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PROBLEM-BASED LEARNING

Case Design to Emphasize Population Health Concepts in Problem-based Learning*

KIM-THU PHAM, MD, MPH[1] & PHYLLIS BLUMBERG, PhD[2]

[1]*Coordinator , Public Health Practice, Yale University School of Medicine, USA; and* [2]*Director of Teaching and Learning Center, University of the Sciences in Philadelphia, USA*

ABSTRACT **Background:** *Medical training traditionally focuses on disease diagnosis and management. The need to incorporate preventive medicine, economics, and health promotion is increasingly apparent. Because problem-based learning (PBL) encourages multidisciplinary thinking, it is ideal for linking traditional medical education and population-oriented training. Although use of PBL has grown in medical education, cases typically focus upon patho-physiology, diagnosis, and therapy of individuals. Even when cases are intended to integrate multidisciplinary topics such as behavioral sciences or prevention, the biological aspects are emphasized.*

Purpose: *To describe approaches to case design that emphasize population perspectives of health.*

Description: *Specific examples drawn from actual cases we have used illustrate how five basic components of a case—namely, title, context, intrigue, indicators of problem resolution, and tight structure—facilitate discussion of, and enhance concern for, population issues.*

Conclusion: *The literature indicates that health professional students tend to favor biological over population content in clinical cases. We illustrate how population content can be represented in specifically designed cases.*

Introduction: Individual versus Population Focus

Medical practice during most of this century has centered on diagnostic and therapeutic interventions for individual patients. Meanwhile, preventive medicine and public health have evolved as distinct fields, addressing the broader population health issues.

Author for correspondence: Kim-Thu Pham, MD, MPH, Department of Epidemiology and Public Health, Yale University School of Medicine, 60 College Street, PO Box 208034, New Haven, CT 06520-8034, USA. E-mail: kim.pham@yale.edu

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Toward the end of this century, bridges among these fields began to emerge. Over the last two decades, the US Preventive Services Task Force (1996), the Institute of Medicine (1994), and the *Journal of the American Medical Association* (McGinnis & Foege, 1993; Lantz *et al*., 1998) have published landmark reports and guides emphasizing the need to address previously under-recognized determinants of health: exposures to occupational, environmental, and social stressors and inequity in access to preventive and therapeutic health care. This population perspective addresses how these factors affect the incidence and prevalence of disease and adherence to recommendations, and provides the framework for evidence-based interventions in the contexts of organizational policy, health care regulation, and managed care (Fairfield *et al*., 1997).

Meanwhile, the venues through which medical students may apply their training have multiplied. These include clinical practice, education, hospital administration, health policy, and research. Hence, the term "population" applies to a patient practice, a geographically defined hospital catchment area, or a self-identified community.

Medical education has struggled to keep pace. Schools and residency programs are beginning to incorporate more preventive medicine, medical economics, and health promotion into their curricula (Raik *et al*., 1995; Cordes *et al*., 1996; Jonas, 1997; Wilkes *et al*., 1998). Yet Hiatt & Goldman (1994) contend that coverage of the "evaluative clinical sciences" such as epidemiology, statistics, cost-effectiveness, economics, or ethics has been inadequate. When population-oriented content is inserted into the curriculum, it may not receive adequate attention from students (Woodward, 1994). They prefer to emphasize biological content, often at the expense of psychosocial or population content (Raik *et al*., 1995).

Problem-based Learning: The Vehicle

Problem-based learning (PBL) encourages integrated, multidisciplinary thinking, and is thus a prime vehicle for bridging the gaps between traditional medical education and preventive, population-oriented education. Although most North American medical schools have adopted PBL for some or all of their classroom instruction (Boud & Feletti, 1991), cases typically focus on diagnosis and management for individual patients.

