

Learning in practice

Effect of a community oriented problem based learning curriculum on quality of primary care delivered by graduates: historical cohort comparison study

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Abstract

Objective To assess whether the transition from a traditional curriculum to a community oriented problem based learning curriculum at Sherbrooke University is associated with the expected improvements in preventive care and continuity of care without a decline in diagnosis and management of disease.

Design Historical cohort comparison study.

Setting Sherbrooke University and three traditional medical schools in Quebec, Canada.

Participants 751 doctors from four graduation cohorts (1988-91); three before the transition to community oriented problem based learning (n = 600) and one after the transition (n = 151).

Outcome measures Annual performance in preventive care (mammography screening rate), continuity of care, diagnosis (difference in prescribing rates for specific diseases and relief of symptoms), and management (prescribing rate for contraindicated drugs) assessed using provincial health databases for the first 4-7 years of practice.

Results After transition to a community oriented problem based learning curriculum, graduates of Sherbrooke University showed a statistically significant improvement in mammography screening rates (55 more women screened per 1000, 95% confidence interval 10.6 to 99.3) and continuity of care (3.3% more visits coordinated by the doctor, 0.9% to 5.8%) compared with graduates of a traditional medical curriculum. Indicators of diagnostic and management performance did not show the hypothesised decline. Sherbrooke graduates showed a significant fourfold increase in disease specific prescribing rates compared with prescribing for symptom relief after the transition.

Conclusion Transition to a community oriented problem based learning curriculum was associated with significant improvements in preventive care and continuity of care and an improvement in indicators of diagnostic performance.


Introduction


Medical education is reformed periodically, but the effect of new training strategies on the quality of care in clinical practice is often not fully assessed. In

1987 the University of Sherbrooke in Quebec, Canada, introduced a reform of medical education from a traditional system based on disciplinary based curriculum to a problem based learning curriculum.¹ The system focused on a new method of learning (problem based education, self directed, small groups), with greater emphasis on community practice rather than hospital practice (see bmj.com for details of the problem based curriculum). The new curriculum aimed to better prepare graduates to provide comprehensive preventive, acute, and chronic disease care. There are unresolved concerns that the curriculum may reduce core competencies in medical diagnosis and treatment.²⁻⁴ We assessed the performance of Sherbrooke graduates in selected indicators of diagnosis and disease management and in the quality of care delivered before and after the reform.

Methods

This is a longitudinal follow-up study of four classes of Sherbrooke graduates; three before the transition to a community oriented problem based learning curriculum (graduates of 1988-90) and one after the transition (graduates of 1991). We compared the performance before and after the transition with a control group of doctors trained in the same period in three medical schools with a traditional curriculum in Quebec. Eligible doctors completed postgraduate training in family medicine and were licensed to practise as a family doctor in Quebec between 1990 and 1993 (see bmj.com for details of examination). The follow-up period for each graduation cohort was between 1 July of the certification examination year and 31 December 1996, providing an assessment of practice for the first four to seven years.

 Additional references (w1-w30) and information are on bmj.com

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Practice activity and environment and performance indicators

We assessed practice using four, previously validated, health administrative databases.^{5,6} These databases provide details of the patients, services provided, treatment, and hospital episodes, including the cause of admission.

We obtained the number and type of practice settings, geographical distribution of the practice population (rural-remote, intermediate, urban; see bmj.com for regions), and workload (practice size, days worked, daily patient volume) for study doctors for each follow-up year.

To assess the hypothesised benefits of the reform we selected two performance indicators with an established link to health outcome.⁷ Mammography screening rate was used to assess preventive care, as doctors who screen for breast cancer are also more likely to carry out other preventive services.⁸ Continuity of care was chosen because of its importance in prevention and chronic disease management.⁹ We selected two additional performance indicators to test hypothesised negative effects of the transition on the quality of diagnosis and treatment. We selected the difference between disease specific prescribing rates and prescribing rates for symptom relief, because higher rates of disease specific prescribing compared with symptom relief prescribing¹⁰ have been linked to diagnostic competence,⁷ and because excess use of drugs for symptom relief is associated with potentially avoidable injuries (benzodiazepines) and gastrointestinal bleeding (non-steroidal anti-inflammatory drugs). We selected the prescribing rate for contraindicated drugs because prescribing errors account for 20% of drug related adverse events and these problems are partly related to deficiencies in doctors' knowledge.¹¹

Practice populations

We assessed mammography screening and continuity of care only in the primary care practice population. We assessed prescribing rates in ambulatory patients aged 65 years or more (older patients).

