compare subgroups of respondents on factor scores derived from this analysis with non-significant results in every case, except that respondents who found the learning sessions useful had significantly higher scores for factor 2 (role of the Clinical Excellence Commission). Respondents from rural and urban teams did not differ on any factor.

4.4 Summary

- 94 per cent of team members said that the Chronic Care Collaborative had improved their understanding of the principles of chronic care management and their knowledge of diagnosis and management of heart failure and the chronic obstructive pulmonary disease. The majority (89 per cent) were confident in their ability to plan future clinical practice improvements.
- 85 per cent of team members agreed that the Chronic Care Collaborative had resulted in improved patient care, and 63 per cent said that this improvement would be sustained, with another 36 per cent unsure. Less than 2 per cent expressed certainty that improvements would not be sustained.
- A substantial majority (89 per cent) thought that extra resources would be needed to sustain the improvements they had achieved and 89 per cent said that effort and time beyond the normal call of duty were needed for a collaborative to succeed.
- In general, the survey found positive responses to a range of questions on the Collaborative, on support from the Clinical Excellence Commission and management, on intended teamwork in the future, on rapport and communications. The exception was a question asking if improvements initiated by their team had received support from senior clinicians not in the team. Only 37 per cent agreed and only 7 per cent strongly agreed.

4.5 Discussion

The questionnaire was anonymous and there was no reason why team members should not have been frank in the opinions and attitudes expressed. The overall finding of the survey was that team members mostly had very positive attitudes to the success of the Collaborative and were confident that their team had made improvements in patient care. There were reservations about the level of involvement of executive sponsors and on input from senior medical staff. There was also some uncertainty as to sustainability without resource input.

The survey was conducted at a learning session held in Sydney at the conclusion of the Collaborative and those who attended may not have been representative of all team members. Those attending the session and completing the questionnaire (N=140) represented 83 per cent of the list of registered team members (N=168) available from the Clinical Excellence Commission. Although these were a substantial majority of team members, it is possible that they differed in opinion from team members who could not attend, or were not selected to attend, the learning session. Attendees were likely to be the most involved members of their team and could have different perceptions from the less involved. It is also possible that they may have seen less of the negative aspects of the interventions, or difficulties and failures. A bias in the direction of over representation of the more involved team members could also be advantageous as these members are likely to be better informed on team and Collaborative matters and to be more likely to continue driving Collaborative innovations and efforts to sustain these.

5 Monthly audits made by Collaborative teams

5.1 Introduction

An essential component of the NSW Chronic Care Collaborative was the auditing by each team of their progress against Collaborative objectives. This auditing took the form of a monthly return to the Clinical Excellence Commission using a data collection sheet provided by the Clinical Excellence Commission or, if available, records already in use at the team's site. The audit had three objectives:

- to provide monitoring information to teams so that they had a quick assessment of their own progress
- to provide information to the Clinical Excellence Commission to aid their central advisory role
- to provide data for a statewide analysis of the Collaborative at a later date.

This section of the evaluation report is concerned with the third of these objectives. The role of the monthly audit for each team is examined in the qualitative analysis of focus group meetings and in the analysis of the semi-structured interviews.

The evaluators received a computer file from the Clinical Excellence Commission containing the monthly audit data for the period April (the baseline) to November (end of the Collaborative) 2004. These data had been collected in hard copy by the Clinical Excellence Commission from all project teams. We also received a copy of the original datasheets. After preliminary analysis of the data in the computer file it was decided to re-build the file from the original paper records. This was to facilitate analysis and to introduce further information from the data sheets.

The monthly audit was undertaken by the team coordinator, usually with assistance from other team members. Instructions were provided by the Clinical Excellence Commission and these allowed considerable flexibility. Teams were asked to establish their own procedures for conducting the audits and to maintain these consistently through to the end of the project. They had the option of choosing a prospective audit (undertaken during the patient consultation) or a retrospective audit (undertaken using health records). They had options of deciding how many patients to audit (10 was the recommendation, but some sites found less) and how these should be selected (for example, it could be the first 10 eligible patients in the first week of each month). If the audit was prospective it was left to teams to decide where it would be undertaken (for example, in the emergency department, at a rehabilitation service, or during a home visit). Information on team decisions on these matters was not available to us, nor did we know until focus group and interview data were collected, how consistent teams were in implementing and maintaining their initial intentions.

For these reasons the analyses reported in this section are concerned with the broader issue of overall success of the diagnostic and management bundles, and the individual items in them irrespective of where and how. Teams reported on the percentage of patients who received each of the bundles (diagnostic or management) in full, but there is ambiguity in these data. This is because some of the items in each bundle were inapplicable at some sites, particularly rural sites. Some teams omitted inapplicable items when auditing, but others included them and thus never succeeded in completing a full bundle of interventions. This limits the most useful results to those for individual items included in the bundles (for example, use of spirometry, use of ACE inhibitors, dose titration).

