# Occupational Exposures and Knowledge of Universal Precautions Among Medical Students

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*Purpose- To examine the relationship between occupational exposures and knowledge of universal precautions among medical students. Method: Graduating medical students were given a survey regarding occupational exposures suffered during their clinical rotations. The survey also tested students' knowledge of universal precautions by asking them to indicate what combination of gloves, mask, and eyeshields should be worn to satisfy universal precautions for ten common procedures. Results: At a seminar one week before graduation, 45 senior medical students were given the questionnaire. The response rate was 100%. 84% of the surveyed students suffered at least one occupational exposure during their clinical training. Of those who had an exposure, 42% reported at least once to an exposure center. The mean percentage of correct answers on the protective equipment questionnaire was 71%. No correlation between number of exposures and score on the protective equipment questionnaire was found (r=0.0). Conclusion: Occupational exposures to blood are common among medical students. Few students report to exposure centers. Knowledge of universal precautions may not correlate with reduced risk of occupational exposures among medical students.*

## Introduction

Accidental exposures to patient blood and body fluids are common among healthcare workers. To address this problem, the Centers for Disease Control introduced universal precautions in 1987. In 1991, the use of universal precautions was prospectively shown to decrease occupational exposures among practicing physicians.[1] In 1992, the American Association of Medical Colleges recommended that medical schools teach universal precautions to students prior to their clinical rotations. At the time, several studies suggested that occupational exposures were common among residents and medical students. A survey at University of Southern California - Los Angeles County found that 71% of surveyed residents and medical students suffered at least one occupational exposure in one training year with only 9% of exposures being reported.[2] Another survey at the University of Washington found that 48% of their graduating medical students had experienced occupational exposures.[3] These statistics are worrisome, and they emphasize the need for efforts directed at reducing occupational exposures among medical students. While most medical schools have implemented universal precautions training, it is still unclear whether knowledge of universal precautions decreases a medical student's risk for occupational exposures. This study sought to explore the relationship between knowledge of universal precautions and frequency of occupational exposures among medical students at the University of Hawaii John A. Burns School of Medicine.

## Method

At a seminar one week before graduation, 45 senior medical students were given a questionnaire composed of two parts. The survey was collected at the end of the seminar. The first part of the questionnaire surveyed the number of occupational exposures experienced by students during their 3rd and 4th years of training and the number of times they sought clinical evaluation after an exposure. Occupational exposures were defined as contact with a patient's blood or body fluids via a needlestick, cut, or splash to a wound or mucous membrane. The second part of the survey assessed knowledge of universal precautions. Students were required to indicate what combination of gloves, mask, and eye-shields should be worn to complete each of ten procedures in accordance with standards obtained from Centers for Disease Control recommendations and review of the literature.[4] The ideal responses for each procedure, as listed in table 3, coincide with those from a similar study on universal precautions by Koenig and Chu.[5] The percentages of students who indicated the correct level of protective equipment utilization, under-utilization, and over-utilization were then calculated. The students were also asked attitudinal questions about their universal precautions training. The exposure data was then correlated with the scores on the procedures questionnaire and the attitudinal questions.

## Results

100% of the surveys were returned. The sample comprised 87% of the graduating class of 1997 at the University of Hawaii John A. Burns School of Medicine. These medical students had received yearly universal precautions training in the form of problem based learning cases, seminars, and audiovisual presentations as required

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by their curriculum. Students fulfilled most of their clinical rotations at university affiliated community hospitals in Honolulu, Hawaii. 76 exposures occurred among the 45 students. 84% (38/45) suffered at least one exposure (with a range of 0 to 4 exposures). 42% (n=16) of students who had at least one exposure, reported at least once to an exposure center (with a range of 0 to 2 reported exposures). The largest number of exposures occurred during surgery (n=19), obstetrics and gynecology (n=15), and emergency medicine (n=8). All but one of the exposures caused by another healthcare worker (n=15) occurred during surgical rotations. Table 1 lists the number of exposures by rotation. Table 2 summarizes the reasons given by students for exposures.

**Table 1. Number of exposures by rotation**

| Rotation | # Exposures |
|---|---|
| Surgery | 19 |
| Obstetrics and Gynecology | 15 |
| Emergency Medicine | 8 |
| Internal Medicine | 6 |
| Pediatrics | 3 |
| Medical or Surgical Intensive Care | 6 |
| Dermatology | 1 |
| Neurosurgery | 1 |
| Orthopedics | 1 |
| Family Practice | 1 |
| Cardiology | 1 |
| Plastic Surgery | 1 |
| Endocrinology | 1 |
| Rotation not specified | 12 |

**Table 2. Reason for Exposure**

| Rotation | # |
|---|---|
| Emergency situation | 17 |
| Patient moved | 16 |
| Carelessness | 18 |
| Exposed to body fluid by another health care worker | 15 |
| Other (glove broke (x4), instrumentation sharper than expected, in surgery, stuck by attending (2x), sprayed, poor visibility during suturing, pumping blood vessel, unknown, perforated an abscess, poor visibility, blood draw) | 13 |

The mean percentage of correct answers on the protective equipment questionnaire was 71%. The mean percentage of incorrect answers indicating over-utilization of equipment was 10.7%. The mean percentage of incorrect answers indicating under-utilization of equipment was 18.2%. Table 3 lists the procedures and student responses. No correlation was found between the number of correct answers on the protective equipment questionnaire and the number of exposures a student experienced (r=0.00).