Mammography screening rate

Annual mammography screening rate was defined as the proportion of eligible women in the primary care practice who were referred for a bilateral mammogram by the doctor.⁷ See bmj.com for details.

Continuity of care

We defined annual continuity of care as the proportion of all visits that were made to the study doctor or gen-

erated by his or her referral among all visits made by his or her patients during the year.⁷ See bmj.com for details.

Prescribing rates

Disease specific and symptom relief prescribing rates—We used the drugs prescribed by the study doctor to all older patients to determine the annual difference between disease specific and symptom relief prescribing rates. Disease specific drugs were those that would rarely be prescribed without a disease being confirmed by investigation (for example, anticoagulants), and symptom relief drugs were those that relieve symptoms but have little effect on the disease process (for example, benzodiazepines), using the McGavock classification.¹⁰

Contraindicated prescribing rate—We defined the annual contraindicated prescribing rate as the proportion of ambulatory older patients prescribed a relatively contraindicated drug by the study doctor. Relatively contraindicated drugs were defined by an updated expert review as 30 drugs that should be avoided in older people because of possible toxic effects, and the availability of safer alternatives.¹²

Statistical analysis

We adjusted for differences in the case mix of the doctors' practice populations and for potential differences in practice experience (see bmj.com). See bmj.com for full details of the statistical analysis.

Results

Between 1988 and 1991, 2013 doctors completed undergraduate training in Quebec medical schools and 930 (46.2%) of these doctors entered postgraduate training in family medicine. Among these doctors, 813 (87.4%) were licensed to practise in Quebec (see table on bmj.com). Family medicine certification examination scores before and after the transition were similar.

Sherbrooke graduates had the highest mammography screening rate (mean 158 per 1000 *v* 94.6 to 114.0 per 1000 for the other schools) before the transition, significantly higher than Laval graduates (table 1). After the transition, Sherbrooke graduates showed a significant and substantial increase in mammography screening rate. A similar trend was observed for the three other schools, but this did not reach significance.

Continuity of care was similar among graduates from the different medical schools in the period before the transition, with the exception of significantly lower

Table 1 Association between medical school attended and quality of preventive care (mammography screening of women aged 50-69 per 1000 in primary care population) for doctors graduating before and after transition to a problem based learning curriculum in first 4-7 years of primary care practice (1990-6)

| Medical school | Before transition at Sherbrooke | | | After transition at Sherbrooke | | | Adjusted within school difference (95% CI) before and after transition | |
|----------------|---------------------------------|-------------------------------------|---------|--------------------------------|-------------------------------------|---------|--|---------|
| | Crude mean rate/1000 (SD) | Adjusted difference between schools | P value | Crude mean rate/1000 (SD) | Adjusted difference between schools | P value | | P value |
| Sherbrooke | 158.0 (146.7) | Reference | — | 204.6 (155.8) | Reference | — | 55.0 (10.6 to 99.3) | 0.01 |
| Laval | 104.6 (130.2) | -35.0 | 0.003 | 135.1 (131.0) | -70.9 | 0.002 | 17.5 (-13.4 to 48.3) | 0.27 |
| Montreal | 114.0 (141.2) | -16.7 | 0.14 | 117.9 (139.4) | -35.4 | 0.13 | 19.0 (-14.0 to 51.8) | 0.26 |
| McGill | 94.6 (110.2) | -13.0 | 0.41 | 104.7 (130.0) | -19.5 | 0.67 | 20.7 (-58.0 to 99.3) | 0.61 |

Annual measurements adjusted for characteristics of doctor (sex, certification examination score, cumulative months of practice) and characteristics of doctor's annual primary care practice population of women aged 50-69 (including age distribution, mean family income, and educational achievement of women aged 50-69 in same post code area), geographical access to mammography centres, propensity for use of healthcare services (ambulatory care groups, number of doctors seen), comorbidity, and rate of admissions to hospital in previous year. See bmj.com for additional information.