A further limitation on the analysis of the audit data is that the teams reported percentages without the counts on which these percentages were based. Thus although many of the percentages are based on 10 patients, some sites may have reported 100 per cent success results based on one patient, or 50 per cent success based on two patients. Even when 10 patients are reported these may have been from a single hospital and selected from a large number of patients, or they may have been collected from smaller numbers at several very different facilities within the team's area. At the time of analysis we obtained retrospective information from the Clinical Excellence Commission on the counts used by teams to calculate the percentages, but mostly our results use the unweighted percentage. Thus variability from this source is nested within implementation of the Collaborative and is uncontrolled.

5.2 Methods

5.2.1 Data

The monthly audits were undertaken in three settings including the community setting, emergency department and at discharge from hospital although not all teams used all these.

The diagnostic bundle and the individual items it contained were audited solely in the community setting. The teams were advised by the Clinical Excellence Commission that the chosen community setting for auditing purposes could be:

- first rehabilitation appointment
- the first nursing home visit
- the first community allied health appointment
- the first community health centre appointment
- a general practice appointment
- some other community intervention point of relevance to the Area Health Service.
- The management bundle and the items in it were intended for use and auditing in each of the three settings for the Collaborative in the community, in the emergency department and at discharge from hospital. Some teams decided, at the start, not to focus auditing efforts in all three settings and some made this decision later usually when problems were encountered.
- The data identified the focus of the team – heart failure or chronic obstructive pulmonary disease, and the Area Health Service in which the team was based. Measures included the percentage of patients audited who have received the diagnostic bundle (community setting only) and the percentage who have received the management bundle (separately for each of the three settings). For the diagnostic bundle, the individual items analysed for this report were:
- clinical assessment including focused clinical history
- physical examination
- echocardiography for patients with heart failure or spirometry for patients with chronic obstructive pulmonary disease.

For the management bundle, the individual items analysed for this report were:

- baseline investigations to guide clinical management
- ACE inhibitors for patients with heart failure or bronchodilators for patients with chronic obstructive pulmonary disease
- approved beta-blockers for heart failure patients or consideration of inhaled steroid therapy
- dose titration schedule for ACE inhibitors or review for suitability to receive home oxygen therapy
- smoking cessation intervention
- self-management support (including action plan) delivered in the context of appropriate education
- referral to or completion of an individually tailored multidisciplinary rehabilitation program
- recommended schedule of review by a general practitioner
- influenza immunization current
- pneumococcal immunization current
- after-hours points of contact.

See Appendix 9 for a fuller description of the items in each bundle. In addition, there was an optional item, discussion of advanced care directives.

For every measure a target percentage was available. Teams also provided a 'baseline' measurement which in most cases was the audit data for the month of April, but sometimes for an earlier month. For this report data have been analysed for the formal duration of the Collaborative, April to November 2004, with the April data as baseline.

In the Tables, variation in the number of teams providing data for the different bundles and items, and in the three settings, is not due to missing data, but to decisions teams made on which of these to include.

5.2.2 Analysis

Descriptive analyses were undertaken using SPSS Version 12.0.135. Run charts were computed showing monthly progress in achieving Collaborative objectives. Paired 't' tests were used to compare mean percentages for April to November 2004. The N value for these results is the number of teams providing audit results for both months. As there was considerable variability within each team's monthly report, comparisons between

baseline and end of Collaborative results in some cases lessened the extent of improvement seen in earlier months. For this reason significance was tested for a linear trend fitted across the monthly data. In many cases a better fit would have been obtained with a higher order trend than linear, however, the issue was in whether or not the team data showed an improvement across time, over and above monthly ups and downs. The N value in these results is the count of audit data available for each month totalled for all teams. No further statistical analysis was made on these data.

5.3 Results

Heart failure initiatives were undertaken by 16 teams (8 urban and 8 rural) and chronic obstructive pulmonary disease initiatives were undertaken by 17 teams (9 urban and 8 rural). Eleven of these teams undertook both (5 urban and 6 rural).

5.3.1 Complete diagnostic and management bundles

From Table 5.1 it can be seen that not all teams provided audit data. For heart failure, 12 of the 16 teams (75 per cent) had audit data for the diagnosis bundle in the community, whereas only 8 (50 per cent) had emergency department data for the management bundle. For chronic obstructive pulmonary disease, 13 of the 17 teams (76 per cent) provided audit data for the diagnostic bundle in the community and the less active area again was the emergency department setting where there was a return from 10 teams (59 per cent). These differences reflect the different interventions and/ or settings selected by teams for action.

Table 5.1 includes the mean increase for patients receiving the diagnostic and management bundle, together with results from tests of statistical significance. From this Table it can be seen that the extent of the increase between baseline and the final month of the Collaborative varied greatly and was significantly greater than zero increase for the heart failure diagnostic bundle in the community and for the heart failure management bundle at discharge. For chronic obstructive pulmonary disease there was a significant increase for the management bundle in all three settings, community, emergency department and at discharge, and the increase for the chronic obstructive pulmonary disease diagnostic bundle in the community approached significance at $p<0.07$. Table 5.1 also includes results for discussion of the advance care directives which was an optional intervention, where on average, there was no significant improvement.

