

# A Multidisciplinary Course on Injury Prevention and Control for Medical Students

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## ABSTRACT

**Purpose:** Medical student education has begun to embrace integration across specialties in order to improve understanding of diseases. The Medical College of Wisconsin's Trauma and Injury Control course was developed to expose students to the science, principles, and practice of injury prevention and control, with emphasis on collaboration among disciplines. This paper describes the development, implementation, and evaluation of that course.

**Methods:** This retrospective study evaluated learner satisfaction and knowledge gained during a fourth-year selective from March 2007 to 2009. The educational experience provided unique activities developed through an interprofessional approach. Student assessment included oral presentations, small-group discussions, and participation in activities. Students evaluated the quality of the experience using written narrative evaluations. Two independent, blinded raters analyzed student narratives using the constant comparative method associated with grounded theory.

**Results:** Thirty-seven students completed the course and provided comments. Evaluations demonstrated high satisfaction. Five themes emerged as strengths and outcomes: (1) recognition of injury as preventable, (2) variety of interactive educational experiences, (3) understanding physician's role in injury policy, (4) opportunity to see the system of injury care, (5) recognition of injury as a disease. Criticisms of the course related to problems with coordination.

**Conclusion:** Horizontal integration of the teaching of injury is feasible and should be promoted as a valued instructional technique.

## INTRODUCTION

Injuries have a far-reaching impact on individuals, families, the health care system, and society through premature death and disability, medical costs, and lost productivity. Injury is the leading cause of death for those between the ages of 1 and 44, and accounts for over 29 million yearly emergency department visits for nonfatal injuries.<sup>1,2</sup> Health care costs associated with injury account for approximately 12% of annual US medical costs.<sup>3</sup> Thus, preventing and controlling injuries has become a major health care challenge.

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Reducing the burden on injuries requires that physicians be trained in public health and prevention. However, in 2005, the Association of American Medical Colleges issued a report describing the current lack of training for medical students in injury prevention and treatment.<sup>4</sup> The report's Advisory Panel recommended an increase in training and development of clearly defined objectives so that upon graduation, all students have a basic understanding of injury prevention and control. The panel also suggested that educators use a variety of strategies, including didactic sessions and experiential learning exercises, to increase support, interest, and collaboration among health care providers.<sup>4</sup>

The Liaison Committee on Medical Education (LCME) Educational Directives mandate medical student participation in experiences that emphasize and demonstrate effective delivery of

multidisciplinary care and services.<sup>5</sup> Students must be able to demonstrate an understanding of the larger context and system of health care and draw upon system resources to provide optimal patient care.<sup>5</sup>

The fourth-year selective allows students to tailor their educational experience to meet their needs prior to entering graduate training. During the fourth year, a student can begin to absorb the totality of information they have experienced during medical school. Cognitive theory suggests that integration of this information is critical to a functioning physician.<sup>6-9</sup> However, a common weakness among many graduating physicians is the ability to function in a collaborative manner with adequate communication across disciplines and professions.<sup>10</sup> According to the 2003 Institute of Medicine Summit on Medical Education Report: *Health Professions Education: A Bridge to Quality*, "All health professionals should be educated

to deliver patient-centered care as members of an interdisciplinary team emphasizing evidence-based practice, quality-improvement approaches and informatics.”<sup>11</sup>

This paper describes the development, implementation, and evaluation of a course on injury prevention that emphasizes collaboration among disciplines.

## METHODS

The Trauma and Injury Control selective is one of several fourth-year courses medical students may take to fulfill their fourth-year integrative course requirement at the Medical College of Wisconsin (the College). This 1-month course, which was first offered in 2007 in its current form, is held twice a year for up to 8 students per course. Using the expertise of faculty and other health care professionals affiliated with multiple disciplines and professions, the course introduces students to the field, science, principles, and practice of injury prevention and control.

A group of adult and pediatric trauma surgeons, emergency medicine physicians, physical medicine and rehabilitation (PM&R) physicians, and educational specialists developed the course and identified 4 core objectives (Table 1).

The course curriculum includes weekly discussion sessions; multidisciplinary, injury-related experiences; independent learning activities; and 20-minute student presentations for peers, course faculty, and administrators.

An administrative team typically meets 2 or 3 months prior to each course to plan and organize the necessary components. This team includes course co-directors (a physical medicine and rehabilitation physician and a trauma surgeon), the Division of Trauma Surgery’s coordinator, the Rehabilitation section’s administrator, and the Injury Research Center’s coordinator. They are responsible for course preparation and evaluation, including organizing course materials, scheduling discussions and learning experiences, procuring supplies and equipment, and arranging classrooms.