89% (40/45) of surveyed students agreed with the statement "I feel that my knowledge of universal precautions is adequate". Agreement with this statement was negatively correlated with the number of exposures experienced by a student ($r=-0.41$, $p < 0.01$). 78% (35/45) of surveyed students agreed with the statement "I feel that I have been given adequate instruction on what to do in the event of a body fluid exposure". Agreement with this statement was negatively correlated with the number of exposures experienced by a student ($r=-0.35$, $p < 0.05$), but not significantly correlated with reporting to an exposure center.

## Discussion

Like earlier studies, this study found a high prevalence of occupational exposures among medical students. These findings, while not surprising, should be interpreted in light of several limitations. Since data was collected using a survey instrument, this study may be prone to reporting bias. Students may have under-reported or over-reported exposures. Under-reporting appears unlikely given that students were asked to recall potentially dangerous (i.e. not easily forgotten) events. Students may also under-report out of concern for being identified and placed at risk for negative academic consequences. To allay these concerns, this survey did not solicit personal information. Given the high prevalence of exposures reported in this study, perhaps the students over-reported exposures. The fact that most of the students reported only 1 or 2 exposures, with 4 being the most exposures reported by one student, does not suggest over-reporting. Furthermore, almost half of the exposed students in this study went to an exposure center suggesting that they were concerned enough about their exposure to seek further help and possible treatment. Like earlier occupational exposure studies, this study defines exposures as including both splash and percutaneous exposures. Although the risk of infection varies with the type of exposure, this study made no distinctions regarding the types of exposures suffered. The goal of this study was to assess prevalence of exposures and not risk of infection, and thus it was beyond the scope of this study to assess the seriousness of exposures. Hopefully, future research will address these matters.

Among our respondents who had an exposure, less than half reported to an exposure center. Prior studies have also found low rates of reporting among medical students.[2,3] Under-utilization of exposure centers is a concern since post-exposure treatment is available. For example, post-percutaneous exposure treatment with zidovudine has been shown to reduce HIV transmission by 79% and current guidelines contain recommendations for combination antiretroviral regimens.[6] While not all exposures require treatment, it is uncertain whether students are capable of assessing their need for post-exposure treatment. Thus, universal precautions training should emphasize prompt exposure reporting and the possibility of post-exposure treatment.

One recent study by Koenig and Chu[5] suggests that despite universal precautions training, many medical students do not know what protective equipment should be worn to be in compliance with universal precautions. Our study, which also assessed knowledge of protective equipment use, reproduces their findings. For several procedures, half of the students underestimated the recommended level of protection. Admittedly, the guidelines used to determine the correct level of protection in these studies were based on conservative recommendations. In practice, there is no universal agreement across different institutions regarding what protection is necessary

**Table 3. Numbers and percentages of 45 fourth-year medical students indicating correct, excessive, and inadequate use of protective equipment for ten common procedures. (*No response was indicated on one survey for this procedure)**

| Procedure (and correct response in parenthesis) | Correct level of protection No. (%) | Excessive protection No. (%) | Inadequate Protection No. (%) |
|---|---|---|---|
| Drawing blood (gloves) | 35 (78%) | 10 (22%) | 0 |
| Suturing (gloves, mask, and eyeshields) | 24 (53%) | 0 | 21 (47%) |
| Coughing patient. (mask)* | 17 (39%) | 18 (39%) | 9 (22%) |
| Handle Specimens (gloves) | 41 (91%) | 3 (7%) | 1 (2%) |
| Suctioning Airway (gloves, mask, eyeshields) | 21 (47%) | 0 | 24 (53%) |
| Endotracheal Intubation (gloves, mask, eyeshields) | 33 (73%) | 0 | 12 (27%) |
| Gastrointestinal lavage (gloves, mask, eyeshields)* | 33 (75%) | 0 | 11 (25%) |
| Inserting intravenous lines (gloves) | 34 (76%) | 11 (24%) | 0 |
| Casual contact (no protective equipment required) | 43 (96%) | 2 (4%) | 0 |
| Examining non-intact skin (gloves) | 37 (82%) | 4 (9%) | 4 (9%) |

for certain procedures. Thus many students may have seemingly underestimated the protection required because the guidelines of their institution did not recommend equipment deemed necessary by more conservative guidelines. Nevertheless, the fact that many students suffered occupational exposures suggests a need for all institutions to adhere to a validated and universally accepted protective equipment guideline.

This study found that students who felt they knew universal precautions well or knew what to do in the event of an exposure suffered fewer exposures, although they did not score better on the knowledge questionnaire. This may suggest that other aspects of universal precautions training, apart from teaching appropriate protective equipment usage, is beneficial. Since retrospective studies cannot confirm causality, an equally plausible explanation is that students who suffered fewer exposures were more confident about their knowledge of universal precautions.

Current attempts at exposure risk reduction have been directed at developing effective universal precautions training programs. Unfortunately, no study has clearly demonstrated that medical students benefit from universal precautions training. One recent survey of matriculating interns at five university affiliated hospitals found no correlation between universal precautions training and the risk of needlestick injuries, rate of exposure reporting, or completion of a hepatitis B immunization series.[7] Our study also did not find any correlation between universal precautions knowledge and number of occupational exposures among medical students. One recent study did show that medical students who scored well on a universal precautions questionnaire were less likely to suffer splash exposures, but those students still had an alarming exposure prevalence of 46% after one clinical year.[8] Thus, no study has clearly demonstrated a large benefit from teaching universal precautions to medical students. Therefore, future efforts should not only be directed at refining universal precautions training, but also at developing other measures to protect students. Given the high prevalence of occupational exposures among medical students, more study is also needed to clarify the risk factors for exposures in this group so that specific interventions may be developed.


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