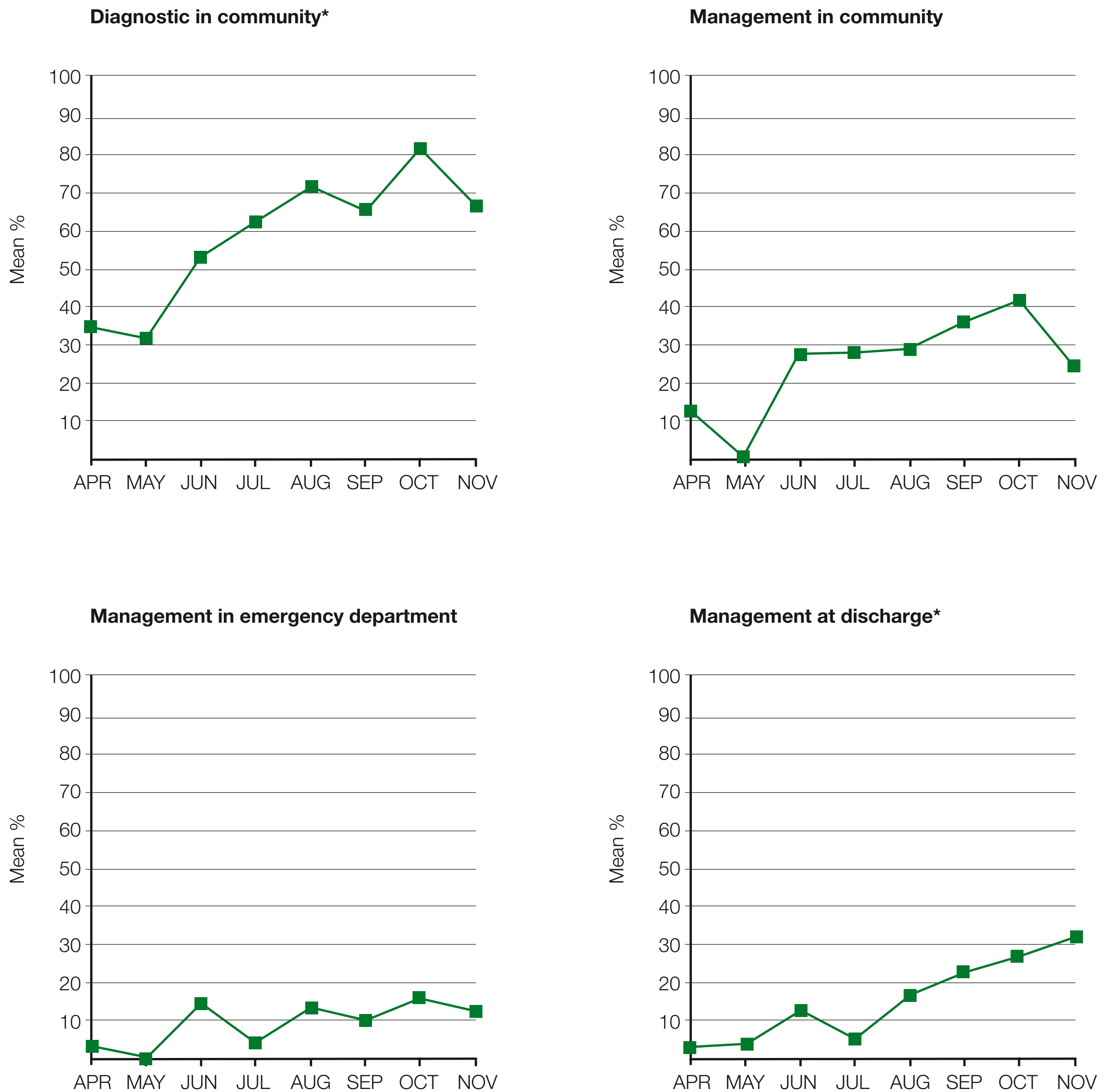
Table 5.1 Percentage increase between April and November 2004 in patients receiving the complete project bundles (diagnostic and management)

	Heart failure				Chronic obstructive pulmonary disease			
Bundles	N[1]	Mean increase %	Range %	SE[2] %	N[1]	Mean increase %	Range %	SE[2] %
Diagnostic bundle in community	12	44.2*	(-35,100)	13.6	13	26.2	(-75,100)	15.0
Management bundle in community	11	18.9	(0, 92)	11.1	14	37.7*	(-20,100)	12.4
Management bundle in emergency department	8	11.1	(0, 49)	7.3	10	22.3*	(0-73)	9.6
Management bundle at discharge	11	29.0*	(0, 100)	10.8	12	40.7*	(0,100)	8.7
Advance care directives	5	8.00	(0,40)	8.00	6	33.7	(-8,100)	19.2

* Statistical significance at $p<0.05$, Paired-sample ‘t’ test.
1 N of teams with both April and November audits.
2 Standard error of mean