### Instructional Process

At the beginning of the course, a needs assessment is conducted using a pre-course quiz and small-group discussion for each student cohort. The quiz serves as a primer to increase learners’ awareness of their current level of understanding regarding injury as a disease process; it is used again at the course’s completion to illustrate knowledge growth. This format creates a learner-centered approach to the educational process.

The course co-directors build upon the initial needs assessments through a series of weekly small-group discussions with injury experts. Students participate in discussions about the unique characteristics of injury as well as the fundamental differences between the concepts of “injury” and “accident,”

**Table 1.** Course Core Objectives

At the end of the 1-month course, each student will be able to:

- Describe injury as a disease process.
- Describe the principles of the scientific field of injury prevention and control.
- Demonstrate an enhanced awareness, appreciation, and knowledge of the consequences and impact of injuries.
- Describe how injury prevention and control will have an impact on their future health care careers.

which is facilitated through the presentation of an injury prevention and control model and discussion of Haddon’s matrix.<sup>12</sup> The injury model and Haddon’s matrix help students understand the essential elements of the scientific field of injury prevention and control, and provide a framework for analyzing the impact of injuries and phases of injury: prevention, acute care, and rehabilitation.

Each subsequent small-group session consists of 2 to 3 faculty presentations, journal article reviews, and interactive discussions. Medical and surgical subspecialists involved in injury-related clinical care and research serve as presenters and facilitators.

The course employs experiential learning activities in a variety of nontraditional locations and incorporates interprofessional exposure to highlight the broad impact of injury across specialties and professions (Table 2).

### Experiential Learning Activities

The students’ first learning activity exposes them to the trauma system and the multidisciplinary team of professionals who work together. During this 3-hour experience, students follow the path of the injured patient through the health care trauma system. They witness the amount of resources and systems coordination required to care for patients, and they meet with emergency medical system and triage personnel, emergency physicians, trauma surgeons, nurses, radiologists, intensivists and hospitalists, physiatrists, therapists, social workers, and discharge planners to learn about their training, roles, and responsibilities.

Given that a substantial number of injuries are fatal and never “enter” the system of care, another primary learning activity is a weekly visit to the Milwaukee County Morgue. Students observe injury-related autopsies performed by the medical examiner, then discuss the risk factors and causes, biomechanics/forces, and consequences of various fatal injuries.

The students also spend time in the emergency department and intensive care unit. They attend inpatient rounds, which provide exposure to information about the causes, consequences, and early hospital management of injured patients. Students focus on initial utilization of resources, the importance of a multidisciplinary team, and the need for effective communication and timely delivery of effectual care and services.

**Table 2.** Experiential Learning Activities

| Activity                                     | Description   |
|--|---|
| Trauma System Experience                     | 3-hour walking tour of hospital trauma system<br>Case-based exploration of path of injured patient from ambulance or helicopter transport to rehab unit<br>Health care providers within each area provide insight and description of their role in care of injured patients and the trauma system |
| Medical Examiner                             | Weekly immersion at Milwaukee County Morgue<br>Observe injury-related autopsies<br>Discussion of causes and biomechanical consequences of ultimately fatal injuries   |
| Emergency Department/<br>Intensive Care Unit | Rotations in emergency department and trauma intensive care units<br>Focus on early hospital management<br>Discuss resource utilization<br>Demonstrate necessity for teamwork and timely communication  |
| Wheelchair Day                               | One day spent using a wheelchair for transport<br>Assigned to visit various locations around medical campus to demonstrate challenges to mobility<br>Identify and discuss environmental modifications necessary after significant injury  |
| Patient Interview                            | Personal interview with injured and permanently disabled patient<br>Focus on cause, consequences, and challenges to long-term recovery  |
| Vehicle Crash Laboratory                     | Witness simulated crash at Milwaukee Veterans Affairs Vehicle Crash Laboratory<br>Observe the biomechanics and science related to vehicle safety and design   |
| Independent Study                            | Perform selected chart reviews to identify challenges to the trauma system associated with communication, consults, and documentation<br>Carry trauma pagers for entire month and track volume and type of trauma activations to increase awareness of resource consumption and burden            |
| Personal Journal                             | Keep daily journal documenting feelings and thoughts about the experience<br>Encourage self-awareness and reflection to generate discussion during month  |
| Student Presentation                         | Each student prepares and gives a 20-minute presentation on an injury-related topic of his or her choice<br>Discussion and feedback provided by course faculty  |

Students also learn, first-hand, the challenges of using a wheelchair as the primary means of mobility. Each student receives a wheelchair to use for an entire day as they visit various locations around the medical campus. Following the experience, students reflect on their personal discoveries, including physical barriers they experienced as well as interactions with strangers and acquaintances. They discuss modifying the environment for people with impairments and disabilities.

