

An Environmental Scan of

Best Practices in Public Health Undergraduate Medical Education

REPORT 1:

Peer-Reviewed Literature Scan

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1. INTRODUCTION

This report covers the recent peer-reviewed literature relevant to best practices in undergraduate medical education. Any literature review is at risk of encountering publication bias: published articles do not necessarily represent the most successful educational approaches—they may simply reflect the cultures of the various medical schools, or the teaching loads of faculty members. The most valuable articles will provide evaluation of the success of teaching approaches, but this raises the difficult question of appropriate outcome measures. Student satisfaction is easy to measure, but it is certainly not the whole story. Examination results are better, but are not necessarily related to performance in practice. Selection of public health electives would be better. Performance in practice would be by far the more useful, but long delayed (perhaps to the extent that the educational approaches that were being evaluated have already changed) and very difficult to measure. Choice of specialty is also highly relevant, but is not an important objective of undergraduate teaching and is also long delayed.

A recurring problem in undertaking this work is the definition of public health. While most public health practitioners and educators would probably subscribe to the standard definition that refers to organized efforts of society, most of the literature regarding undergraduate medical education is concerned with clinical preventive medicine. While many of the concepts and methods of the clinical and population streams are similar, their orientations are quite different. A clinical focus seems quite appropriate for a medical school, but it must also sensitize students to the role and contribution of public health, and induce a certain proportion of students to enter that field. So an article that deals only with the clinical aspects of prevention can only be considered partially relevant. For this report, the most appropriate approach would be that of the Population Health Learning Objectives proposed by the AFMC Public Health Educators' Network, and the search covers that territory fairly well. But consistent with the Request for Proposals for this project, the term "Public Health" is used throughout this document to include population health, community health, preventive medicine, social medicine, etc.

2. METHODS

The following Medline search was conducted for the years 1996-present:

- 1 (“public health” or “population health” or “preventive medicine” or “community medicine” or “social medicine” or “community health” or “epidemiology”).mp. [mp=title, original title, abstract, name of substance word, subject heading word] (126676)
- 2 (“education, medical, undergraduate” or “clinical clerkship” or “students, medical”).mp. [mp=title, original title, abstract, name of substance word, subject heading word] (11717)
- 3 1 and 2 (613)
- 4 from 3 keep ... (151 selected on the basis of titles of the articles)
- 5 from 4 keep ... (72 selected on the basis of the abstracts, where available)

Several of the selected articles were eventually discarded as irrelevant, and a few additional articles were identified from citations in the selected articles and from general knowledge. We ended with 70 references.

We intended to emphasize articles that made specific reference to public and population health (as distinct from clinical practice), and that provided at least some evaluation, but ended up scrapping the latter condition (in the interests of retaining enough articles to constitute a decent review). A considerable proportion of the articles were hortatory, simply pointing to the need for greater emphasis on public health education; these were excluded. Inclusion of “preventive medicine” in the search yielded many articles that proved to be mainly related to clinical practice; these were retained if there was any mention of population health or its activities. The full text of the remaining articles was then reviewed, where available, and other articles added that were recommended in the reviewed articles or by colleagues. The Tables of Contents of all issues of *Academic Medicine* from 2003-08 inclusive and of *Medical Education* from 2006-08 inclusive were then reviewed to determine if any relevant articles had been missed, and only one such article was found. Accordingly, this time-consuming search was not pursued further. An attempt has been made to draw attention to the successful educational approaches by presenting the relevant assessment section in **bold**, although it may be inappropriate to count isolated demonstrations of student satisfaction as indicators of success. Nearly all the articles used are summarized in the accompanying Table.

3. RESULTS

3.1 EDUCATIONAL METHODS

A. Background

Many of the articles mentioned in this review were prompted by major reports on public health education in the USA and the UK.

B. Developments in the USA

In the USA, the far-reaching GPEP report, “Physicians for the Twenty-first Century: Report of the Project Panel on the General Professional Education of the Physician and College Preparation for Medicine”, was published in 1984 by the Association of American Medical Colleges (AAMC)¹. While stressing the importance of teaching students how to help both patients and communities “prevent or ameliorate disease,” the report also promoted organizational issues such as interdisciplinary teaching, integration of basic science and clinical education, and centralization of responsibility for the medical school curriculum. For example, the 1994 AAMC report “Academic Medicine and Health Care Reform”² contained the specific charge to medical educators to “make more explicit and visible in the curriculum an emphasis on prevention, public health, and community medicine.” Perhaps reflecting this growing prevention-oriented trend, a 1993 survey³ of chairs of departments of preventive medicine reported a steady increase in the number of departmental teaching hours over the previous five years. However, along with this optimism, concerns were also being voiced by preventive medicine educators and administrators who regarded this GPEP report-instigated curricular trend more cautiously. These concerns were primarily centred around the fear that the implementation of interdisciplinary, centrally administered courses would result in a weakening of content and teaching expertise as well as a loss of departmental power and control. Some of this happened.

Meanwhile the Office of Disease Prevention and Health Promotion led the Healthy People initiative, which set health objectives for the nation. Objective 1–7 in *Healthy People 2000* read: “Increase the proportion of schools of medicine, schools of nursing, and other health professional training schools whose basic curriculum for health care providers includes the core competencies in health promotion and disease prevention”.

Subsequent developments were described in a 2000 Supplement to *Academic Medicine* that comprised 15 articles on “Teaching Prevention Throughout the Curriculum: Multidisciplinary perspectives on enhancing disease prevention and health promotion in undergraduate education”. An article by Pomrehn *et al*⁴ gives the context for teaching preventive medicine and presents core competencies, as defined by the Bureau of Health Professions of the Health Resources and Services Administration and the Association of Teachers of Preventive Medicine, building on a earlier study⁵.

McClary *et al*⁶ conducted a repeat survey of undergraduate medical education in preventive medicine in 1999, to examine the changes in preventive medicine context, content, and allotted hours that had occurred in the transition from the traditional Flexnerian curriculum to the more interdisciplinary, centrally controlled curriculum. Data on medical school curricula for 1990–91, 1993–94, 1995–96, and 1998–99 were examined for the 126 U.S. and 16 Canadian medical schools. By 1998–99, 35 schools moving to the new interdisciplinary format had retained preventive medicine teaching as a separate course, although the courses usually had incorporated topics that went beyond the traditional ones. In another 35 schools, preventive medicine hours had been lost in the transition; but in 25 of these new courses it was clear that preventive medicine played a very significant role. It was assumed that the lost hours were more than replaced as preventive medicine concepts permeated these courses. Of greatest importance were the hallmark courses of the six nontraditional curricula that had designated preventive medicine as a major-theme course. However, at ten schools, preventive medicine listings disappeared in the move to nontraditional curricula.

Assessment: This article cannot show very recent developments, but does show many of the changes made after the big move to integration.

Later in the Supplement, Dismuke and McClary⁷ outline a four-part plan for a four-year curriculum in preventive medicine: develop the desired objectives or competencies; present the basics in years one and two of the curriculum; in years three and four make health promotion/disease prevention (HPDP) and the population perspective relevant to the practice of medicine; and finally, develop a mechanism to track the curriculum and then improve it.

Assessment: This article would be useful for any medical school that is developing or revising their curriculum in public health. Other articles from the Supplement will be referred to later.

The Clinical Prevention and Population Health Curriculum Framework was the initial product of the Healthy People Curriculum Task Force convened by the Association of Teachers of Preventive Medicine and the Association of Academic Health Centers (Allan *et al*⁸). The Task Force included representatives of allopathic and osteopathic medicine, nursing and nurse practitioners, dentistry, pharmacy, and physician assistants. It also aimed to accomplish the Healthy People 2010 goal of increasing the prevention content of clinical education for many health professions. The Curriculum Framework provides a structure for organizing curriculum, monitoring curriculum, and communicating within and among professions. The Framework contains four components: evidence base for practice, clinical preventive services and health promotion, health systems and health policy, and community aspects of practice. The full Framework includes 19 domains, several of which are directly relevant to public health: health surveillance, screening, immunization, methods of assessing community health needs, media communication, environmental health. The title “Clinical Prevention and Population Health” was chosen to include both individual- and population-oriented prevention efforts.

Assessment: Like the previous publication, the Framework should be of value to any North American medical school undertaking design of a new curriculum, or revision of an existing one.

C. Developments in the UK

The General Medical Council's (GMC's) blueprint for medical training, "Tomorrow's Doctors"⁹, helped to entrench the position of public health and related disciplines in undergraduate curricula. A White Paper¹⁰ on public health issued by the Department of Health served to emphasize further the importance of training in this area. In a study reminiscent of the present project, Gillam and Bagade¹¹ surveyed the public health program directors in UK medical schools in 2003. They found a great deal of variability between schools in teaching methods and resources used. In 76% of UK medical schools, public health and clinical teaching were integrated to some extent. The proportion of teaching delivered as lectures was decreasing and that of self-directed learning was increasing. A range of methods was used to assess students and in only 33% of schools did these assessments contribute to final Medical School marks. More than half the medical schools had difficulty finding teachers, and staffing levels had deteriorated in 55% of schools. Many interviewees felt that their contributions were undervalued. Few were aware of the level of funding received to support teaching. The authors concluded that there is a need to increase the supply of well-trained and motivated teachers and combine the best traditional teaching methods with more innovative, problem-based approaches. Faculties need to share “learning about what works” and teaching resources across medical schools, as well as address a culture of neglect of teaching in some

departments. The authors offered several suggestions as to how undergraduate public health teaching can be strengthened:

- Shared consensus on what constitutes the “public health syllabus” at this level (which did not exist in the UK at the time)
- Further evaluation of problem-based public health learning and attempts to integrate it with clinical teaching
- More sharing of teaching materials and experience
- Ensuring that epidemiology and public health are examined at final examinations
- Induction and continuing developmental support for teachers
- Appropriate recognition and incentivisation of teaching activities within academic departments.

Assessment: All of these points resonate in the Canada of 2008 and in the context of the present project.

D. Learning Styles

Piane *et al*¹² studied the learning style preferences of public health students, using Kolb’s classification of four distinct learning styles: Convergers, Divergers, Assimilators, and Accommodators. Learning styles of the students sampled were neither predominantly of one learning style nor evenly distributed. Learning style preferences did not vary significantly according to gender, occupation, or public health program. Learning styles also did not predict the students’ choice of oral presentation or written exam. The course that was studied primarily used lectures, which cater to the needs of Assimilators, who depend on the teacher to give them facts. Not surprisingly, Assimilators scored significantly higher than the other three learning styles on the theoretical exam and in their course grade. The authors suggested that public health instructors employ a variety of teaching methods and evaluative opportunities when class composition is initially assessed as having diverse learning styles. This “instructional pluralism” is necessary to facilitate learning, maximize participation, and permit multiple pathways for students to demonstrate educational performance.

Assessment: It seems likely that similar variability exists among medical students (although not necessarily in the same distribution), so these findings and conclusion may be relevant to designing curricula and choosing teaching methods. Variety is good.

E. Integration

Integration can be horizontal (across disciplines) or vertical (between preclinical and clinical studies). The vertical variety now seems well accepted in virtually all medical schools, albeit to varying degrees. The horizontal variety appears to be more difficult, and is the main focus here.