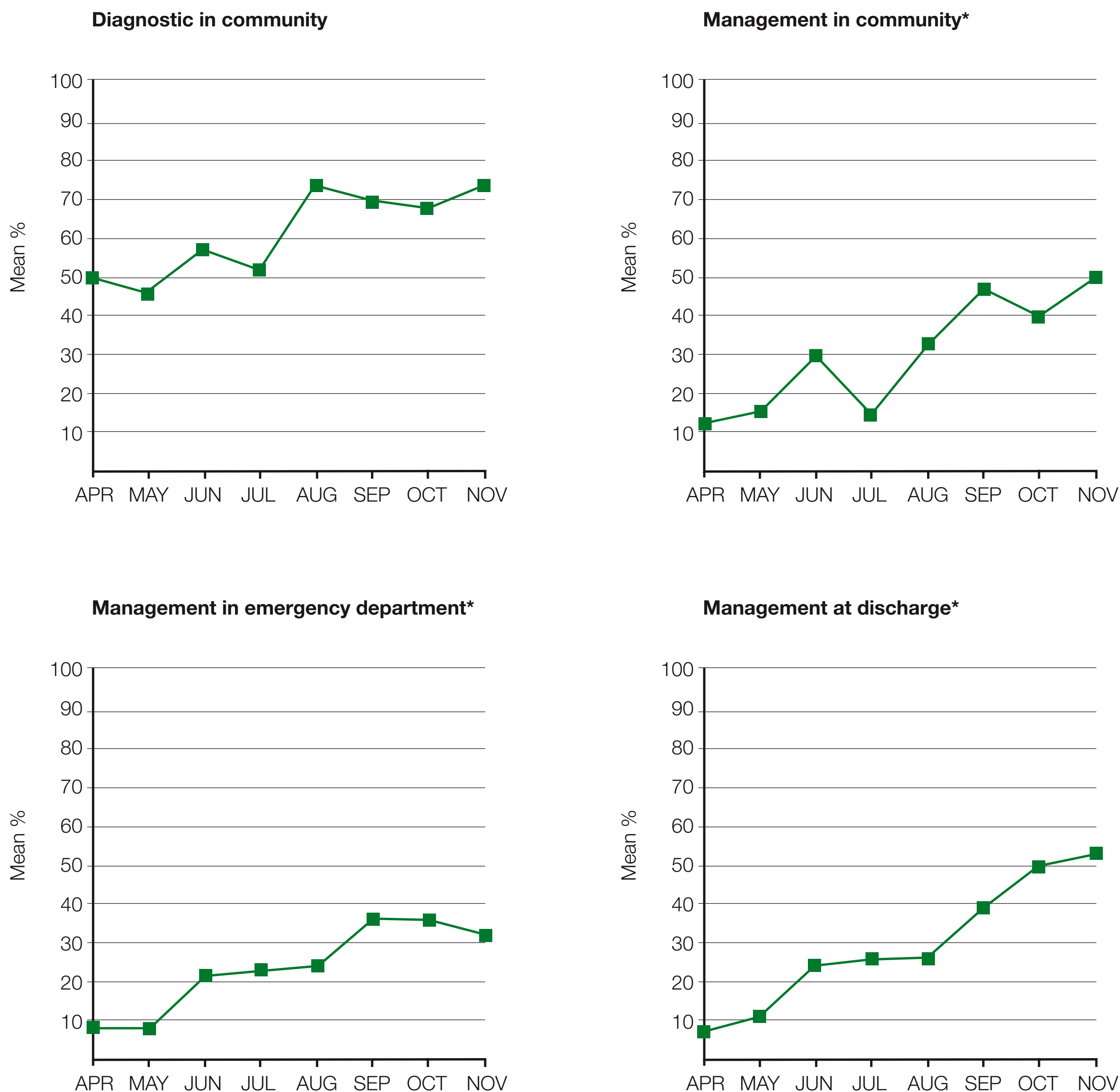
These results were examined in run charts plotting the percentages for each month separately (Figure 5.1 for heart failure, Figure 5.2 for chronic obstructive pulmonary disease and Figure 5.3 for advance care directives). From these it can be seen that in most cases the highest percentage of patients receiving the bundle was in October and not in the final month November 2004.

Figure 5.1 Completion of the diagnostic and management bundles by NSW Collaborative teams focusing on heart failure, showing percentage increase between April – November 2004



* Statistical significance at $p<0.05$, paired-sample + test

Figure 5.2 Completion of the diagnostic and management bundles by NSW Collaborative teams focusing on chronic obstructive pulmonary disease showing percentage increase between April-November 2004



* Statistical significance at P<0.05, paired +test

As can be seen from Figures 5.1 and 5.2, despite ups and downs in the percentage of patients receiving the complete bundles, in most cases there is an underlying increase in the percentages. This is shown in Table 5.2 as the average increase per month for each bundle in each setting for both heart failure and chronic obstructive pulmonary disease. From the Table it can be seen that in every case for heart failure, except the management bundle in the emergency department, there is a significant increase in the use of the complete bundle with patients. In every case for chronic obstructive pulmonary disease, there is a highly significant increase. There is also a result approaching significance for discussion of advance care directives by chronic obstructive pulmonary disease teams (P<0.07).