The curricula at two health professional schools that have provided leadership in the use of PBL, McMaster University in Hamilton, Canada, and Maastricht University, The Netherlands, were written to focus on the entire patient, emphasizing biology, prevention and behavior almost equally. Yet, researchers at these institutions have found that even with these integrated cases, psychosocial and population content are inadequately discussed, and rarely made into learning issues for further research (Solomon *et al*., 1992; Dolmans, 1994). A survey of the faculty at McMaster University found that facilitators felt the cases

and their learning issues were 70% biology, 15% behavior and 15% population (unpublished data, personal communication with G. Norman, 1994). An observational study revealed that some groups never raised relevant behavioral or population content. If the facilitator pushed the group, they briefly discussed some of these topics and then chose not to research them further (Solomon *et al.*, 1992). Still, these schools have found that cases specifically geared to population content ensure closer attention to these domains (Blake, 1992; Blumberg & Macpherson, 1991; Crankshaw & Rangachari, 1990).

Case Construction: Alternative Approaches

Crafting cases with a population perspective entails deviating from the highly predictable clinical pathology conference format, in which the protagonist is a health care provider, the subject is always the patient, and the objective is to determine diagnosis and therapy. In our first year of using population-oriented cases, cases resembled typical clinical cases. A review of the students' learning issues revealed that biomedical content drove discussions, whereas little attention was given to population content. Through successful revisions of these cases, we devised the following strategies for conveying a population perspective.

The Name of the Case

A major challenge of case development is engaging the reader in an appropriate learning direction. The first opportunity to do so lies in the title of the case. A disease entity or individual patient's name focuses learning on disease mechanisms and management. We have found that a broader title redirects thinking to population issues and helps students identify resources. For instance, a case initially titled "Osteoporosis" evolved into "Case-control studies" and focused on determinants of hip fracture risk and research methods.

The Context of the Case

Many realistic contexts are possible when a population, rather than an individual, serves as the target for health improvement. The contexts of our cases have ranged from management in the hospital setting to developing a "Healthy Communities" program.

Consider a case addressing unintentional childhood asphyxiation. In standard medical training, such a case might focus on treating a child who has choked on a small toy, and review airway anatomy. The case that we designed highlights developmental behavior and the roles of legislation, media, and product regulation. The students' goals become to increase public awareness, reduce childhood injury, and advocate for change.

Keeping the Case Intrinsically Interesting

Population-oriented cases may emphasize critically reviewing literature, making policy recommendations, or serving in decision-making task forces and, thus, may not have this same intrinsically motivating sleuthing aspect of a clinical diagnostic dilemma. The method of "progressive disclosure," through which pertinent details are provided gradually, proves useful in this setting.

To further increase interest, cases might contain information reflecting real-life situations, derive from recent medical news, quote controversial articles or popular media, or present traditional topics from a new perspective. Attention to the many stakeholders involved in health promotion activities and disease and disability prevention add to the potential richness of population-oriented cases.

Indicators that the Problem Is Solved

As with some cases of medical management, various solutions are frequently viable for population-based problems; however, some solutions may be preferred over others. Alternatively, some population/public health problems cannot be solved; only incremental steps toward solution might be feasible. These realities should be presented not as disappointments but as sparks for further endeavors and creative approaches.

Loosely Structured versus Well Structured

Barrows[1] suggests that the medical problems within PBL "need to be ill structured," and should lead students in many potential directions. This challenge seems meant for cases that follow the formula of the clinical pathology conference, in which structure is implicit (i.e. presentation of signs and symptoms, history and physical, laboratory and study findings, and differential diagnosis) and care needs to be taken to ensure that the students don't become too narrowly focused prematurely. In contrast, exercises that may be incorporated into population-oriented cases are as diverse as the contexts involved. Examples of tasks range from investigating an epidemic; considering the components of a health education program; drafting an editorial on a health issue; developing a focus group questionnaire; to devising an organizational chart for a health system or practice.

Given the diversity of problems and tasks in population-oriented cases, care must be taken lest learners become overwhelmed by the possibilities and not meet the learning objectives deemed essential by faculty. The facilitator should also reinforce the objectives. However, as with traditional medical cases, the importance of students generating their own learning issues cannot be overestimated (Norman & Schmidt, 1992).

Appropriate Level of Learners

The population-based perspective, especially cost containment, has traditionally

been reserved for residency training or for continuing medical education. However, it is becoming increasingly apparent that these principles should be incorporated throughout medical education.