Public health teaching has traditionally been quite separate from the rest of the medical curriculum, and is often regarded by students as peripheral—and not really medical. Contributing to this separation is its emphasis on populations (instead of the individuals whom students entered medical school to learn to treat), the different educational backgrounds of its faculty from that of clinicians, and the fact that much of public health is indeed not "medical". Woodward¹³ has presented the arguments for both sides of this debate. Against the teaching of public health in medical schools: "There are two reasons why public health has no place in the undergraduate medical course: it is an unrewarding and inefficient use of scarce resources, and public health does not need medicine—indeed medical education is largely irrelevant to the most important tasks of public health...". And on the affirmative side: "There are two simple, symmetrical and unassailable arguments in favour of public health within the medical curriculum: medicine needs public health, and public health cannot function without clinical medicine". Both educational and regulatory authorities (and Woodward) appear to have declared for the affirmative side, and the question is now how to do this most successfully. Pretty well everyone argues that the answer is horizontal integration of public health teaching with the "mainstream" curriculum.

Integration of preventive medicine into the mainstream curriculum was given the ultimate seal of approval when it became the first theme of the New Pathway in General Medical Education at Harvard medical school (Taylor and Moore¹⁴). This comprehensive model involved both the didactic teaching of prevention and the inclusion of prevention-related material within the context of clinical activities. Teaching of health promotion and disease prevention was integrated within several major courses throughout the medical school's curriculum, and complemented a course in preventive medicine and nutrition taken by students during their second year. During the third and fourth years, health promotion, disease prevention, and community-based prevention were integrated into clinical activities of the clerkships, especially those encompassing the care of ambulatory patients. The authors argue that such an

integrated approach is not only educationally sound but also does not require the allocation of additional curriculum time, which may facilitate its acceptance by the faculty. However, an integrated approach requires significant effort to track specific activities in a longitudinal fashion using a matrix design to ensure appropriate coverage of such topics. An inventory of prevention-related topics included in various courses and clerkships needs to be maintained to ensure appropriate emphasis, overlap, and integration.

Assessment: The original design had the nifty attribute of doing Primary Prevention in Year 1, Secondary Prevention in Year 2, and Tertiary Prevention in Years 3 and 4 (Quaternary Prevention being as yet undeveloped). It is an elegant and comprehensive approach, and has influenced many other schools.

A leading proponent of integration, Stone¹⁵ argued that integration can expand students' awareness of the complementary orientations of population and clinical practice, enhance clinical skills by enabling them to apply epidemiologic and public health insights to clinical practice, and contribute to a positive attitude towards incorporating social, environmental and political perspectives into clinical practice. Community clinics, health centres and family physicians' offices are obvious settings to demonstrate this integration, because of the number of patients, variety of problems and emphasis on prevention. He presented a theoretical framework for integrated teaching of public health and clinical practice, with stages of the natural history of disease (prevention, diagnosis, treatment and follow-up) on the vertical dimension and four key public health dimensions (epidemiology, behaviour, environment and services) on the horizontal scale. The matrix could be used to locate the content of teaching, stimulate thinking about interdisciplinary boundaries, and identify gaps in teaching.

Assessment: **This is an excellent statement of the arguments for integration of public health teaching with the "mainstream" curriculum. And the matrix should indeed live up to the claims made for it.**

Trevena *et al*¹⁶ describe a toolkit that can be used by students and faculty to integrate, apply and assess the principles and practice of clinical prevention and population health within a health curriculum. It illustrates how the University of Sydney Medical Program's (USydMP) population health goals and learning outcomes are implemented via this toolkit and also maps the toolkit against the components and domains of the Clinical Prevention and Population Health Framework. To progress through their program and to graduate, students must achieve competence in four themes: Basic and Clinical Sciences (BCS), core science and clinical disciplines; Patient and Doctor (Pt-Dr), bedside skills in history and clinical examination;

Community and Doctor Theme (CDT), population health; and Personal and Professional Development (PPD), ethics, attitudes, group process, and evidence-based medicine. Like others, the authors have found it challenging to bridge the gap between individual- and population-level health care. To overcome this, they developed an eight-part checklist of questions that form the basis of their entire curriculum and form a simple mental prompt for considering any health problem from a population perspective. They relate directly to the theme goals, and are known among their students as “The Eight Essential CDT Questions”. They deal with: (1) distribution of the problem; (2) its cause; (3) its prevention; (4) its management; (5) the evidence base; (6) personal effects of having the problem; (7) societal effects of the problem and its management; and (8) societal response to the problem. Despite the utility of the eight-question toolkit, they found that students needed more specific learning outcomes in order to understand the meaning of these question areas, so specific sub-questions were formulated for each area.

Assessment: A very practical approach that ought to help us integrate population health principles into clinical curricula. At the time of publication, it was too soon to examine its success.

Whelan and Black¹⁷ describe the new curriculum in New South Wales, Australia. The medicine program was designed with three phases and with clinical experiences introduced early in the program. The approach was to trigger learning with scenarios and with vertical integration to reinforce lifelong learning. Four life cycle domains and three content streams (biomedical science, social aspects, medical practice) with public health teaching and understanding were integrated into all components. As the program was only in its 4th year at the time of publication, there had been no summative evaluation of the impact of this approach. However, formative evaluation through Phase 1 found that student portfolios demonstrated a good understanding of public health concepts in the satisfactory way students have addressed one of the eight graduate capabilities: Social and Cultural Aspects of Health and Disease (subdivided into Social Determinants of Health, Measuring Health Status, Health Care Systems, and Improving Health through Social Approaches). Another indicator of an appreciation of public health issues in medicine was the choice of social and cultural topics in students' independent learning projects. Summative evaluation was to occur when the University's new program graduates work in the existing health care system.

Assessment: This is a useful description of implementation of an integrated curriculum, and it reports some promising empirical outcomes. But what we really need is that summative evaluation.

F. Role of Family Medicine

Stine *et al*¹⁸ note that departments of family medicine—including departments of family and community medicine, departments of family and preventive medicine, and departments of family practice—at U.S. medical schools regularly participate in teaching prevention principles to students, using a variety of formats and methods. Required clinical experiences (i.e., clerkships and preceptorships), required nonclinical courses, and electives frequently include prevention content. Collaborative interdisciplinary clerkships, interdisciplinary nonclinical courses, and courses directed by other departments also enable family medicine faculty to teach prevention principles. The article describes examples of innovative educational programs in which family medicine faculty teach prevention content to medical students. Some base their clinical teaching prevention teaching on recommendations of the US Preventive Services Task Force, while some use standardized patients or families. The authors argue that medical schools must reconnect with the health needs of people and form alliances with community groups and programs that focus on prevention.

Assessment: The focus of the article is almost entirely on clinical prevention, for which it offers plenty of good ideas. But it makes little mention of a population health approach.

G. Contribution of Clinical Epidemiology

Stone¹⁹ examined the clinical epidemiology ward round (CEWR) as an educational tool for integrating the teaching of epidemiology with clinical paediatrics. It aimed to facilitate the acquisition of the knowledge, skills and attitudes that promote the effective application of epidemiological insights into routine clinical practice. The paper described experience of the CEWR in a UK medical school and initial student responses to it. Since 1995, the CEWR has formed an integral part of the clinical teaching given to all final phase medical students during their eight-week child health course at the University of Glasgow. It took place in a general paediatric ward of the Royal Hospital for Sick Children, Glasgow. Groups of up to seven students were taught by a clinical epidemiologist with a strong research interest, as well as clinical experience, in child health. Each round lasted approximately 90 minutes and the teaching style was informal and interactive. At the end of the child health course, students were asked a series of questions relating to the CEWR's educational objectives. The evaluation indicated that the CEWR had been well received by students, 85 per cent of whom said it was an excellent or good idea in principle, and 71 per cent of whom said it worked well in practice. However, most students seemed unconvinced about its role in reinforcing epidemiological knowledge or in clinical skill development. The author concluded that the CEWR requires

further development but offers a potentially inexpensive, effective and enjoyable vehicle for integrating the teaching of two previously separate components of the curriculum.

Assessment: Like so many of the articles, this has a mainly clinical focus, although it mentions prevention and public health in passing. It will certainly enhance the clinical care provided by the future doctors through its emphasis on such clinical epidemiology topics as Evidence-Based Medicine, but seems unlikely to interest them in public health careers.

H. Need for Faculty Development

Sachdeva²⁰ acknowledges that comprehensive coverage of prevention-related topics in the curricula of medical schools is important for the training of future physicians, but notes that the changes needed in educational programs to include such topics are likely to challenge many institutions. Faculty members are central to the successful adoption of any new curricular paradigm, yet many of the impediments to change are also likely to be found within the faculty ranks.

Achieving major curricular change requires institution leaders to define a new vision and allocate sufficient resources to support faculty efforts. Appropriate steps should be taken to actively involve the faculty early in the process of change and to recruit stakeholders from within the faculty ranks to play prominent roles. The educational models should be based on educationally and scientifically sound underpinnings that will facilitate acceptance of the models by the faculty, and faculty members must be offered appropriate opportunities to develop the skills to successfully implement the models.

The most expedient approach to incorporating prevention-related objectives across all years of the curriculum is to build them into a global curricular renewal or reform process of the school. The author cites the experience at the University of Rochester School of Medicine as an example of how this can be undertaken. A significant effort directed at the integration of prevention-related topics across all four years of the curriculum was launched in the fall of 1999. This is part of the school's curricular reform process mandated by the dean and the policy-setting Medical School Advisory Committee and is being implemented under the aegis of the Curriculum Steering Committee, which represents institutional, not departmental, interests and goals.

The core educational approaches include a commitment to integrate several crosscutting themes, including prevention, across all four years of the curriculum. The prevention theme, led by a designated faculty member and guided by the Association of Teachers of Preventive

Medicine's Inventory of Core Competencies, is being actively incorporated into problem-based learning cases, organ-system pathology modules, interdisciplinary conferences, primary care preceptorships, and community health projects.

Sachdeva continues that a school-wide faculty development program should address organizational development, instructional development, and personal development. The expertise needed to design and implement these activities may be secured from within or outside the institution. Individuals who have played key roles in the curricular change process must be rewarded and given appropriate recognition for their contributions. These steps will help in the successful integration of prevention-related topics into the curriculum, which will add a much-needed dimension, resulting in students being better prepared to address the needs of their patients and the community.

Assessment: There is no doubt that enhancement of faculty members' expertise in public health (along with some work on their attitudes) is crucial to integrating public health into a total curriculum. The article presents very reasonable and practical advice for curricular reform, but no empirical results are presented.

I. Community-Oriented Medical Education

It has been widely argued that medical education should take place in the community and should be oriented towards the population's health care needs. This should provide students with a population perspective, and should instil an enthusiasm for prevention and an appreciation for community services, including public health services²¹.