Figure 5.3 Completion of the advance care directives by NSW Collaborative teams focusing on heart failure and chronic obstructive pulmonary disease

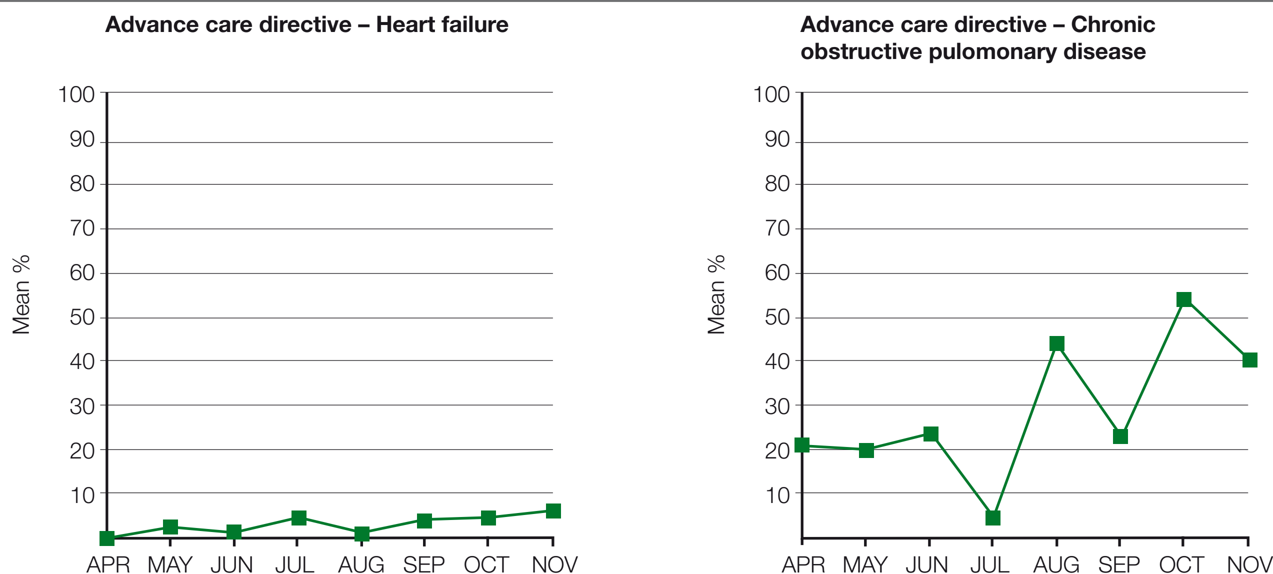


Table 5.2 Average per cent change per month, April to November 2004, of the complete diagnostic and management bundles

	Heart failure			Chronic obstructive pulmonary disease		
Bundles	**N[1]**	**Change[2]**	**P[3]**	**N[1]**	**Change[2]**	**P[3]**
Diagnostic bundle in community	84	6.7	0.001	94	4.1	0.009
Management bundle in community	81	3.8	0.02	90	5.4	0.001
Management bundle in emergency department	75	1.7	0.10	75	4.2	0.001
Management bundle at discharge	97	4.4	0.001	98	6.6	0.001
Advance care directives	52	0.7	0.10	49	4.4	0.07

1 N of audits for this item
2 Average per cent change per month (the slope coefficient for the linear trend across the months April to November).
3 Significance of the change per month.

5.3.2. Results for each item in the diagnostic bundle for heart failure and chronic obstructive pulmonary disease

Results for each of the items in the diagnostic bundle are shown in Table 5.3. The diagnostic bundle was used only in the community setting which could have been the first general practitioner appointment or some other community intervention point. From Table 5.3 it can be seen from the range column that some teams made no gain. The average increase ranged from 10.9 per cent to 29.4 per cent and that only the increase for physical examination for heart failure was significant.

Table 5.3 Percentage increase between April and November 2004 for items in the diagnostic bundle for heart failure and chronic obstructive pulmonary disease interventions

	Heart failure				Chronic obstructive pulmonary disease			
Bundles	**N[1]**	**Mean increase %**	**Range %**	**SE[2] %**	**N[1]**	**Mean increase %**	**Range %**	**SE[2] %**
Focused clinical history	10	21.5	(-20,78)	10.1	13	14.8	(-50,71)	9.3
Physical examination	8	29.4*	(0-71)	9.0	12	10.9	(-50,71)	11.3
Echocardiography	10	16.9	(-50,80)	14.9	-	-	-	-
Spirometry	-	-	-	-	15	15.2	(-40,92)	10.4

1 N of teams with April and November audits.
* Test at $p<0.05$ that the difference April to November is significantly greater than zero.
2 Standard error of mean

Run charts showing the trend across the months April to November for each item in the diagnostic bundle can be seen in Figure A5.1 in Appendix 5A for heart failure and in Figure A5.14 in Appendix 5B for chronic obstructive pulmonary disease. Inspection of the charts for heart failure reveals a fairly consistent linear increase for all three items in the diagnostic bundle, but this is less for chronic obstructive pulmonary disease. Results for a test of the statistical significance of these trends for heart failure care found highly significant improvement for undertaking a focused clinical history and physical examination, but not for echocardiography (Table 5.4). For chronic obstructive pulmonary disease only the use of spirometry increased significantly between April and November 2004 (Table 5.4).