Extracts from Five Illustrative Cases

The following examples illustrate how strategic use of case design techniques yielded cases that both elicited appropriate learning issues and stimulated student interest.

Curriculum Case Study 1: Defining Health Improvement

> The State of Pennsylvania is comprised of 67 counties; eight have functioning Departments of Public Health. You are Commissioner of one that does not …
>
> … A multi-vehicle collision has resulted in the deaths of seven final-year high school students returning from their graduation party. Several were known to have been drinking heavily. Amidst this tragedy, there has been one positive effect: to mobilize community residents in their call for a division within the Department of Public Health devoted to disease prevention and health promotion.

The general title compels students to begin with a key definition of "health." The case continues, highlighting competing interests and their impact upon health promotion measures:

> … You have often heard government officials argue, "we don't have any health problems in our community," or refuse to fund health-related programs because "that would mean higher taxes" … Over the course of the next week, you call upon members of the community who are professionals in fields that have impact upon health care … You begin the first discussion with, "I think we should start by defining health …"

Specific tasks emerge, e.g. defining individual and population health, identifying indices of health, recognizing a variety of stakeholders. Invoking the method of progressive disclosure, some guides are slowly unveiled:

> … Several of the panel members begin by outlining commonly used dimensions of health, such as physical, emotional, behavioral, mental, functional, social, and environmental.

Through this case, students are introduced to the broad definition of health first formalized by the World Health Organization in 1946. This case emphasizes

that problems frequently do not lend themselves to single "best" solutions, but instead to a multitude of incremental interventions.

Curriculum Case Study 2: What? Measles Deaths in 1991?

> A raging controversy has been unfolding in the headlines of the local newspaper … Today's edition: Tuesday, February 19, 1991, Page B1. "City sees measles subsiding but 23 from churches still ill." S. Fitzgerald.
>
> The measles outbreak that has claimed the lives of five children from two religious congregations shows signs of winding down … Two of the 23 children who still have measles were in fair condition yesterday … after getting hospitalized under court order on Sunday when their parents refused to allow medical treatment.
>
> In recent weeks, measles has spread rapidly among hundreds of children … You and your team have been very interested in identifying health beliefs, social, and cultural factors that might influence immunization behaviors.

This case is based upon an epidemic that actually occurred in Philadelphia, where our school is located. As the case evolves, students must learn infectious disease epidemiology, immunization recommendations, and the social and cultural factors that influence individuals' immunization behaviors. The case recounts how court-mandated immunization of these children incited ethical and legal debate on a national scale. Explicit notes included in the faculty facilitator's guide help to maintain a focused discussion in the face of such complex issues, e.g.:

- identify cues to action (Health Belief Model) in this setting: media coverage, health professionals' recommendations, legal action, societal pressure; and
- identify gaps and redundancies in health services as potential barriers to action and targets for intervention.

Direct quotes from the local newspaper provide context and content, and offer a richness that fiction could never have duplicated.

Curriculum Case Study 3: Epidemics

> You are responsible for the Employee Health Service … at a large University Hospital in an urban location … over the past 36 hours, a total of 22 hospital employees have come down with a "flu-like" illness and so far six (6) of them have been hospitalized …
>
> … You must consider that the health and welfare of the entire workforce as

well as patients and visitors could be in jeopardy. You need to develop a plan to assess the risks, communicate whatever those risks may be, and address the possibility that a true epidemic may be occurring …

Students are faced with investigating the epidemiology of an infectious disease outbreak. The disease pathogen, *Legionalle pneumophilia*, is not revealed until the close of the case. This tactic, in conjunction with the broad title of "Epidemics" encourages mastery of general concepts of host, agent, nosocomial infection, environmental factors, and association versus causation, before delving into the specifics of a particular infectious disease entity.

Curriculum Case Study 4: Observational Studies: Birth Outcomes

This "tale" unfolds in the form of a standard manuscript, walking through the process of defining a research question, planning a study, and conducting preliminary data analyses.