Rolfe *et al*²² compared the attitudes towards community medicine of first and final year students from two Australian medical schools: Newcastle (a problem-based, community-oriented curriculum) and Adelaide (a more traditional lecture-based curriculum), using the Attitudes to Community Medicine questionnaire, which measures attitudes to community-oriented health care, identification of health care needs, holistic care, prevention, collaboration, evaluation of health care and overall attitude. "Community Medicine" appears to mean community-oriented family practice in this context, not public health. Students selected into both medical schools were found to have positive attitudes with respect to most aspects of community medicine. However, those entering Newcastle had more positive attitudes toward community medicine overall than their Adelaide counterparts. They also scored more positively on subscales relating to holistic care and evaluation of health care interventions. Students who were older and female scored more positively on some subscales, but correction for age and gender did

not change the conclusions about medical school differences. Final year students (from an earlier cohort) at Newcastle also had more positive attitudes than those at Adelaide.

Assessment: This study confirms the ancient wisdom that what you put into an educational system largely determines what you get out. It would have been most helpful to see how attitudes changed by the time that students graduated.

Howe *et al*²³ addressed the situation in the United Kingdom. The modernising agenda of the NHS and recommendations of professional bodies demand that all doctors achieve a basic understanding of a population health perspective. The principle of integrated learning and the logistics of its provision make it inappropriate for such learning to be delivered solely by public health specialists; community-based learning has been promoted as the best setting in which to assist this objective. However, there is little evidence from practice as to whether non-specialist staff are willing or able to play a role in orienting tomorrow's doctors to the needs of communities.

These investigators used semi-structured interviews, questionnaires and focus groups to canvass the opinion of key stakeholders (staff of health authorities and community trusts, primary care group members, GP tutors, and social and voluntary agencies) on their preferred contributions to community-oriented undergraduate medical education. Framework analysis was used to elicit key outcomes and process factors. There was consensus that community-based learning should be a core element of the medical curriculum, as it can demonstrate the socio-environmental context of care and the doctor's role in interagency working and preventive care. But stakeholders saw themselves as being on the very margins of curriculum planning, and minimally involved in teaching. They had much more to offer and they wanted to offer it. Students were less enthusiastic, seeing the community topics as less relevant (e.g., to exams) than the "real medical" material.

Effective academic/NHS partnerships were called for, with higher education leading the agenda on aims and objectives, creating collaborative structures and reallocating resources to support new learning. Community-based stakeholders would offer the translation of theory into practice by demonstrating clinical and social diversity, models of team-working, and a context for the application of prior learning. These respondents also promoted recurrent contact with communities, and suggested an enhanced role in mentoring students through longer term relationships.

Perhaps the most important curriculum design implication is that the cohort developed an argument for prolonged recurrent relationships for students within communities, rather than the conventional model of cross sectional or intermittent course-specific links. The authors point out that community-based personnel and NHS users are an under-used resource for medical education. Their proposed contributions strongly accord with the agenda for a population health perspective in basic training. Curriculum planners need to make long-term partnerships with community-based agencies, rather than using them as an intermittent provider of limited learning sessions with narrowly defined objectives.

They cite examples of curricular innovation which create learning opportunities for students to gain competencies in population health care through community-based medical education: clinical epidemiology ward rounds (see article by Stone), a community diagnosis exercise (see article by Davison), multi-agency courses using voluntary and specialist community health resources (see article by Wasylenki) and direct service involvement of students in population care.

Assessment: Very likely similar findings would be found in Canada, although the staff of such community agencies are increasingly stretched (as they are in the UK). The lack of student enthusiasm would also be found here, and indicates that we have a big marketing job on our hands. The authors' proposals for partnerships are somewhat reminiscent of Ontario's former Teaching Health Units.

Davison *et al*²⁴ describe an exercise in community diagnosis at the University of Glasgow, based on the premise that medical education should become more community-oriented and that a student-centred approach encourages students to learn by intellectual discovery and critical thinking. The first of the three teaching sessions explores the strengths and weaknesses of routine statistics, and reveals the lack of information regarding individuals' and communities' health and health care needs. The second session is a community-based rapid participatory appraisal arranged by general practitioners: students interview patients, care providers, and local key informants and health care professionals about their perceptions of health and health needs. In the final campus-based session, students combine and present their findings. Medical students valued the contrasting perspectives and information provided by different sources, and were able to identify strengths and weaknesses of each. After completing the three sessions, most students and tutors considered it an interesting, enjoyable and educational experience. This innovative community-oriented teaching programme gave students some insight into how health, morbidity and mortality are measured, why these might vary between different communities, and how different community members' perspectives might

differ regarding perceived health and social needs.

Assessment: It can be difficult to interest students in community diagnosis, especially in the use of existing population health data, but this course offered the opportunity to contrast published with interview data, and seemed to catch the students' interest. Worth exploring.

Wasylenki *et al*²⁵ describe the University of Toronto's Health, Illness and the Community course. After no faculty member could be found to direct the course, a full-time administrator was hired to manage it. It was initially based in the Home Care program and was presented in years 1 and 2 of the curriculum. Pairs of students accompanied healthcare providers for a day, but this involved too much travel. Public health agencies were then added, and the course divided into three components: Health Care in the Community (year 1), Promoting Health in the Community (year 2) and Achieving Health in the Community (year 3).

Assessment: An astonishing accomplishment, considering the huge size of the class. This course has lasted a long time, and has been in continual evolution. Its current version is described in our companion report of interviews with university representatives.

Unverzagt *et al*²⁶ described a population health curriculum using methodologies from community-oriented primary care (COPC), developed in 1994 as part of a required third-year family medicine clerkship at the University of New Mexico. The curriculum integrates population health/community medicine projects and problem-based tutorials into a community-based, ambulatory clinical experience. By combining a required population health experience with relevant clinical training, student careers have the opportunity to be influenced during the critical third year. Results over a 7-year period describe a three-phase evolution of the curriculum, within the context of changes in medical education and in health care delivery systems in that same period of time. Early evaluation revealed that students viewed the curricular experience as time-consuming and peripheral to their training. Later comments on the revised curriculum showed a higher regard for the experience, which they now described as important for student learning. The authors concluded that: (1) The COPC model, when used as the basis for clerkship activity in population health, was difficult for students to fully implement in the short duration of a clerkship; (2) Defining and harnessing institutional assets can facilitate curriculum success; (3) Designating faculty with expertise and interest in community medicine and population health to develop projects and mentor students is essential for the provision of valuable learning experiences for students and for meaningful change to arise from project

activities; (4) Paying attention to a variety of mechanisms for feedback is essential to responding to students' evaluations of their experience; and (5) Measuring the long-term effect of the curriculum is difficult but should be undertaken.

Assessment: This article contains many useful lessons and recommendations for anyone who is setting up a community-oriented curriculum. Few outcomes are presented, beyond student satisfaction.

Dowell *et al*²⁷ describe the development of an educational attachment to remote predominantly Maori rural communities in New Zealand. They point out that cultural factors in health and illness, and an awareness of community health needs analysis, are important issues for medical education. Both have received relatively little recognition in the medical education literature. The twin purposes of the programme were to encourage students to adopt broad public health approaches in assessing the health needs of defined communities, and to increase their awareness of the importance of cultural issues. During a one week attachment, 51 students from the Wellington School of Medicine were hosted in six small communities in the East Cape region of New Zealand.

Students gained an insight into the health needs of the communities and were encouraged to challenge their own attitudes, assumptions and thinking regarding the determinants of health and the importance of cultural factors in health and illness. The programme included both health needs assessment and cultural immersion. Students made visits with primary health care professionals and were also introduced to Maori history and cultural protocol, and participated in diverse activities ranging from the preparation of traditional medicines to performing their own songs in concert. The students evaluated the course extremely highly. Attachments of this sort provide an opportunity for students to appreciate how cultural values have an impact on health care, and how they also make the teaching and learning of topics such as community health needs analysis an enjoyable and dynamic experience.

Assessment: This paper has very obvious relevance to Canadian aboriginals, and provides very useful ideas for medical schools that want (as they should) to enlighten their students on cultural issues.

Lyman *et al*²⁸ [full text not found] introduced the use of an academic data warehouse of encrypted patient information into an existing 2nd year medical school course. Exercises were developed requiring students to retrieve and interpret information regarding local disease prevalence, practice patterns, and patient characteristics. These exercises were integrated into

existing weekly problem sets, in a multiple-choice format. Faculty and student perceptions were assessed with surveys, and augmented with interviews of student volunteers, and database usage statistics. Their results indicated widespread agreement among both students and faculty that population-based medicine warrants inclusion in undergraduate medical education. The majority of the students felt the exercises complemented the clinical cases around which they were structured. There was less agreement, however, that the exercises were valuable, with several students suggesting a more open-ended, discussion-oriented approach. It was clear that faculty perceptions had a significant impact on student reactions.

Assessment: This article is reminiscent of the work of the Health Intelligence Units that formerly existed in Ontario (where at least one attempt to involve that work in undergraduate medical education met with the same lack of student enthusiasm). More evidence of the marketing job that faces us!

J. Problem-based Learning (PBL)

Problem-based learning presents small groups of students with clinical scenarios and invites them, assisted by a non-expert tutor, to formulate questions arising from the scenarios and then find answers to those questions. It has been widely introduced into medical education, largely under the leadership of McMaster University, but at present its critics appear to dominate the literature. PBL is claimed to be soundly theoretically based, but three reviews in 1993^{29 30 31} failed to find convincing educational benefits. Colliver³² reviewed the more recent literature and found no convincing evidence that PBL improves knowledge base and clinical performance, at least not of the magnitude that would be expected, given the resources required for a PBL curriculum. After considering the educational theory that underlies PBL and its basic research, he concluded that the ties between educational theory and research (both basic and applied) are loose at best. Shanley³³ argues that its reliance on small-group work with tutor-facilitators make it expensive to implement and limit the potential educational value of a case study. He goes on to conclude that the PBL approach misuses the faculty, tends to compromise the authenticity of cases, and results in an unnecessarily varied and impoverished educational experience for students. Williams and Lau³⁴ point out the problems of PBL in a highly readable polemic¹. Finally, PBL has been difficult to apply to public health, at least when used in an integrated curriculum (see Australian experience, below).

¹ “In our area, problem based learning is popularly known as FOFO - f—ck off and find out.”

Anne M. Rothery, Medical Director, Tameside and Glossop Primary Care Trust, Denton, Manchester, UK. First published July 2004 in the BMJ's Rapid Response column relating to the Williams & Lau article.

In a very recent empirical study, Srinivasan *et al*³⁵ compared PBL (characterized as an open-inquiry approach) with Case-Based Learning (CBL, characterized as a guided-inquiry approach) at UCLA and UCD, which changed first-, second-, and third-year Doctoring courses from PBL to CBL formats. Ten months after the shift, students and faculty who had participated in both curricula completed a 24-item questionnaire about their perceptions and the perceived advantages of each format. CBL was preferred by students (89%) and faculty (84%), across schools and learner levels. The few students preferring PBL (11%) felt it encouraged self-directed learning (26%) and valued its greater opportunities for participation (32%). From logistic regression, students preferred CBL because of fewer unfocused tangents, less busy-work, and more opportunities for clinical skills application. The authors concluded that, given the dense medical curriculum and need for efficient use of student and faculty time, CBL offers an alternative model to traditional PBL small-group teaching. The study could not assess which method produces better practising physicians.

Assessment: An interesting study that fails to answer the most important question: which approach produces the better doctors?