Table 5.4 Average per cent change per month, April to November 2004, for individual items included in the diagnostic bundle for heart failure and chronic obstructive pulmonary disease

	Heart failure			chronic obstructive pulmonary disease		
Bundles	**N[1]**	**Change[2]**	**P[3]**	**N[1]**	**Change[2]**	**P[3]**
Focused clinical history	77	3.5	0.004	85	1.3	0.32
Physical examination	66	4.7	0.002	73	1.1	0.46
Echocardiography	76	2.6	0.11	-	-	-
Spirometry	-	-	-	99	2.8	0.05

1 N of audits for this item.
2 Average per cent change per month (the slope coefficient for the linear trend across the months April to November).
3 Significance of the change per month.

5.3.3 Results for the separate items in the management bundle for heart failure

The heart failure management bundle included 11 items for interventions by Collaborative teams (Table 5.5). The interventions in this bundle were for use, and auditing, in all three settings in the community, emergency department and at discharge from hospital. From Table 5.5 it can be seen that for almost every intervention in each of the settings there was an increase in the proportion of patients receiving the heart failure interventions. The only exceptions were the scheduling of a general practitioner review in the community, and the completion of baseline investigations in the emergency department. The means shown in Table 5.5 have large standard errors and for each item the range (not shown in the Table) includes negative values, that is some teams were less successful at the conclusion of the Collaborative than they were for the April baseline on some items. Every team, however, had gains for a majority of items included in their audit.

Table 5.5 Overall change between April and November 2004 for items in the management bundle for heart failure

	Community			Emergency department			Discharge		
Intervention	**N[1]**	**Mean %**	**SE[2] %**	**N[1]**	**Mean %**	**SE %**	**N[1]**	**Mean %**	**SE[2] %**
Baseline investigations	7	8.1	11.4	7	-16.1	21.1	11	17.8	12.6
ACE inhibitors	7	25.6	20.9	7	6.0	18.0	11	24.8	12.5
Beta-blocker	7	17.4	14.9	7	31.1*	11.5	11	30.3*	10.2
Dose titration	7	4.0	14.0	6	34.7	18.2	11	37.5*	11.0
Smoking cessation	5	47.0	20.2	6	22.5	18.4	10	54.0*	15.2
Self-management support	7	18.6	10.8	7	8.6	7.7	11	30.4*	12.8
Rehabilitation program	7	17.4	11.2	7	11.4	14.1	11	24.9	15.0
Schedule of GP review	7	-11.0	15.2	6	16.8	28.9	11	41.2*	12.5
Influenza immunisation	7	17.9	9.2	6	8.3	15.8	11	23.1	11.1
Pneumococcal immunisation	7	13.1	8.6	6	5.0	12.6	11	18.1	10.4
After hours contact	7	42.4	18.5	6	18.3	29.5	11	30.9	19.2
Advance care directives	3	13.3	13.3	3	-23.3	12.0	5	-9.6	9.6

1 N of teams with April and November audits.
2 Standard error of mean.
* Test at $p<0.05$ that the difference April to November is significantly greater than zero.

Run charts for each of the items in Table 5.5 are included in Appendix 5 (Figure A5.2 to A5.13) these illustrate notable successes for some items. Results of significance tests on the linear component of these trends are given in Table 5.6 together with the average per cent change per month. An example of a successful intervention is action on smoking cessation where there is an increase in the community setting ($p<0.01$) and at discharge ($p<0.001$) averaging between 6 per cent and 8 per cent for each month of the Collaborative. Prescription of a dose titration schedule was highly successful in the emergency department ($P<0.001$) and at discharge ($P<0.003$) as were provision of ACE inhibitors ($P<0.004$) and after hour contacts in the community setting ($P<0.001$).

Table 5.6 Average per cent change per month, April to November 2004, for items included in the management bundle for heart failure teams, in the community, emergency department and at discharge

	Community			Emergency department			Discharge		
Intervention	**N[1]**	**Change[2] %**	**P[3]**	**N[1]**	**Change[2] %**	**P[3]**	**N[1]**	**Change[2] %**	**P[3]**
Baseline investigations	55	1.69	0.16	54	-1.18	0.54	82	3.39	0.002
ACE inhibitors	55	4.97	0.004	54	1.28	0.45	82	2.91	0.01
Beta-blocker	55	0.01	0.99	54	3.91	0.02	82	2.78	0.04
Dose titration	54	2.13	0.32	49	5.00	0.001	81	4.49	0.003
Smoking cessation	49	6.48	0.01	48	3.57	0.19	74	7.53	0.001
Self-management support	54	1.50	0.51	54	1.43	0.22	83	3.39	0.07
Rehabilitation program	54	-0.70	0.78	54	1.02	0.51	82	2.11	0.27
Schedule of GP review	54	-1.08	0.59	48	0.93	0.72	81	3.61	0.004
Influenza immunisation	55	3.84	0.009	49	1.78	0.39	82	3.52	0.02
Pneumococcal immunisation	55	1.32	0.45	49	1.09	0.51	82	2.89	0.03
After hours contact	55	9.22	0.001	49	4.24	0.17	81	5.48	0.02
Advance care directives	44	-0.33	0.76	40	0.08	0.96	62	0.25	0.85

1 N of audits for this item.
2 Average per cent change per month (the slope coefficient for the linear trend across the months April to November).
3 Significance of the change per month.