Students meet and interview an individual who has been injured permanently and is now living with life-long impairments and disabilities. They hear how the injury has affected the individual as well as the lives of his or her family and sig-

nificant others. The individual's ability to gain employment, pursue a career, and be productive professionally is discussed.

Students visit the Milwaukee Veterans Affairs Vehicle Crash Laboratory, a federally funded research facility, to witness a simulated crash. This enables them to observe the science of biomechanics of motor vehicle crashes and to witness the effect of physical forces on the vehicle and crash test dummies. The Vehicle Crash Laboratory experience relates to discussions about the history and development of vehicular safety, including the strategies and techniques used today to prevent serious motor vehicle injuries.

### **Individual Independent Study and Written Assignments**

In addition to the experiential learning activities described above, students carry trauma pagers; record the pages; and research, document, and discuss select cases with faculty. They conduct selected chart reviews and discuss the clinical course of injured patients focusing on resource consumption and system of care with faculty.

Throughout the course, each student keeps a daily journal to document his or her personal feelings, thoughts, and ideas. This is intended to encourage them to reflect on their experiences, identify what they have learned, and recognize their changed perspectives.

At the end of the course, each student prepares and delivers a 20-minute oral presentation on a topic of his or her choice in the area of injury prevention and control. Students apply the principles of Haddon's matrix and incorporate into their presentations the issues and principles discussed throughout the course.

### **Assessment Methods**

Course faculty use predetermined criteria, tools, and rating forms to evaluate students based on participation and completion of the required assignments. Students are assessed through a variety of methods including pre- and post-tests, participation in group discussions, attendance and participation in the

active-learning experiences, completion of the daily journal, chart audits of selected trauma patients, and final oral presentations.

Students evaluate each learning activity at the end of the course by responding to the following 4 questions:

- What are the highlights of the course?
- What could be improved?
- Would you recommend this course to others?
- How did this course change your perspective of trauma and injury control?

Faculty analyze the evaluations and use them to revise and modify the course and its components.

For this paper, the authors analyzed all written comments and identified themes and subthemes by using the constant comparative method associated with grounded theory.<sup>14,15</sup> Two independent raters (TW, LH) then coded each theme, and after all comments were analyzed, the raters compared themes. They achieved consensus iteratively through reanalysis of all comments and coding, then tabulated comments within each theme according to the number of times each theme was indicated by the students. As this study was solely a review of the course itself, the authors did not seek Institutional Review Board (IRB) approval, consistent with our institution's human research protection guidelines.

## RESULTS

Researchers analyzed the comments from all 37 students, which demonstrated high satisfaction with the course. Thirty-two students provided positive comments and there were no negative responses to the question "Would you recommend this course to others?" Seventeen comments identified communication and coordination as an area needing improvement. Five themes emerged as the greatest strengths and outcomes of the selective: (1) recognition of injury as preventable, (2) variety of interactive educational experiences, (3) understanding physician's role in injury policy, (4) understanding the system of care, (5) recognition of injury as a disease (Table 3).

*Recognition of Injury as Preventable.* Students highlighted a new understanding and awareness that trauma and injury is preventable. They found the focus for prevention differed from their typical focus on acute care treatment. Comments included, "I now have a better understanding of the preventable nature of many injuries," and "I see now that everything could be prevented."

*Variety of Interactive Educational Experiences.* One of the course's greatest strengths appears to be the variety of unique, innovative, educational experiences provided during the month-long course. Student comments consistently identi-

**Table 3.** Themes Identified (N=37)

| Themes  | Number of related comments |
|---|----------------------------|
| Recognition of injury as preventable            | 20                         |
| Variety of interactive educational experiences  | 13                         |
| Understanding physician's role in injury policy | 15                         |
| Understanding the system of care                | 11                         |
| Recognition of injury as a disease              | 6                          |

fied the following as specific course highlights: the "wheelchair experience," which elicited 17 comments, "medical examiner" (13 comments), "system of care" (12 comments), and the "crash lab" (10 comments).