A study from Turkey (Gurpinar³⁶) compared the performance of two medical school classes—the last of the old and the first of a new PBL-based curriculum—on the public health topics in a multiple-choice examination. Public health topics were highly integrated into the weekly problems. The first class to use PBL scored significantly higher than the last class to use traditional methods, especially in health management and chronic diseases, but the difference was less than the faculty had hoped. The authors feared that the tutors may have de-emphasized public health.

Assessment: It is good that the study included evaluation, but the 25-question MCQ examination was hardly satisfactory, and there was ample room for a Hawthorne effect. Furthermore, the first year of a major innovation does not provide an adequate example of what that innovation can do.

Bland³⁷ studied the experience of Australian medical schools in using PBL to teach statistics. No Australian medical school taught statistics and research methods in a totally integrated way, as part of general PBL teaching. In some schools, statistical material was integrated but taught separately, using different tutors (primarily because the regular tutors felt unable to deal with statistical aspects). The patient scenarios were usually not suitable for introducing population health concepts. In one school, PBL was used only for “public health” related subjects, which meant that the statistician tutors were free to set appropriate problems. In some, a parallel

course using more traditional techniques was given alongside the PBL teaching of other material. This model was deemed less successful than the others, since students saw the statistical material as divorced from the mainstream curriculum, and thus less relevant, and also since problems were apt to be changed or re-ordered by the mainstream curriculum planners without consulting the statistical tutors—an argument in favour of integration. The author argued that further attempts must be made to introduce statistical topics into the mainstream problems.

Assessment: The suggested solution sounds right, but the tutor problem (see the Maudsley article) is serious. Yet more evidence of the need for faculty development.

Dyke *et al*⁸⁸ conducted a controlled trial of traditional and problem-based learning (PBL) methods of teaching epidemiology. All second-year medical students ($n = 136$) at the University of Western Australia Medical School were offered the chance to participate in a randomized controlled trial of teaching methods for an epidemiology course. Students who consented to participate ($n = 80$) were randomly assigned to either a PBL or a traditional course. Students who did not consent or did not return the consent form ($n = 56$) were assigned to the traditional course. Students in both streams took identical quizzes and exams. Their scores, a collection of semi-quantitative feedback from all students, and a qualitative analysis of interviews with a convenience sample of six students from each stream were compared. There was no significant difference in performances on quizzes or exams between PBL and traditional students. Students using PBL reported a stronger grasp of epidemiologic principles, were more confident that they could critically read the literature, enjoyed working with a group, and, at the end of the course, were more enthusiastic about epidemiology and its professional relevance to them than were students in the traditional course. PBL students worked more steadily during the semester but spent only marginally more time on the epidemiology course overall. Interviews corroborated these findings. Non-consenting students were older and more likely to come from non-English-speaking backgrounds. The authors concluded that PBL provides an academically equivalent but personally far richer learning experience. They noted that it is important to study whether PBL presents particular challenges for students whose first language is not the language of instruction.

Assessment: Useful evidence that PBL can improve students' attitudes toward epidemiology. But note that this was a separate course, not integrated into the general curriculum, so both problems and tutors may have been more appropriate than would be found in the more fashionable integrated curriculum. Is it possible that the combination of integration and PBL creates problems for teaching epidemiology (and perhaps public health)?

K. Tutors for PBL

Maudsley³⁹ examined how problem-based learning (PBL) tutors at the University of Liverpool (with diverse medical and other content expertise) conceptualised their students' integrated learning agenda, particularly for content less familiar to the vast majority, such as public health elements. A cross-sectional, semistructured telephone interview study was undertaken during spring 1997, with open-ended questions about their first Semester's experience of the four main themes. Qualitative data were analysed inductively and iteratively for emerging patterns and instances. Tutors mostly identified with the basic/clinical science theme (Structure and Function). Almost half articulated a clear division (implicitly or explicitly "fact" versus "non-fact") between it and the other three themes of behavioural science, population science, and ethicolegal aspects of professional practice, respectively. Only 41% of tutors (including both public health doctors) outlined the public health-based theme adequately without disclosing confusion, antagonism/indifference or difficulties/uncertainty. This study provides baseline qualitative insights about new PBL tutors' insecurities when facilitating student discussion across integrated content. Given the difficulties of recruiting suitable educators into this role and potential resource limitations, staff retention and development strategies still must confront the reality of PBL tutors' bemusement when they are placed outside their usual comfort zones. A more general and longer article, not focussing on public health, has also been published.⁴⁰

Assessment: This study is particularly relevant to the challenge of integrating public health into a PBL-based curriculum, and it suggests that the process will not be easy. But the study was conducted after the first year of experience of the university's PBL-based curriculum, and it may be that the tutors would have become more comfortable after more experience.

A related and recurring question when small groups are used is whether others can be as effective tutors as public health physicians. Trevena⁴¹ analyzed student evaluations of small-group tutors at the University of Sydney, Australia. A population health theme (Community and Doctor) is one of four themes presented in an integrated PBL program. In the third year, this

theme is addressed in student-led small groups while students are on medical-surgical rotations, with a faculty facilitator present. The facilitators were either population-health professionals (some worried about their credibility in a clinical setting) or clinicians (whom some population-health tutors feared would lack the necessary content expertise). At the end of the course, students rated clinical and population-health tutors very similarly. Whilst a degree of content expertise in population health was considered desirable in a tutor, students rated its value as secondary to good facilitation skills and an enthusiasm for teaching. The authors concluded that faculties implementing small-group methods of teaching population health should consider facilitation skills and interest in teaching as priorities when recruiting and training staff. As is the case for self-directed student-led learning in basic and clinical sciences, these factors appear to be more influential than content expertise, from the students' perspective.

Assessment: Very relevant to schools using such a curriculum. One suspects that the pool of potential tutors is usually not large enough to allow schools the luxury of recruiting suitably oriented individuals. Which brings us back to the importance of faculty development.

L. Case-based Learning

This approach uses scenarios based on real or hypothetical clinical cases to apply and consolidate knowledge that students have previously acquired, through reading, lectures, etc. Thus, students are not required to develop their own objectives or clinical questions.

- Case-Based Series in Population-Oriented Prevention (C-POP)

A 2003 Supplement to the *American Journal of Preventive Medicine (AJPM)* published a series of teaching cases that were designed to bolster skills and competencies in prevention for medical students and physicians-in-training.⁴² The Case-Based Series in Population-Oriented Prevention (C-POP) was developed and taught at State University of New York (SUNY Syracuse)–Upstate Medical University.

Epling *et al*⁴³ point out that the importance of prevention teaching is increasingly recognized in medical education, but its implementation in medical school curricula is hampered by its cross-specialty nature, lack of curricular time, and perception as a topic of less importance than the traditional basic and clinical sciences. They present the Case-Based Series in Population-Oriented Prevention (C-POP), which was developed to address national objectives for prevention education in a format that recognizes the students' abilities and preferences for case-based learning. A population-based prevention perspective was defined as “ability to assess the

health needs of a specific population and evaluate interventions to improve the health of that population; and provide care for individual patients in the context of the culture, health status, and health needs of the populations of which that patient is a member”.

This series uses small-group clinically-derived cases that can be adapted to a variety of settings and instructor capabilities, in small-group discussions with specific learning objectives. Cases deal with bicycle helmet effectiveness, adolescent suicide prevention, racial and ethnic disparity in low birth weight, sexually transmitted diseases in adolescents, an outbreak of tuberculosis in a homeless men’s shelter, community health assessment, and colorectal cancer screening. These cases guide the learners from a specific clinical problem to the broader clinical and population-based prevention issues for the topic. The cases were developed with the use of local health department scenarios and data, and have been taught and refined in a number of settings. As part of the curriculum development project, evaluation tools that examined prevention skills and orientation were developed and tested. With its emphasis on small-group learning, clinical relevance, and adaptability to a variety of learner and instructor needs, the authors claim that the C-POP project effectively integrates prevention concepts into medical education.

***Assessment:* These would be very useful for schools that have separate courses in public health, although they appear to focus more on clinical prevention than on population approaches. Local data could (and should) be inserted into them.**

McCurdy⁴⁴ describes the implementation of C-POP at the University of California at Davis Medical School. This took the form of a 26-hour course on prevention over four weeks in second year: 16 hours of lectures and five 2-hour small groups sessions, the latter designed to expand on material from the lectures. Attendance is compulsory only for the small group sessions. Students are required to hand in home assignments at the beginning of these sessions, in order to ensure prepared participation in the session, but the homework is not graded. Answers (insofar as they exist) come out during the discussion, and the instructor resists requests to post the “right” answers. Issues include flexibility of the curriculum, student acceptance of case-based learning, and effect of preceptor availability and training on the successful implementation of the C-POP curriculum.

***Assessment:* This is practical discussion of issues faced in implementing case-based learning of public health topics. Unfortunately, no evaluation is provided.**

Pearson *et al*⁴⁵ describe the pilot testing of C-POP and accompanying evaluation instruments in a new hybrid (problem-based plus didactic) medical curriculum at the University of Rochester Medical Center. Issues of implementation and evaluation of the C-POP curriculum are discussed in the article. Several of the C-POP cases were used as laboratory exercises, with rather mixed results: the evaluation instruments revealed no change in population-oriented skills or orientation. The authors suggest that the cases may have been introduced too late in the curriculum, when students had already been taught many of the concepts in other courses.

Assessment: One has the impression that the cases and evaluation instruments were not an excellent fit into the Rochester curriculum, but this project was so disrupted by the events of 9-11 that it is difficult to draw useful lessons from it. The implementation could not be effected as planned, and major adjustments had to be made on the fly, so that the evaluation results may have little validity.

- Other Experience with the Case-Based Approach

Zimmerman *et al*⁴⁶ developed case-based curricular materials on immunizations that promote preventive medicine skills and evaluated them in a before-and-after trial in the Teaching Immunization for Medical Education (TIME) Project. A multidisciplinary team developed learning objectives, abstracted clinical cases, and created case-based modules that use contextual learning and small-group interaction to solve clinical and public health problems. The case-based methods are multistation clinical teaching scenarios (MCTS) and problem-based learning (PBL).

Outcomes were knowledge gained by learners from pre-test to post-test and the overall ratings of the sessions by learners and facilitators based on evaluation questionnaires. For the MCTS method, mean scores increased from the 10-item pre-test to the post-test by 3.1 items for measles, 3.8 for influenza, 1.8 for hepatitis B, 3.9 for pertussis, 1.9 for adult vaccination, 1.9 for childhood vaccination, and 2.6 for *Haemophilus influenzae* type b ($P < .01$ for each). For the PBL method, mean scores increased by 3.4 items for measles, 3.3 for influenza, 2.6 for hepatitis B, and 2.5 for pertussis ($P < .01$ for each). Most learners (MCTS, 98%; PBL, 89%) and most facilitators (MCTS, 97%; PBL, 100%) rated the sessions overall as very good or good. The authors concluded that use of TIME modules increases knowledge about immunizations, an essential step to improving vaccination practices of future clinicians. Given the realities of decreased faculty time and budgets, educators face major challenges in developing case-based curricula that prepare learners for the 21st century. Nationally tested libraries of cases such as

the TIME modules could address this dilemma.

Assessment: This initiative was directed at future clinicians, but must have sensitized them to an important public health activity.