5.3.4 Results for the separate items in the management bundle for chronic obstructive pulmonary disease

The chronic obstructive pulmonary disease management bundle included 11 items for interventions by Collaborative teams (Table 5.7). This bundle was used and audited in all three settings, in the community, in the emergency department and at discharge. From Table 5.7 it can be seen that for most interventions there is an increase in the proportion of patients receiving the intended improvements in their care. These increases are in general smaller than for the heart failure teams, particularly in the case of interventions in the emergency department. The reason for this was that baseline values were higher for chronic obstructive pulmonary disease interventions than was the case for heart failure, which restricted the amount of interventions increase possible. The means shown in Table 5.7 have large standard errors and for each item the range (not shown in the Table) included negative values, that is some teams were less successful at the conclusion of the project than they were for the April baseline on some items. The significant gains in the overall means, as shown in Table 5.7 were for inhaled steroid therapy in the emergency department, and for referral to a rehabilitation program and immunization (influenza and pneumococcal) at discharge.

Table 5.7 Overall change between April and November 2004 for items in the management bundle for chronic obstructive pulmonary disease

	Community			Emergency department			Discharge		
Intervention	N[1]	Mean %	SE[2] %	N[1]	Mean %	SE %	N[1]	Mean %	SE[2] %
Baseline investigations	11	-5.8	16.9	10	-7.0	16.9	10	7.2	11.6
Bronchodilators	10	17.3	8.8	9	-4.0	13.2	10	10.2	4.9
Inhaled steroid therapy	10	26.1*	8.5	8	-0.9	15.6	10	14.6	10.7
Home oxygen suitability	9	19.9	10.6	6	8.5	17.1	10	19.7	12.9
Smoking cessation	11	31.6	14.7	9	13.6	23.1	10	3.5	19.8
Self-management support	11	1.8	12.4	7	-3.6	1.8	10	-3.9	10.2
Rehabilitation program	10	23.5	13.6	7	11.6	9.5	10	35.7*	11.8
Schedule of GP review	11	31.5	13.7	7	-8.9	14.1	10	14.3	10.3
Influenza immunisation	11	7.5	10.2	8	12.8	9.2	10	30.4*	8.2
Pneumococcal immunisation	11	10.7	9.4	8	9.4	7.3	10	27.8*	8.2
After hours contact	11	17.9	12.4	7	4.7	18.1	10	27.6	15.6
Advance care directives	4	21.3	21.3	3	5.0	7.6	3	5.5	5.5

1 N of teams with April and November audits.
2 Standard error of mean.
• Test at $p<0.05$ that the difference April to November is significantly greater than zero.

Run charts showing progress with these items across the 8 months (April to November 2004) of the Collaborative were included in Appendix 5B (Figure A5.15 to Figure A5.26). When these are compared to similar charts for heart failure interventions it could be seen that mostly the baseline percentage (April) was higher leaving less room for improvement. Within this narrower range there were monthly ups and downs and the average monthly change was not significant. For example, for baseline investigations for chronic obstructive pulmonary disease completed in the community there was a gain of almost 20 per cent between April and August, but this was lost in September, mostly gained again in October, but lost and reduced to below baseline in November (Figure A5.15).

Results for significance testing of the charts included in Appendix 5B are given in Table 5.8. This Table shows the count of audits available for each management bundle intervention in each of the three settings. It lists for each of these interventions the mean change per month in the per cent of patients receiving the intervention together with probabilities for a test of the statistical significance of the increase or decrease. The only significant effects were for scheduling of general practitioner review in the community ($P<0.05$), referral to a rehabilitation program at discharge ($P<0.001$) and provision of after hour contact at discharge ($P<0.006$).

Table 5.8 Average per cent change per month, April to November 2004, for individual items in the chronic obstructive pulmonary disease collaborative management bundle in the community, emergency department and at discharge

	Community			Emergency department			Discharge		
Interventions	N[1]	Change[2] %	P<[3]	N[1]	Change[2] %	P<[3]	N[1]	Change[2] %	P<[3]
Baseline investigations	74	-0.52	0.77	79	-1.54	0.40	81	-0.82	0.50
Bronchodilators	67	0.86	0.44	72	-0.51	0.66	81	0.47	0.54
Inhaled steroid therapy	67	1.87	0.13	65	1.28	0.40	81	1.68	0.09
Home oxygen suitability	61	3.40	0.10	50	1.70	0.32	76	1.71	0.34
Smoking cessation	75	2.35	0.16	71	3.62	0.10	80	1.08	0.52
Self-management support	77	0.22	0.90	64	-0.31	0.86	76	1.03	0.55
Rehabilitation program	69	2.66	0.22	59	1.71	0.26	84	4.69	0.001
Schedule of GP review	74	2.64	0.05	53	-1.52	0.44	76	1.95	0.16
Influenza immunisation	78	1.08	0.49	66	-0.03	0.99	82	2.87	0.10
Pneumococcal immunisation	76	1.89	0.16	64	-0.28	0.87	82	3.28	0.07
After hours contact	77	2.18	0.09	56	1.03	0.69	74	5.85	0.006
Advance care directive	38	2.77	0.41	35	1.06	0.11	42	12.66	0.11

1 N of audits for item.
2 Average per cent change per month (the slope coefficient for the linear trend across the months April to November).
3 Significance of the change per month.