Table 2 Association between medical school attended and continuity of care for doctors graduating before and after transition to a problem based learning curriculum in first 4-7 years of primary care practice (1990-6)

| Medical school | Before transition at Sherbrooke | | | After transition at Sherbrooke | | | Adjusted within school difference (95% CI) before and after transition | |
|----------------|---------------------------------|-------------------------------------|---------|--------------------------------|-------------------------------------|---------|--|---------|
| | Crude mean %* (SD) | Adjusted difference between schools | P value | Crude mean %* (SD) | Adjusted difference between schools | P value | | P value |
| Sherbrooke | 30.9 (10.2) | Reference | — | 32.6 (13.2) | Reference | — | 3.3 (0.9 to 5.8) | 0.007 |
| Laval | 29.8 (11.1) | 0.4 | 0.57 | 30.6 (10.8) | -2.6 | 0.05 | 0.9 (-1.2 to 2.9) | 0.42 |
| Montreal | 26.2 (10.6) | -0.8 | 0.23 | 27.4 (11.6) | -2.3 | 0.08 | 0.8 (-1.1 to 2.7) | 0.40 |
| McGill | 23.2 (9.8) | -4.7 | <0.001 | 22.9 (9.3) | -4.6 | 0.10 | 2.6 (-2.3 to 7.6) | 0.30 |

Annual measurements adjusted for characteristics of doctor (see table 3) and characteristics of doctor's annual primary care practice population including age and sex distribution, mean family income, and educational achievement of adults in same post code area, geographical access to tertiary care centres, propensity for use of healthcare services (see table 3), comorbidity, and rate of admissions to hospital in previous year. See bmj.com for additional information.

*Mean percentage visits for patients to study doctor or referred to consultants in primary care practice population.

continuity of care for McGill graduates (table 2). After the transition, Sherbrooke graduates showed a statistically significant improvement in continuity of care. Although McGill graduates also showed substantive improvement in the period after the transition, the change in continuity of care was statistically non-significant, possibly due to fewer graduates.

In the period before the transition, McGill graduates prescribed disease specific drugs to 10.3 more patients per 1000 than symptom relief drugs, whereas Sherbrooke graduates prescribed fewer disease specific drugs than symptom relief drugs (see bmj.com). After the transition, however, Sherbrooke showed a fourfold greater improvement in the difference between the two rates than did McGill (32.2 *v* 8.0). The increase for Montreal graduates was also statistically significant although smaller than for Sherbrooke graduates. The difference in the magnitude of the pre-post reform changes between the schools was statistically non-significant.

Sherbrooke graduates had significantly higher rates of contraindicated prescribing in the period after the transition than did graduates from some of the other schools (see bmj.com). Contraindicated prescribing rates declined in the period after the transition, with the largest declines in Laval (11.8 per 1000). We found no evidence of any increase at Sherbrooke, where a non-significant decrease of 5.2 per 1000 was observed.

The point estimates of the interaction effect suggested that changes in most outcomes in the other schools were two to three times smaller than in Sherbrooke.

Discussion

The performance of graduates from Sherbrooke University improved significantly in all indicators of diagnosis and management analysed before and after the introduction of a community oriented problem based learning curriculum, but changes compared with graduates of a traditional curriculum were generally not significant. These may be due to the small number of graduates after the transition, and the low power of the study.

We did, however, find a significant improvement between Sherbrooke and Laval in the difference between disease specific and symptom relief prescribing rates, a marker of diagnostic ability.⁷

Although requirements for admission were not altered as part of the reform,¹ the particular attributes of the reform that may have generated the positive

changes in practice performance can not be readily disentangled for Sherbrooke, or for most other schools that have implemented innovations to their curriculum. That significant differences existed in outcomes of graduates of different medical schools in the period before the transition, even after adjustment for certification examination scores, suggests that school level factors beyond the formal curriculum influence subsequent practice activity. The greater emphasis on community oriented practice experience in the problem based learning curriculum may have contributed to improvements in continuity and preventive care of Sherbrooke graduates. To inform future policy for medical education, the effect of the clinical training environment on subsequent medical practice needs to be systematically investigated.¹³

In our study the performance of new graduates fell short of desirable outcomes. In particular, mammography screening was below the 70% coverage expected to reduce mortality from breast cancer.¹⁴ The variability in contraindicated rates between graduates from different medical schools suggests that basic training may be an additional factor that needs to be examined to improve future prescribing behaviour.