M. Combined Medicine–Public Health Programs

Around one-third of medical students in the UK take an intercalated honours degree in addition to their basic undergraduate course. The honours year has been reported to have a major influence on subsequent career choice: honours students show greater interest in research and laboratory medicine careers and less in general practice and public health. At the University of Nottingham Medical School, all students complete a research-based honours year within the 5-year course, leading to the award of a Bachelor of Medical Sciences degree. Students are attached to one of six pre-clinical departments, including Public Health and Epidemiology (PHE), and gain first hand experience of carrying out research. Nguyen-Van-Tam *et al*⁴⁷ examined the career choice of 195 Nottingham medical graduates who had completed an honours year in public health and epidemiology (including general practice). 78% of graduates were currently employed in medicine. 44% were working in general practice (compared with 40-45% of all British doctors graduating in the same years) and 8% in public health medicine (compared to 2%). Overall 19% (expected 4-11%) had chosen academic careers, including nine of the 15 choosing an academic career in public health. The majority (60%) reported that the honours year had influenced their career choice, while 55% reported that the year had increased their likelihood of choosing an academic career. The authors concluded that the honours year does encourage entry into academic and research careers in general and that the honours year department strongly influences the subsequent choice of specialty.

Assessment: This looks like a successful program, but could it be replicated in Canada with our longer premedical training? Perhaps with master's degrees.

Although MD-MPH programs exemplify the initiative for collaboration between schools of medicine and public health and address the expanding requirements for effective medical practice, information on such programs is scant. Chauvin *et al*⁴⁸ explored perspectives and motivations of students enrolled in the 4-year MD-MPH program at Tulane University, with a view to benefiting existing and new programs and inspiring future research. About 20% of their medical students join the program, of whom about 83% complete it. A questionnaire, based on

previously identified themes, was mailed to all 110 students enrolled in the MD-MPH program at Tulane University, of whom 69 responded. The typical respondent expected to practise medicine full-time after graduation (mostly in primary care), and expected to practice internationally up to 3 months annually. None specifically mentioned public health practice, although one (1.4%) intended to enter "administration (e.g., public health agency)". The authors concluded that increased awareness of MD-MPH programs at the undergraduate level might be beneficial. Respondents valued the broader perspectives on the doctor-patient-society triad and additional career opportunities gained through their combined studies.

Assessment: One has the impression that these students were preparing to work in managed care clinical environments, and that this program is not about preparing graduates for public health practice—possibly not even about prevention.

N. Electives in Public Health

Compared to clinicians, few physicians in public health practice are visible role models for medical students, so students are largely unaware of public health career opportunities. While public health and epidemiology lectures may fail to attract significant interest compared with clinical topics, learning through participation in public health activities such as an outbreak investigation may create greater enthusiasm among medical students. Elective rotations in health departments expose medical students to public health practice and career opportunities in applied epidemiology and preventive medicine. Public health officers and epidemiologists can serve as excellent role models for medical students.

The Liaison Committee on Medical Education (LCME) accreditation standards affirm that the medical school curriculum should include elective courses to supplement the required courses and provide opportunities for students to pursue individual academic interests. The breadth of opportunities in preventive medicine and population health is extensive, as students can seek rotations at health departments, rural and urban community health centres, community agencies, occupational health sites, schools, and abroad.

An article by Eckhert *et al*⁴⁹ describes four prototypes that foster student learning in preventive medicine—Population Health, International Health, American Medical Student Association Opportunities, and Public Health Degree Programs. These choices aim to increase students' knowledge and competence through experiential learning in several domains: community and population health, continuous quality improvement, organizational and behavioural change,

interprofessional teamwork, and health care policy. Under the heading population health, the article describes the University of Rochester's Health Action Electives. Teams of medical, nursing, and public health students work on projects that explicitly derive from priority health goals and strategies that are part of an ongoing, broad-based community health improvement initiative, Health Action, led by the Monroe County Department of Health. The Center for the Study of Rochester's Health, a partnership between the Department of Health and the University of Rochester Schools of Medicine, Dentistry and Nursing, sponsors and administers the electives and provides the vital linkage between Health Action and the student teams. Evaluation of the electives consists of several components: (1) faculty evaluations of the students' performances; (2) students' self-evaluations of their increases in knowledge of the specific domains; and (3) students' satisfaction with the electives, including evaluations of the faculty members. In addition, the students keep journals that are summarized and discussed every few weeks. These four types of electives enable students to participate in the front lines of preventive services through experiential learning in: community and population health both at home and abroad, continuous quality improvement, organization and behavioural change, interprofessional teamwork, and health care policy.

Assessment: This looks like an impressive program, and provides Canadian schools with plenty of ideas for elective programs. The Center for the Study of Rochester's Health is reminiscent of Ontario's Teaching Health Units, and equivalent partnerships in other provinces. It is a pity that no evaluation is provided.

Rosenberg⁵⁰ reported on the efforts of Columbia University to provide medical students with a variety of options for studying public health. School of Public Health faculty participate in basic public health courses within the required medical curriculum: introductions to epidemiology, biostatistics, the American health care system, social aspects of medicine, medical ethics, and disease prevention, as well as a parasitology course. Medical students can take up to two elective courses at the School of Public Health each semester with no additional tuition costs. Carefully coordinated academic schedules at the two schools facilitate a "dual-degree program," in which students can obtain the full master of public health (MPH) degree during the 4 years of medical school.

A survey of Columbia's medical graduates who had taken elective courses in public health explored the reasons they began their studies, why some did not continue, their assessment of the value of public health courses, and their careers after graduation. Response rate was 50%. Health policy, international health, and clinical prevention were the primary interests leading

them to study public health. Courses in epidemiology, biostatistics, and policy and management were cited as the most useful.

The proportion of medical students taking courses in public health has been steadily increasing. Eighty-four percent of respondents who had enrolled in the MPH program (whether or not they had received the degree yet) indicated that their public health training had been of value in their professional work. This was true for only 31% of respondents who had taken elective courses but not enrolled in the MPH program. Comments from the latter respondents suggested that many of them had chosen to supplement their medical education in the belief that public health courses would help them to function more effectively as clinicians in managed care and similar settings - they apparently never considered a career in public health. The pressure of clinical training was the major reason why some did not complete the master of public health (MPH) degree in a timely fashion. Among students who had enrolled in the MPH program and finished medical school before 1990, 84% eventually received the MPH, although some took as many as 12 additional years to complete the degree. These respondents allocated the largest portion of their typical work week (38%) to direct patient care, suggesting that the dual-degree was not a rich source of public health practitioners.

Medical students who studied public health did not differ greatly from their classmates in their specialty choices, but those who completed the MPH chose academic, governmental, and corporate practice settings more frequently than other young physicians, and devoted more time to non-clinical activities. Few survey respondents named epidemiology, and none mentioned biostatistics, as important to them when they began public health studies. These were the two subject areas, however, that the largest number of respondents identified as most useful in their careers, and several commented on their value in assessing the literature and conducting clinical research. This finding supports the importance of including these subjects in the required medical school curriculum at medical schools. Also, exposure to the teachers of these subjects seems to have been an important factor in attracting some medical students to public health. The authors concluded that public health educators can serve a variety of career needs for future physicians. In addition to personal interests, the presence of role models is an important reason that students begin studying public health.

Assessment: This is another impressive program, offering an array of choices. Graduates may or not be practising better prevention than they would otherwise have done, but the MD-MPH combination does not guarantee a career in public health, to say the least.

O. Links with Public Health Agencies

Dannenberg *et al*⁶¹ identified such electives by consulting medical schools' Web sites and by contacting state epidemiologists, teachers of preventive medicine, and medical school associate deans. In this report, they describe some "likely best practices" among epidemiology and public health electives for medical students in state and local health departments (the judgement apparently based on the fact that all had attracted at least 3 students in the preceding five years). They found that electives were offered in nine state and five local health departments; these are described in detail. The electives usually focussed on infectious diseases, involved students in outbreak investigations when possible, lasted four or more weeks, were open to other students and medical residents, and were overseen by a health department preceptor with a medical school faculty appointment and a commitment to train students. Some electives included more didactic components, encouraged the student to publish a manuscript, or were coordinated by a preventive medicine residency director. Some health departments went to considerable lengths to facilitate the electives, e.g., arranging subsidized housing. Three types of individuals had been responsible for the creation and maintenance of these electives: (1) the state epidemiologist, state or county health officer, or other senior health official, (2) the director or staff of the preventive medicine residency program at the health department or state medical school, (3) combined position of health department director and as medical school associate dean. The authors observe that health departments can benefit from training enthusiastic medical students via such electives; these students bring fresh ideas to the departments. Medical school catalogues, Web sites, and word of mouth are important means for promoting these electives. Ideally, in the future every medical school will offer a state or local health department elective so that all medical students will become aware of epidemiology and public health career options. The electives reported in this article can help guide additional medical schools and health departments as they initiate such rotations.

Assessment: These have been labelled as "likely" best practices, because no evaluation was presented. Nine states and five local health departments is not very impressive in a country of 300 million, and 3 student placements per department over five years is setting the bar pretty low. But many of the ideas look good, and some of the health departments are strongly supportive.

Melville *et al*⁶² examined the educational linkages between medical schools and public health agencies (PHAs), characterized programs for medical student placement at PHAs, explored attitudes toward using PHAs as student teaching sites, and investigated factors that facilitate or

hinder such placements. A 20-item questionnaire was mailed in the summer of 1994 to all allopathic medical schools in the United States. 63% of respondents reported having a program that places some or all students at PHAs. Two barriers differentiated schools having a PHA placement program from those not having one: lack of faculty interest and lack of a designated PHA contact person. The most common facilitating factors were proximity of PHA(s) (84%), faculty interest in public health (76%), support of the PHA director and personnel (67%), and faculty appointments for public health personnel (63%). The most common barriers were lack of curriculum time and lack of funding. The most common student activities were working in clinics (80%), introduction to public health (52%), education/outreach (48%), and policy development and planning (46%). The authors concluded that an unexpectedly large number of schools placed students in PHAs to receive training. However, medical schools are not utilizing the full potential of PHAs as teaching sites.

Assessment: These are *considerably* larger numbers than reported in the Dannenberg paper, and the reasons are not obvious. It may be relevant that Dannenberg focused more on health departments, while Melville focused on medical schools. Yet again, there is no evaluation of the placements.

The CDC initiated an elective in epidemiology and public health for senior medical students in 1975, in order to increase awareness of and interest in public health and epidemiology. Attempts are made to place all eligible students applying for the elective for 6 to 8 weeks, depending on the student's schedule. The structure of the elective is highly dependent on the CDC area of assignment and the primary supervisor: no general structure is dictated, but a major objective is to gain experience in applied epidemiology in a hands-on fashion. Students are evaluated as required by their respective schools by the primary CDC mentor during the elective, but no formal written report, evaluation, or summary is required from the student by CDC. The number of students increased steadily over the years, from an average of 16 per year during the 1970s, to 58 students during the then most recent academic year (1996-97).