BACKGROUND

The United States is ranked number 23 in the industrialized world with respect to infant mortality rate. Given the tremendous wealth and technological resources of this country, this ranking is somewhat surprising and certainly disturbing. In 1985, the Institute of Medicine convened a panel to study low birth weight and preterm delivery—the leading causes of infant mortality in the US … The following study … was undertaken to expand the search for possible risk factors and to explain the long-standing racial group differences in rates …

METHODS

In order to identify new factors that might explain racial group differences in birth outcomes, the investigators wanted to include women from several different racial groups …

… Some members of the research team felt that very few subjects would be lost to follow-up in such a short period of time, so that a prospective study would be feasible. Other team members pointed out that prospective studies are very expensive because so many women must be followed in order to identify "cases." …Perhaps a case control design … would be more efficient …

… Taking into consideration the kinds of information needed for the study … some of the psychosocial factors might not be available in existing records, primary data collection … would be appropriate. Would it be best to collect such information from women during pregnancy or have them provide the data after delivery? …

… Next, they turned their attention to the question of where to find pregnant women in the selected ethnic groups. An obvious place to look

was prenatal care clinics. But not all pregnant women receive prenatal care …

A tightly structured case, this serves as a prime example of progressive disclosure. The "results" section requires the student to review common statistical concepts, and the case leaves students with the task of reviewing findings and implications for the "discussion" section.

Curriculum Case Study 5: Chronic Disease Epidemiology: Diabetes

For the first time in nearly 20 years, new policies for the diagnosis and management of diabetes mellitus (DM) are being formulated.You are a member of the current Expert Committee on the Diagnosis and Classification of Diabetes Mellitus that is developing these policies …… The oral glucose tolerance test (OGTT) is time consuming, and subjects find it relatively unpleasant. Therefore, many physicians do not order this test in non-pregnant patients …

…. The Committee debates whether the sensitivity of the fasting blood glucose (FBG) using a cutoff of 140 mg/dl is sufficiently high to warrant its continued use as a screening tool … In the meantime, realizing that it must consider not only the test characteristics but the practical application of the test, the Committee weighs the costs of the disease to the individual and to society: the increased risk of developing complications faced by individuals who remain undiagnosed and/or inadequately treated; the cost in health care dollars required to treat these complications versus the cost of controlling the disease; the cost of screening on a wide scale; and the cost to individuals erroneously diagnosed as diabetic …

A recent modification in the screening guidelines served as the basis of this case, challenging students to determine chronic disease management from a population perspective.

Discussion and Conclusion

The rigors of practice within a highly cost-constrained (and in many places, a managed care) environment, and the recognition that providers must offer more than cure of disease, require that medical education broaden its perspective. Yet, it would be insufficient to simply expose students to population terminology or tools, the classic examples being courses in epidemiology or statistics. The ideal medical curriculum envisioned by faculty and administrators of 17 US and Canadian medical schools has the following characteristics: (1) patient-centered, (2) integrated, (3) developmental, and (4) population-based (Tresolini & Shugars, 1994). One such official notes that "although classroom instruction in

principles of epidemiology is important, students also need to know 'how to connect epidemiology with actual practice'."

Indeed, Greenlick (1996) observes, "training physicians for both the 1-to-1 role set," consistent with Hippocratic tradition, "and the 1-to-n role creates for us a very different medical education task" from the traditional mold. Inui[2] has described particular competencies for practicing in a population-based setting, which include managing information and resources, and integrating practice guidelines with clinical judgement.

Problem-based learning, a multidisciplinary approach to learning, by nature lends itself to the inclusion of public health/population health concepts. We have found, as have others (Solomon *et al.*, 1992; Dolmans, 1994), that achieving a population perspective is not a straightforward task. As we have sought to illustrate, population-oriented cases differ in multiple ways from clinical, individually-oriented cases and can take various forms. While this article has focused upon medical education, the principles presented herein are applicable to the education of all health care professionals.

Notes

1. Barrows, H. (presenter) (1997). Panel session, "What do we mean by problem-based learning? Toward a terminology to better classify and describe some approaches to learning." American Educational Research Association, Annual Meeting, Chicago, IL, March.
2. Inui, T. (1994) The provider's role in population-based care: essential tools and skills. Keynote address to the Group Health Cooperative of Puget Sound's Symposium, "Population-based care: protecting life across the life span," Seattle, WA, September, 30.

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