Our study has limitations. Using administrative databases we could assess only a subset of outcomes that would be of importance in judging the quality of

What is already known on this topic

Community oriented problem based learning has been implemented in many medical schools to improve the ability of graduates to deliver more comprehensive medical care

Concerns are that problem based learning may lead to gaps in knowledge and reduced core competencies in diagnosis and treatment

The impact of problem based learning on subsequent medical practice has not been assessed

What this study adds

Transition to community oriented problem based learning in one medical school was associated with improvement in comprehensive care without a decline in diagnosis and management

Doctors graduating from traditional medical schools within the same period did not exhibit the same improvement in performance

primary care. We excluded salaried doctors from the evaluation. Our evaluation of the effect of a community oriented problem based learning curriculum was limited to one school's experience and the first graduation class of that curriculum. Future research should assess whether transition to a problem based learning curriculum is associated with other expected changes in the quality of care, particularly in populations of patients where important gaps exist between optimal and current therapy, such as those with asthma or diabetes and those needing management for cardiovascular risk.¹⁵

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My biggest mistake

A lesson from a death

Neurocysticercosis is a major public health problem in many developing countries in Asia and has a profound impact on productivity, health, economy, and quality of life. It is endemic in Nepal and is the commonest parasitic infestation of the central nervous system, caused by larvae of the tapeworm *Taenia solium*. Neurological manifestations vary from a simple chronic headache to life threatening meningoencephalitis depending on the location and number of the parasites in the brain.

In August 2000, I came from Britain (free from neurocysticercosis) to join the Manipal Teaching Hospital as assistant professor of medicine. There was no consultant neurologist in the hospital at that time.

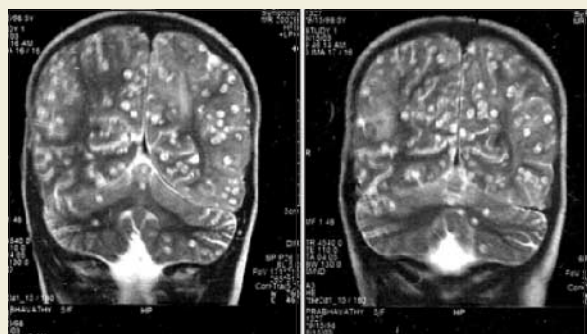
One night, when I was on call, I was asked to attend a patient at 1 am. He was a 41 year old former member of the Indian army, who had presented in a drowsy state and throwing generalized tonic-clonic seizure. He had been treated seven years previously for an intractable seizure and had a ventriculo-peritoneal shunt. He was taking phenytoin, prednisolone, and acetazolamide regularly.

General examination showed the patient was drowsy, and all four limbs were weak. Reflexes were brisk in limbs and jaw, and plantars were extensor. The patient also had multiple cranial nerve palsies, a gaze-evoked nystagmus, and papilloedema of the right optic nerve. Systemic examination was unremarkable. The usual laboratory tests were normal, as was the chest radiograph and electrocardiograph. Computed tomography of the brain with contrast revealed a "starry sky" appearance due to multiple cystic, ring enhancing, and calcified lesions throughout the brain. Massive and diffuse cerebral oedema was present, and the ventriculo-peritoneal shunt was in place. The findings were suggestive of generalised neurocysticercosis.

We treated the patient with albendazole, antiepileptic drugs, and measures to reduce cerebral oedema. However, the patient died two days later in the intensive care unit because of uncontrolled seizures.

After investigating the cause of his sudden death, I realised that I had probably made a mistake by giving him albendazole. His disseminated neurocysticercosis had caused an "encephalitis" with raised intracranial pressure and true and false localising signs. Albendazole can cause liberation of cytokines after lysis of active cysts that leads to rapid rise of intracranial pressure, resulting in herniation and intractable seizures.

I learnt, too late, that cysticidal drugs such as albendazole may be fatal and should be given only with the greatest care in cases of generalised neurocysticercosis with the characteristic "starry sky" appearance in computed tomography or magnetic resonance imaging (see figure).



Magnetic resonance imaging of the brain of a patient with multiple neurocysticercosis showing characteristic starry sky pattern (reproduced from Adhisivam B, Mahadevan B. Starry sky: multiple neurocysticercosis. *Arch Dis Child Educ Pract Ed* 2004;89:ep75 (<http://ep.bmjournals.com/cgi/content/full/89/3/ep75>))

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