Examples of recent investigations include infectious disease outbreaks, response to natural disasters, impact of reduction of public clinics for treating persons with sexually transmitted diseases, cost-benefit of raccoon rabies vaccination, and assessment of surveillance of prenatal care access with welfare reform. In addition, some students have arranged (with their own funding) participation in overseas projects working with CDC staff. Buffington *et al*⁶³ reviewed CDC records to describe participation in the elective, to assess whether students subsequently enrolled in the Epidemic Intelligence Service (EIS), and, if enrolled, employment status following

EIS. A review of documentation of board certification in preventive medicine determined how many participants later chose this specialty, one indicator of public health and prevention as a career choice. From 1975 through 1997, 632 students participated in the elective. Of these, 438 (69%) were assigned to infectious disease areas, 95 (15%) to environmental health, 59 (9%) to chronic disease, and 40 (7%) to other areas.

Students participated in at least 278 official investigations of important public health problems including infectious disease outbreaks, natural disasters, chronic disease problems and access to health care. Of 530 students who had completed the elective through June 1995, 91 (17%) were enrolled in EIS by July 1997. Of 83 completing EIS by July 1997, 65 (78%) had continued in public health careers: 35 with CDC; 17 with local or state health departments; 7 with other federal agencies; 4 in academic public health; and 2 in international health. Of those not enrolling in EIS, at least 5% were certified by the American Board of Preventive Medicine, compared with 34% of those completing EIS. The authors concluded that an elective rotation in public health and applied epidemiology is valuable in introducing future physicians to the practice of public health, and can provide important role models for encouragement to pursue careers in public health.

Assessment: This looks like a highly successful program for recruiting physicians into public health, which should be entirely replicable in Canada.

P. International Electives

Many observers have noted the high proportion of public health physicians who have had international experience. Imperato⁵⁴ [full text not found] describes the 25-year experience of the Downstate Medical Center in Brooklyn in sending fourth-year medical students on international electives. The emphasis is on public health, preventive medicine and primary care, and the students love it.

Assessment: One hopes that the full text indicates the career choices of students who selected these electives (even so, it would not indicate the direction of causation: perhaps students who are already bound for public health choose international electives).

Q. Student-Led Learning

Trevena and Clark⁵⁵ point out the tension between a population health perspective and integration with clinical teaching, then describe the education model used to integrate population

health learning into a new 4-year medical program at the University of Sydney. Their two-pronged approach is designed to prepare third-year students to integrate population health thinking into their day-to-day clinical reasoning and to equip them with skills to investigate specific population health topics. The model aims to bridge the gap between

population and individual healthcare concepts while incorporating the principles of self-directed learning. The Community and Doctor theme [see Trevena's other paper] covers population health, and comprises about one-eighth of the curriculum.

They provide an example of a student-led, small-group session on health issues for disadvantaged populations, along with an outline of their assessment and evaluation methods. During the first two campus-based years of the curriculum, students receive dedicated community and doctor theme lectures, PBL learning topics, and interactive 90-minute theme sessions, all relating to the problem-based case for that week. The planners of Community and Doctor incorporated specific population health discussion points and learning topics into the PBL cases wherever appropriate. This first strategy - "infiltration" of population health content - aims to integrate it with day-to-day clinical practice and assist with its contextualization. During the teaching hospital-based third year of the program, community and doctor theme-specific learning topics and discussion points continue within the PBLs, and a more sophisticated 2-hour, student-led, small-group session once every 2 weeks replaces the earlier academic-led, 90-minute theme sessions. This is included to ensure students acquire population health skills.

Wherever possible, examples from the students' clinical attachments were incorporated into the 13 core population health sessions. Local resource people working in the area of interest for that topic were available for students to meet and work with (e.g., patient educators and drug and alcohol counselling and treatment workers). Where appropriate, students were given the opportunity to visit sites in the community that exemplified their topic area (e.g., visits to prison clinics and to outreach clinics for the homeless). The sessions were sequenced to lead students centrifugally from individually focused topics to those that explored issues related to the general population and to the health system.

In the fourth (and final) year of the program, which consists of four specialty rotations, the integrated PBL elements continue to feature as before, but students prepare individual population health papers and a needs assessment project on topics of their choice within the four terms. Thus, by the final year, it is intended that students can independently identify population health issues that relate to their clinical learning and demonstrate ability to research,

critically analyze, discuss, and report on them. The ability to incorporate population health issues into the clinical reasoning process was assessed by the inclusion of population health questions into written multiple-choice and modified-essay questions in exams on clinical topics.

Students are assessed on these issues both formatively and summatively. To complement this strategy, the instructors assigned to each student group assessed each student's ability to explore a population health topic in detail by applying a set of predetermined performance criteria while the student led the small-group tutorial on his or her selected topic. This innovative course illustrates one approach to the challenge of motivating students to bridge the gap between their interest in the medical care of individual patients and the healthcare needs of whole populations. Students performed adequately in the assessments required for progression to the next year of the program. Students rated the case-based exercises, self-directed learning, on-line and library resources, tutor facilitation, and student-led, small-group sessions as effective methods for learning, and reported levels of engagement with the material that were comparable to those with clinical topics.

Assessment: This paper describes the program very thoroughly, and provides some evaluation. The results of that evaluation are rather lukewarm, but the fact that levels of student engagement were comparable to those in clinical teaching indicates success.

In order to enhance student participation in lectures of hygiene and public health, Yano *et al*⁶⁶ introduced a student facilitator (SF) system into the lectures of fourth grade Japanese medical students. All students were assigned to one of the 28 classes as SF, thus each class had 4 to 5 SFs.

A few weeks before the lecture, each teacher gave SFs various instructions to prepare for the class depending on the theme and teaching strategies. Some classes consisted of dialogues between the teacher and SFs, while in other classes SFs gave presentations related to the theme of the lecture. For example, SFs in an epidemiology class performed a small epidemiological survey using their fellow students as study subjects, thus allowing students to learn epidemiological design and calculation of odds ratios.

The evaluation survey for the SF system showed that in general, students rated the SF system positively, especially at the time they served as SFs. Most of the students showed more interest in the subjects and felt more confident about what they learned as compared to ordinary classes. This finding is important because, previously, the largest problem with the lectures of hygiene and public health used to be the poor interest of students in the subject itself. On the other

hand, students sometimes complained about the poor quality of the presentation by SFs. Also, a few students sometimes felt that for obtaining the large volume of knowledge required by the national board examination for medical practice, the SF system was inefficient.

In summary, the SF system has some advantage in evoking interest in learning hygiene and public health with sufficient systematic preparation. However, it may not be an efficient way to obtain large amounts of knowledge. To improve the SF system, well designed teaching strategies in addition to a carefully prepared textbook are essential.

Assessment: Fairly similar to Trevena and Clark, but students were somewhat more enthusiastic.

R. Distance Learning

Bruce *et al*⁶⁷ describe the experience of the London School of Hygiene and Tropical Medicine in offering a computer-based course in epidemiology and statistics for MSc students, many of whom were living in remote locations. Development of the computer-assisted learning (CAL) components of the course took far longer than the faculty had expected, but these were by far the most popular with the students. Indeed, the whole course was popular (except for the necessity to learn Stata!).

Assessment: The article provides a very detailed “how-to” description of CAL, and may have some relevance for satellite Canadian medical schools (as well as students doing remote electives). The course content was quite different from that required by medical students. [See also: Epidemiology Program Office, CDC. Principles of epidemiology: an introduction to applied epidemiology and biostatistics. Second Edition. Atlanta, GA: U.S. Department of Health and Human Services, CDC, 1992.]

S. Specific Topics

- Epidemiology

Abramson⁵⁸ [full text not found] reviews the teaching of epidemiology inside and outside the classroom. There is no single ideal way of teaching epidemiology. Teaching can take place in different situations, and its techniques and content may differ. A good teaching programme is one that is geared to its students' needs, capacity, interests and preferences, and exploits

available teaching situations and techniques to provide learning opportunities that will achieve the educational objectives. The article starts with a discussion of the main factors that affect the choice of methods and then deals in turn with conventional classroom methods, laboratory teaching (problem-solving and other exercises), self-instruction, problem-oriented projects, and distance learning. Separate consideration is then given to teaching in the hospital and in the field (with special attention to teaching in a community health centre).

Assessment: A useful overview by a master teacher, and the author of PEPI. Reasonable advice, but no evaluation in the abstract.

Lawler *et al*⁵⁹ report on experience in a first year medical school course on epidemiology at the University of Oklahoma. Students had the option of using calculators or PDAs in class, and were told that they could bring them to the examination, loaded with anything they chose. This raised a storm of protest from those who did not have PDAs, who claimed that they would be placed at a disadvantage. The instructor accordingly compared the performances of those with and without PDAs on the final examination in two successive years, and found no apparent effect, even on topics (like working a 2x2 table) where a benefit would have been expected. The authors acknowledge the lack of random allocation, but suggest that ability to understand the underlying concepts is more important than having a tool to speed up the calculations.

Assessment: Canadian students at the university we know best cannot afford PDAs!

A common method in the teaching of epidemiology at the London School of Hygiene and Tropical Medicine is 'paper critique'. This refers to a close reading of published research articles, in which students are asked to assess their coherence and validity. The intention is to improve the students' analytic and writing skills, as well as acting as a form of summative assessment.

Alexander⁶⁰ tries to use literary theory to conceptualize the method of paper critique, and hence propose how it might be made more effective. He links his experience of this method to concepts such as rhetoric, myth and semiology, and uses them to try to develop paper critique as an educational method. This treats medical research papers as persuasive devices, an approach complementary to that used in Evidence-Based Medicine (EBM), which treats them as an essentially transparent, frictionless medium that gives the reader unhindered access to the actions of the authors.

Assessment: After the off-putting social science jargon in the introduction, this turns out to be a thoughtful (and entertaining) article on how authors manipulate readers, and it contains a number of ideas and examples that could be used for critical appraisal courses in medical schools. It is equally relevant to public health practice and to clinical practice, and could be used to enrich small-group sessions in EBM.

- Statistics

In a paper by Astin *et al*¹, two undergraduate medical students at the University of Bristol comment on their experiences of learning medical statistics. In general, medical students' focus is on acquiring skills needed to practice clinical medicine, and great care must be taken to explain why disciplines such as statistics and epidemiology are relevant to this. Use of real examples and an emphasis on the need for evidence has meant that medical students are increasingly aware of the pressure on clinicians to justify their treatment decisions and the associated need to be able to understand and critically appraise medical research.

It was felt that medical statistics courses should focus on critical appraisal skills rather than on the ability to analyse data, which can be acquired by particular students when they need to do this (although students are provided access to a CAL package called *Statistics for the Terrified*). Medical statistics should be taught early in the curriculum, but there is a need to reinforce such skills throughout the course. Teaching and assessment methods should recognize that what is being taught is a practical skill of clinical relevance. This means that problem-based small groups, data interpretation exercises and objective structured clinical examinations will be more productive than traditional teaching and examination methods.

Assessment: Good advice, but it seems likely that most Canadian medical schools already use the recommended approaches.

Marantz *et al*² described the experience of Albert Einstein College of Medicine in teaching a required first-year course in epidemiology and biostatistics. After years of trying various approaches, all of which received low student ratings, the course was revised to use the case-discussion teaching method used by the Harvard Business School. In preparation for the course, experienced faculty participated in an intensive, two-day training workshop. The course, taught to 163 first-year medical students, was structured in two parts: (1) three lectures (attendance not mandatory) complemented by a detailed syllabus, followed by a multiple-choice

midterm exam; and (2) six case-discussion seminars, followed by a short answer/essay final exam. The cases were not about patients, but rather about doctors or medical students making decisions or interpreting information. There were seven case-discussion groups with 23–24 students each.