5.4 Summary

Following breakthrough series methodology, teams obtained feedback on their progress by monthly (sometimes bi-monthly) audits made in the community (for example, a general practice or allied health setting), in the emergency department or at discharge.

The team audits were sent to the Clinical Excellence Commission and were analysed for the present evaluation. Improvements were tested by fitting a linear trend across the 8 months of the Collaborative and calculating the significance of the mean change per month.

Heart failure

The following outlines the results from audits completed by teams focusing on heart failure during the Collaborative. These results show the effect of the Collaborative overall and not that of individual teams.

- Diagnostic bundle: for heart failure there were significant improvements between April and November 2004 for the use of the full bundle of diagnostic interventions in the community (P<0.001).
- Management bundle: for heart failure there were significant improvements between April and November 2004 for the use of the full bundle of management interventions in the community (P<0.02), at discharge (P<0.001) but not in the emergency department (P<0.10).

- Individual items in the heart failure diagnostic bundle (used in the community) which showed improvement were focused clinical history ($P<0.004$), physical examination ($P<0.002$) but not echocardiography ($P<0.11$).
- Many of the individual items in the heart failure management bundle showed a significant linear improvement across the months April to November 2004.
- In the community, there were significant improvements for ACE inhibitors ($P<0.004$), after hours contact ($P<0.001$), influenza immunization ($P<0.009$) and smoking cessation ($P<0.01$).
- In the emergency department there were significant improvements in the use of beta blockers ($P<0.02$) and dose titration ($P<0.001$).
- At discharge, there were significant results for baseline investigations ($P<0.002$), ACE inhibitors ($P<0.01$), dose titration ($P<0.003$), influenza immunisation ($P<0.02$), pneumococcal immunization ($P<0.03$), use of beta blockers ($P<0.01$), schedule of general practitioner review ($P<0.004$), after hours contact ($P<0.02$) and smoking cessation ($P<0.001$). Self-management support approached significance ($P<0.07$).
- For heart failure Collaborative teams referral to a rehabilitation program and implementation of the advance care directives were not significant in any setting.

Chronic obstructive pulmonary disease

The following outline results from the audits completed by Collaborative teams focusing on chronic obstructive pulmonary disease. These results show the effect of the Collaborative overall and not that of individual teams.

- Diagnostic bundle: for chronic obstructive pulmonary disease there were significant improvements between April and November 2004 for the use of the full bundle of diagnostic interventions in the community ($P<0.009$).
- Management bundle: for chronic obstructive pulmonary disease there were significant improvements between April and November 2004 for the use of the full bundle of management interventions in the community ($P<0.001$), at discharge ($P<0.001$), and in the emergency department ($P<0.001$).
- The only individual item in the chronic obstructive pulmonary disease diagnostic bundle which improved significantly was the use of spirometry ($P<0.05$) with focused clinical history ($P<0.32$) and physical examination ($P<0.46$) not significant.
- Teams were less successful with individual items in the chronic obstructive pulmonary disease management bundle than was the case for heart failure, with only schedule of a general practitioner review improving significantly in the community ($P<0.05$) and rehabilitation program ($P<0.001$) and after hours contact ($P<0.006$) improving significantly at discharge.
- From the data it could be seen that for chronic obstructive pulmonary disease levels of provision for some management bundle interventions were already high at baseline with less room for improvement than was the case for heart failure.

Advance care directives

- There were no significant improvements in the use of the advance care directives in the community ($P<0.76$), in the emergency department ($P<0.96$) or at discharge ($P<0.85$).

5.5 Discussion

Common sense needs to be employed when interpreting the results for the audit data pooled for all Collaborative teams. Firstly there was minimum control of data quality, and with the best will in the world teams will have used different methods when making the audits. Regular self-audits of progress by Collaborative teams is an essential component of the breakthrough series methodology. The focus group and interview data contain many comments by team members on the value to them of feedback from this source, but these audits cannot be necessarily brought together for an overall analysis. Different teams concentrated their efforts on different interventions. Local conditions, infrastructure, facilities, levels of support from outside the team have meant that for an overall evaluation the pooled data from all teams will have included many uncontrolled differences. At best one can say that despite these differences the run charts for the pooled data do show fairly consistent significant improvements for some interventions.

When interpreting the results presented in this section we suggest that a cautious reader will first look at the run charts to see if there appears to be an improvement over and above the monthly variation evident in many of the charts. The next step will be to look at the tests of significance on the linear component of the trend. A significant result will suggest that an improvement has taken place greater in extent than would be expected just from chance. In some cases there will be little room for improvement (for example, bronchodilators provided in the emergency department, or at discharge) and the linear trend across the months of the project will not be significant. In another case, there could be clinically meaningful increases in the early months, followed by a decline to the extent that again there is no possibility of a significant linear trend across the duration of the Collaborative (for example, home oxygen suitability reviewed in the emergency department). Or it could be that there is a very late start, with an improvement only in the final month with the average across the whole period being minimal (smoking session in the emergency department where negative effects can be seen in the early month followed by a steady increase in the later months).