*Understanding Physician's Role in Injury Policy.* Students established a new understanding of the physician's role in societal and community injury policy. They developed an appreciation for their future roles in shaping policy and laws regarding injury prevention. Several comments described being proactive in policy decisions as future goals. One student said, "The biggest impact this course has had is to further my interest in policy." Another wrote the course "helped me realize that an individual can make a difference."

*Understanding the System of Care.* Students better appreciated the team approach to trauma care and injury prevention. They also recognized the broad array of professionals needed to care for patients from the time of injury to the rehabilitation stages of recovery. Students frequently described "a greater appreciation for how the trauma system works and how injury cases are handled."

*Recognition of Injury as a Disease.* Students noted that the course provided them with new insight into injury as a disease process. One student wrote, "I now view injury as a disease that is preventable rather than just treatable."

*Room for Improvement: Communication and Coordination.* One common theme arose from the question "What could be improved?" Seventeen comments highlighted the difficulty in coordinating the integrated experience across specialties and locations. Comments pointed out instances where expectations were not clear, and communication breakdowns had occurred in planning immersive experiences. Comments included: "I felt that in a few of the sessions people were not expecting me," and "When I showed up... they didn't know exactly what to do with me."

Pre- and post-test results demonstrated a modest knowledge increase. Both tests were identical, 44-question multiple-choice examinations. The average pretest score over the 2-year study period was 71% (range 61%-83%) vs 77% (range 57%-87%)

on the post-test. Using student's t-test to assess for significant improvement in knowledge gained, this overall 6% cumulative average increase did not reach statistical significance ( $P=0.06$ ).

## DISCUSSION

The Trauma and Injury Control Selective is an innovative 1-month course for fourth-year medical students at the Medical College of Wisconsin that focuses on the injury prevention and control field and the delivery of effective multidisciplinary care and services. Based on principles of active learning and learner engagement, the highly successful course employs simulation and experiential education as fundamental teaching methods.<sup>13</sup>

Much of the course's success is attributable to the innovative integration of the educational experience across disciplines and professions. Many medical schools currently are considering vertical and horizontal integration of educational experiences in their curricula,<sup>9</sup> but much of the emphasis has been in areas such as cancer, genetics, and cardiovascular. Trauma and injury control has been ignored largely in student training.

Injury is a disease process well-suited for integration of inter-professional management concepts and systems-based practice principles. As demonstrated by our evaluation data, when students receive exposure to the longitudinal patient experience through the course of an injury, they develop an appreciation for the concept of injury as a disease with a specific etiology, pathophysiology, and outcome.

This fourth-year selective has proven itself an effective method for introducing injury control principles to students; however, it is reaching a small percentage of the medical school population. Further development and implementation of similar teaching strategies and programs should be considered. Vertical integration of instructional methods and material is one of the goals for the College's curriculum.

The Trauma and Injury Control Selective is a very complex course that requires coordination of extensive resources, multiple components, multidisciplinary faculty, and detailed individual and group schedules. It requires significant planning and committed administrative support. The administrative group typically meets 2 or 3 months prior to each course to plan and organize the necessary components. The course continues to evolve primarily in the advanced preparation and recognition of potential scheduling pitfalls. Suggested new experiences are vetted among the course directors and staff with an eye on continued innovation and improvement.

Of course, there are limitations to wide dissemination of this type of learning experience. Much of the program's success can be attributed to the unique active-learning experiences. However, limitations such as space, equipment, time, faculty, and financial resources present challenges when trying to accom-

modate all students. Because a variety of spaces, resources, and faculty are needed, scheduling and coordinating the course requires significant administrative support.

There also are limitations to this report. The small cohort of students who have enrolled and evaluated the course to date limits the ability to generalize our results. Most of the learners had some interest in injury; therefore, their evaluations may have been biased by preconceived ideas and opinions. To date, 30% of the students who completed the course matched into surgery or one of the surgical subspecialties. Another 24% matched into emergency medicine programs. No data is available currently to provide long-term impact information regarding pursuit of injury prevention and control as a career or scholarly focus. Additionally, the pre- and post-test results show only a modest increase in knowledge gained; however, the results of the qualitative analysis support attainment of the course objectives. Revision of the test may be necessary to better assess the real knowledge gained during the course.

Despite these limitations, we feel the Trauma and Injury Control Selective can serve as a model for utilizing an inter-professional approach to teach medical students about injury as a disease and integrating the principles of injury prevention and control into the medical school curriculum.

We hope that by increasing opportunities in other medical schools, we can improve physician knowledge about their important role in preventing and treating injuries, which will lead to better treatment and prevention of fatal and nonfatal injuries.

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