The program was evaluated using subjective faculty feedback, examination scores, and student evaluation questionnaires. Faculty noted excellent student preparation and participation. Multiple-choice exam scores were comparable to those from earlier years, and a short answer/essay exam demonstrated good student mastery of the required material. Student evaluation was overwhelmingly positive, and significantly improved from prior years; indeed, the course went immediately from being one of the least popular to one of the most popular courses in first year.

Positive student evaluations of the course using this teaching method continued over the next four years; National Board of Medical Examiners examination scores indicated success in mastery of the material; and student assessment of the course improved on the AAMC Graduation Questionnaire. This favourable experience suggests that case-discussion teaching can be employed successfully in teaching principles of epidemiology and biostatistics to medical students.

Assessment: This is a most exciting paper, indicating a promising solution to a problem that has plagued us all. Admittedly, they spent vast amounts of money and time in preparation and faculty development.

- Health Systems & Health Policy

Riegelman⁶³ argues that a curriculum in health systems and health policy is crucial to the education of all future physicians and other health professionals. The Clinical Prevention and Population Health Curriculum Framework of the Healthy People Curriculum Task Force recommended a health systems and health policy curriculum that includes the domains of organization of clinical and public health systems; health services financing; health workforce; and health policy process. The curriculum should commence prior to year three and continue in years three and four so that students have a framework for integrating and subsequently sharing their experiences. Current Liaison Committee on Medical Education data indicate that on average fewer than 70% of medical schools require any curriculum in these four domains (two of which are among the least frequently offered of any domains included in the Curriculum Framework), and only 40% of medical schools include all four of these domains in their required

curriculum. Incorporation of all of these domains into well-defined, required curricula that are broad in scope has the potential to change the attitudes of future clinicians toward efforts to control costs, collaborate with other health professions, and influence health policies.

Assessment: This article provides a very well-argued case for inclusion of this topic, but little concrete advice on how to do it.

Finkel and Fein⁶⁴ present one way to do it. In 1996, the Weill Medical College of Cornell University created a new, integrated public health curriculum to reflect the changes in the ways that medical care is organized, financed, and delivered. Teaching medical students to understand the constantly changing health care system is a primary objective. As part of this curriculum, the medical college instituted a required public health clerkship that focussed on the health care system, to be taken in either the third or fourth year. Students are prepared for the clerkship by taking courses in epidemiology, biostatistics, and evidence-based medicine in the first year and an introduction to the health system in the second year. The two-week clerkship, which may be unique in U.S. medical education, seeks to present an in-depth exposure to issues in health care financing and delivery by means of lectures, panel discussions with experts in the field, seminars, and field assignments to health care organizations and agencies.

Assessment: This looks interesting, but could one find enough placements in a city smaller than New York? And the content looks fairly didactic: will students find it less boring than they have found our lectures on the topic?

- **Controversial Topics**

D'Eon *et al*⁶⁵ compared “Structured Controversy” (a semi-formal debate-like small-group activity) with a traditional open discussion format in a randomized trial among medical and physical therapy students at the University of Saskatchewan. For the study reported in this article the topic was “Private sector involvement must be significantly increased to save Canada’s health care system”. They found that those students who participated in Structured Controversy changed their personal opinion on the topic more than those who were in Open Discussion groups. Students in the Structured Controversy group also commented more often that being “forced” to explore both sides of the topic made a difference to their learning. The authors concluded that the time and effort invested in organizing the Structured Controversy experience for students is worthwhile because it encourages students to more seriously consider many aspects of an argument and helps promote sustained change of opinion.

Assessment: Many of the topics in public health are controversial and "political". This article presents a novel way of helping students to think about such issues, perhaps without identifying faculty members with one or another faction.

T. Evaluation Methods

Garr *et al*⁶⁶ surveyed US medical schools regarding the extent to which they are evaluating the learning of medical students about disease prevention/health promotion. The results revealed more emphasis on teaching and evaluating the learning of medical students in the areas of clinical preventive services and quantitative methods than on community dimensions of medical practice and health services organization and delivery. Only 21% of respondents were satisfied with the quality of their evaluation methods. 46% wanted help with methods to teach and/or evaluate learning. Written tests were most common, followed by unstructured observation. The authors suggested that schools must use community-based experiences, not just talk at the students. In carrying out the survey, they often had difficulty identifying a school's leader for prevention education, and recommended that schools designate someone with this responsibility.

Assessment: It is not unexpected that the emphasis in evaluation would be similar to that in teaching, *viz.*, clinical prevention. And evaluation of clinical prevention would probably fit better into typical medical school methods than evaluation of population prevention.

Blue *et al*⁶⁷ note that the knowledge, skills, and attitudes associated with prevention cut across clinical disciplines. Thus, they are often subsets of disciplines not otherwise present in the traditional curriculum (e.g., epidemiology or statistics) or are considered the province of many disciplines (e.g., risk reduction or cancer screening). Evaluation of elements of prevention education can often become lost in the myriad other outcomes that are assessed in students, or they are intermingled with other content and skills. Their article highlights the value of assessing students' competence in prevention knowledge, skills, and attitudes, provides general guidance for programs interested in evaluating their prevention instructional efforts, and gives specific examples of possible methods for evaluating prevention education. It systematically addresses the strengths and weakness and possible applications of written examinations (still the most common), oral presentations, questionnaires/surveys, student-developed products (especially portfolios), simulations (whether paper or computer-based) and observation (brief structured observations, standardized patients, OSCEs). While it is important to tailor assessment

methods to local institutional objectives, it is possible to share assessment methods and materials regionally and nationally. Sharing problems, as well as successes, encountered in developing appropriate assessment methods will advance the field of evaluation of prevention curricula.

Assessment: This is an excellent, practical overview into a difficult topic. It should be useful to all our undergraduate programs.

Sutphen *et al*⁶⁸ developed assessment instruments to measure student skills before and after introduction of a case-based curriculum at State University of New York-Upstate Medical University. The curriculum used five cases from the C-POP series and three other cases. Their evaluation method used three testing instruments that measure preventive medicine skills. They selected three topics different from the eight cases used for instruction, and developed an evaluation instrument for each: sexually transmitted disease, lead toxicity, and ischemic heart disease. All three instruments measured four key preventive medicine skills areas: (1) using and interpreting data sources; (2) measuring disease frequency, including incidence and prevalence; (3) making inferences and identifying bias in data presentations; and (4) identifying appropriate study design and screening tests. Second-year medical students were assessed before and after their preventive medicine course, using the evaluative instruments; there was no control group that received traditional methods of instruction. Before-and-after instruction analysis, overall and by skills area tested, revealed a significant increase in student preventive medicine skills in all four categories. On conclusion of the case-based curriculum, students were also asked to rate the cases. The majority (60%) of the students thought the cases were of value to their medical education, and 58% believed that they added to their skills in population prevention. The investigators concluded that these instruments can measure change in preventive medicine skills before and after a course in preventive medicine, but were unable to comment on the effectiveness of the intervention relative to other teaching methods.

Assessment: Another useful and practical article. Unfortunate that they had no comparison intervention.

Novick *et al*⁶⁹ developed an instrument to assess orientation to a population-based prevention perspective. Orientation was defined as a willingness to use population-based preventive alternatives. They used hypothetical situations describing nine health issues that could be encountered by a primary care physician. Outcome measures included population and

treatment scales, and the difference between the two. Pilot testing of the instrument showed statistically significant differences between public health physicians and family medicine physicians, although there were many inconsistencies for individual questions. For medical students taught the Case-Based Series in Population-Oriented Prevention (C-POP), there was an overall increase in the population scale and the population-treatment differential - but since there were other methods of instruction in the program as well as the C-POP cases, it is not possible to ascribe the change to the cases.

Assessment: Population-based orientation would be a useful dimension to include in evaluation of students, but are the instruments suitable for routine use? And are they gameable?

White⁷⁰ reported on a very comprehensive approach to evaluation of undergraduate medical teaching at the University of Newcastle upon Tyne (England). Quality assurance has been implemented using a variety of approaches at seven stages of the programme:

- Curriculum development (surveys of other schools and a consensus conference)
- Staff development (requirement that all faculty have training in teaching and formal assessment of their educational needs)
- Course management (dedicated teaching administrator working with a team)
- Student assessment (co-marking of assignments, much student feedback, student-led peer assessment of presentations)
- Course evaluation (formal and informal evaluation by students)
- External assessment (peer-reviewed publications, university standards for course; documentation, review by a national agency)
- Continuous quality improvement (all of the above plus an annual retreat to evaluate the educational program).

Assessment: This article tackles the evaluation of a whole curriculum in public health. Would that we were all as thorough as Newcastle!

4. COMMENTS

It was striking that the initial literature search turned up so few articles (actually two) from Canada. Equally striking was the large number from Australia.

This is not a rich literature and many of the published articles lack evaluation. Not surprisingly, there are lots of articles on what sounds like a good idea, fewer articles offering practical advice on how to implement it, still fewer offering empirical evidence on short-term outcomes and practically none on long-term outcomes. What evaluation is presented is often rather unsophisticated, e.g., uncontrolled studies of student satisfaction. Many of the articles are published very soon after the introduction of curricular innovations, too soon to determine whether they really work. Where were the later evaluations of earlier curriculum innovations? Perhaps energy and enthusiasm had waned and perhaps some innovations had even failed.

This review is limited to articles and topics that came up in the search of the recent literature, so is not a comprehensive review of all educational approaches. The interviews with undergraduate program directors will certainly reveal best practices for other approaches, such as lectures, and these will be incorporated in our the final report.

5. MAJOR FINDINGS

Major conclusions from the literature review are:

- 1) **Students have varied learning styles**, and therefore need diverse opportunities for learning. One size does not fit all.
- 2) **Integration of public health into clinical teaching has many benefits.** Medical schools interested in increasing the amount of integration of public health teaching with clinical teaching should find valuable guidance in: (1) a 2000 Supplement to *Academic Medicine* on “Teaching Prevention throughout the Curriculum: Multidisciplinary perspectives on enhancing disease prevention and health promotion in undergraduate education” and (2) a 2004 *American Journal of Preventive Medicine* series on the Clinical Prevention and Population Health Curriculum Framework.
- 3) **Logical locations to demonstrate integration include community health centres, family physicians’ offices, and clinical epidemiology services.** Stone provides a useful matrix and Trevena a tested eight-part checklist of questions that form a simple mental prompt for considering any health problem from a population perspective.
- 4) **In an integrated approach, it is important maintain an inventory of prevention-related topics** included in various courses and clerkships, to ensure appropriate emphasis, overlap, and integration (Taylor).
- 5) **The combination of PBL and horizontal integration can create difficulties for public health teaching**, because it is difficult to include public health in clinical problems, and also because tutors are often uncomfortable with public health topics (Maudsley).
- 6) **Faculty development should be a high priority**, especially training clinical and basic science tutors to be more comfortable with public health topics (Sachdeva).
- 7) **A community orientation is central to public and population health.** Students could be assisted in developing this by a short course on community diagnosis (described by Davison) and a much longer one on Health, Illness and the Community (described by Wasylenki).

- 8) **Virtually everyone agrees that practical experiences are an essential component of learning.** We should therefore use teachers and placements in public health agencies (PHAs) very extensively. The literature suggests that medical schools should develop continuing associations with Public Health Agencies, in a fashion similar to that of the Teaching Health Units that formerly existed in Ontario (Howe, Wasylenki).
- 9) **Placements in aboriginal communities would do much to sensitize future doctors to the challenges faced by these communities** and appreciate the need for a population perspective, in addition to broadening their clinical experience (Dowell).
- 10) **There may be a trend away from PBL to CBL.**
- 11) **Good cases are available to support case-based learning**, e.g., the C-POP cases and Multistation Clinical Teaching Scenarios (Epling, Zimmerman). They may work better in a separate PH curriculum, although this would sacrifice the principle of horizontal integration.
- 12) **The literature contains a number of interesting ideas for undergraduate electives in public health** (Eckhert, Dannenberg, Melville, Imperato)
- 13) **Electives at PHAC might well be successful in recruiting students to public health careers** (Buffington).
- 14) **There may be a case for using students as tutors**, since this can engage them more deeply in the subject matter (Trevena/Clarke, Yano).
- 15) **Web-based courses (Bruce) and the case-discussion approach (Marantz) have been found more successful than lectures for teaching epidemiologic and statistical methods.**
- 16) **Structured controversy debates look like a valuable method** of getting students to think deeply about controversial topics (D'Eon).
- 17) **US educators have developed some interesting instruments for measuring students' preventive skills and orientation** (Blue, Sutphen).

- 18) **The University of Newcastle upon Tyne has developed an impressive framework for evaluating a medical school's curriculum in public health (White).**
- 19) **A survey of the public health program directors in UK medical schools in 2003 had very similar findings to the present study and made similar recommendations.**

6. SUMMARY TABLE OF PEER-REVIEWED LITERATURE

(Particularly recommended articles marked with asterisk)

Technique	Author (ref)	Place	Design	Outcomes of method being studied			
				Satisfaction (Student, Tutor)	Elective Choices	Student Performance	Specialty Choice
TEACHING METHODS							
Curriculum Design							
Curriculum Planning	McClary ⁶	USA	Survey of US schools	No outcomes provided			
	*Dismuke & McClary ⁷	USA	Guide to curriculum planning	No outcomes provided			
	*Allan <i>et al</i> ⁸	UK	Guide to curriculum planning	No outcomes provided			
Strengthen public health teaching	Gillam & Bagade ¹¹	UK	Survey of UK schools	No outcomes provided			
Cater to learning styles	Piane <i>et al</i> ¹²	N/A	Correlative study			Assimilators did best in lecture course	

Integration with clinical teaching							
Integration with rest of curriculum	Taylor & Moore ¹⁴	US	Description of new curriculum	No outcomes provided			
	*Stone ¹⁵	UK	Overview; arguments in favour	No outcomes provided			
	*Trevena <i>et al</i> ¹⁶	Sydney, Australia	8 questions to develop population perspective	Students needed detailed questions to identify population aspects			
	Whelan & Black ¹⁷	NSW, Australia	Description of new curriculum		Chose more social topics for independent learning projects	“Good understanding” of social and cultural aspects of health & disease	To be studied
Family physicians teach prevention	Stine <i>et al</i> ¹⁸	USA	Descriptive	No outcomes presented			
Clinical epidemiology ward round for teaching epidemiology	Stone ¹⁹	Glasgow, UK	Description, Follow-up survey	S: Liked it, but not convinced that relevant to epidemiology			

Need for faculty development	Sachdeva ²⁰	Rochester, USA	Description; Hortatory	No outcomes presented			
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Community orientation							
Introduction of community-oriented curriculum	Rolfe <i>et al</i> ²²	Australia	Comparison to a traditional school	Entering S: More positive to community, holistic medicine, evaluation of interventions			
Community-based learning	Howe <i>et al</i> ²³	UK	Survey of community stakeholders	Agencies keen to have larger role in education			
	*Davison <i>et al</i> ²⁴	Glasgow, UK	Description of course in community diagnosis	S: Reasonably popular T: positive		Students able to identify strengths and weaknesses of data	
	*Wasylenki <i>et al</i> ²⁵	Toronto	Description of Health Illness and Community course				
Community-oriented family medicine clerkship	Unverzagt <i>et al</i> ²⁶	New Mexico	Longitudinal study	First few years: S found it time-consuming, peripheral. Later years: found it important for learning			

Placements in remote areas, focussing on health needs, cultural factors	*Dowell <i>et al</i> ²⁷	New Zealand	Follow-up study	S: Very popular			
Academic data warehouse with exercises to complement clinical cases	Lyman <i>et al</i> ²⁸	USA	Follow-up survey	S,T: warrants inclusion in curriculum S: Agreed that complemented the cases, but not convinced that valuable			
Problem-Based Learning							
Comparison of PBL and CBL	*Srinivasan <i>et al</i> ³⁵	California, UCLA & UCD	Follow-up study after switch from PBL to CBL	Students and faculty overwhelming preferred CBL			
Introduction of problem-based curriculum	Gurpinar <i>et al</i> ³⁶	Turkey	Comparison of last "before" students and first "after" students			Higher marks on MCQs, especially on health management & chronic diseases	
PBL for statistics	Bland ³⁷	Australia	Comparative study of medical schools			Traditional teaching of stats in otherwise PBL curriculum was least successful model	

PBL for epidemiology	Dyke <i>et al</i> ⁸⁸	Western Australia	RCT among 2 nd -year students	S: Reported stronger grasp of epi principles, enjoyed working with group, were more enthusiastic about epi		No difference in marks	
Attitudes of PBL tutors	Maudsley ³⁹	Liverpool	Survey of tutors	T: identified mainly with basic/clinical science, uncomfortable with behavioural science, population science, ethicolegal aspects			
Public health physicians vs. others as tutors	Trevena ⁴¹	Australia	Analysis of student ratings	S: Content expertise desirable, but facilitation skills more important			
Case-based learning							
Case-Based Series: Population-Oriented Prevention (C-POP)	*Epling <i>et al</i> ⁴³	SUNY-Syracuse, USA	Descriptive	No outcomes presented			
	McCurdy ⁴⁴	Univ of California, Davis, USA	Described implementation	No outcomes presented			
	Pearson <i>et al</i> ⁴⁵	Univ of Rochester, USA	Implementation Before-after study			No change in population-oriented skills or orientation	

Teaching immunization skills by Multistation Clinical Teaching Scenarios (MCTS) and PBL	*Zimmerman <i>et al</i> ⁴⁶	USA	Before-after trial	S and T: Great majority rated sessions good or very good		Significant increase in scores for both methods	
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Combined Medicine/Public Health Programs							
Intercalated year of public health study	*Nguyen-Van-Tam <i>et al</i> ⁴⁷	Univ of Nottingham, UK	Comparative study	Over half said the year influenced career choice			8% chose public health (expected 2%), 19% chose academic career (expected 4-11%)
Combined MD-MPH program	Chauvin <i>et al</i> ⁴⁸	Tulane Univ, USA	Survey of students	S: Valued broader perspectives on doctor-patient-society triad, and additional career opportunities			Most planned to practise medicine full-time, with international component

Electives in Public Health							
Electives in preventive medicine & population health	Eckhart <i>et al</i> ⁴⁹	USA	Description	No outcomes presented			
Electives in public health	Rosenberg ⁵⁰	Columbia University, USA	Survey of graduates who had taken electives in PH	S: epi, stats and policy/management courses most useful. Most eventually completed MPH.			Those with MPH chose similar specialties from others, but more likely institutional
Links with public health agencies	Dannenberg <i>et al</i> ⁵¹	USA	Survey of web sites, faculty, deans	No outcomes presented			
Medical school-public health agency linkages	Melville <i>et al</i> ⁵²	USA	Survey of US medical schools	63% offered public health placements			
Career choices after electives at CDC	*Buffington <i>et al</i> ⁵³	CDC, USA	Review of CDC records				17% joined EIS; 78% of these continued in public health, 34% certified by ABPM

Electives in international health (emphasis on public health, preventive medicine, primary care)	Imperato ⁵⁴	Downstate Medical Centre, Brooklyn	Survey of 4 th year students who did international electives	S: Extremely popular			
Student-led learning							
Self-learning of population health: student-led, small-group sessions	*Trevena & Clarke ⁵⁵	Sydney, Australia	Student survey; routine evaluations. No comparison group	S: effective methods of learning; as engaging as clinical topics		Adequate	
Student facilitators	*Yano <i>et al</i> ⁵⁶	Japan	Evaluation survey	S: positive ratings, especially of serving as SFs. Greater interest, confidence. Some thought inefficient, found SF presentations poor			

Distance learning							
Distance learning of epidemiology & statistics (public health students)	*Bruce <i>et al</i> ⁵⁷	London School of Hygiene, UK	Descriptive + follow-up	Very enthusiastic. Liked computer-assisted learning; hated Stata.			
Teaching specific topics							
Teaching epidemiology: Methods	Abramson ⁵⁸	NA	Overview	No outcomes presented			
Teaching epidemiology: Use of personal digital assistants in epidemiology examination	Lawler & Cacy ⁵⁹	Univ of Oklahoma, USA	Comparison of exam performance of users and non-users of PDA			No effect	
Teaching epidemiology by Paper critique	Alexander ⁶⁰	London, UK (LSTMH)	Descriptive	No outcomes presented			
Teaching statistics	Astin <i>et al</i> ⁶¹	Univ of Bristol, UK	Perceptions of two medical students. No evaluation.	S: relevance, critical appraisal>data analysis. PBL/exercises/ OSCEs > lectures/MCQs.			

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Teaching epidemiologic and statistical methods	*Marantz <i>et al</i> ⁶²	Albert Einstein College, NYC	Before-after study	S: course changed overnight from one of least popular to one of most popular T: found students better prepared		Licensing exams: students scored higher on E&B than in any other area	
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Teaching health policy	Riegelman ⁶³	USA	Overview	No outcomes presented			
	Finkel & Fein ⁶⁴	Cornell U, USA	Description of public health clerkship	No outcomes presented			
Teaching controversial topics: Structured Controversy	*D'Eon <i>et al</i> ⁶⁵	Saskatchewan	RCT compared debates with open discussions	S: changed opinion on complex issues more frequently			

EVALUATION METHODS							
Evaluation of prevention education	Garr <i>et al</i> ⁶⁶	USA	Survey of medical schools	No outcomes presented			
	*Blue <i>et al</i> ⁶⁷	USA	Overview	No outcomes presented			
Evaluation of Case-based curriculum	Sutphen <i>et al</i> ⁶⁸	SUNY-Syracuse, USA	Before-after study	S: Most found cases valuable, add skills in population prevention	More preventive skills in all 4 measured categories		
Evaluation of C-POP	Novick <i>et al</i> ⁶⁹	SUNY-Syracuse, USA	Before-after assessment, using hypothetical scenarios			Increase in population scale and population-treatment differential	
Quality assurance in undergraduate medical education	*White ⁷⁰	Newcastle upon Tyne, UK	Description	No outcomes presented			

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