IMPROVING INFLUENZA IMMUNIZATION RATES AMONG HEALTHCARE WORKERS CARING FOR HIGH-RISK PEDIATRIC PATIENTS

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ABSTRACT

OBJECTIVE: To assess influenza vaccination rates of healthcare workers (HCWs) in neonatal intensive care units (NICUs), pediatric intensive care units (PICUs), and oncology units in Pediatric Prevention Network (PPN) hospitals.

PARTICIPANTS: Infection control practitioners and HCWs in NICUs, PICUs, and oncology units.

METHODS: In November 2000, posters, electronic copies of a slide presentation, and an influenza fact sheet were distributed to 32 of 76 PPN hospitals. In January 2001, a survey was distributed to PPN hospital participants to obtain information about the immunization campaigns. On February 7, 2001, a survey of influenza immunization was conducted among HCWs in NICU, PICU, and oncology units at participating hospitals.

RESULTS: Infection control practitioners from 19 (25%) of the 76 PPN hospitals completed the surveys. The median influenza immunization rate was 43% (range, 12% to 63%), with 7 hospitals exceeding 50%. HCWs (n = 1,123) at 15 PPN hospitals completed a survey; 53% of HCWs reported receiving influenza immunization. Immunization rates varied by work site: 52% in NICUs and PICUs compared with 60% in oncology units. Mobile carts and PPN educational fact cards were associated with higher rates among these subpopulations ($P < .001$) (361 [63%] of 575 vs 236 [44%] of 541 for mobile carts; 378 [60%] of 633 vs 219 [45%] of 483 for fact cards).

CONCLUSION: Despite delayed distribution of influenza vaccine during the 2000–2001 season, immunization rates at 7 hospitals and among HCWs in high-risk units exceeded the National Association of Children's Hospitals and Related Institutions goal of 50% (*Infect Control Hosp Epidemiol* 2004;25:912-917).

Annual epidemics of influenza cause substantial morbidity and mortality in the United States, accounting for approximately 100,000 hospitalizations and 20,000 deaths annually.[1,2] Strategies for the control of influenza have included immunization of individuals at high risk for complications from the illness, their close contacts, and the healthcare workers (HCWs) who care for them.[3,4] HCWs are an important reservoir of infection, being implicated in the transmission of influenza to other HCWs and to patients during outbreaks in acute care or long-term–care facilities.[5-7] Influenza among HCWs is also associated with increased absenteeism. Such influenza-related absenteeism compounds the already severe nursing shortage, and the quality of patient care suffers.[8] Both HCW absenteeism and nosocomial transmission of influenza from HCW to patient increase hospital costs.[9,10]

Influenza immunization effectively prevents influenza in HCWs, subsequently decreasing the potential for transmission to other HCWs, patients, or visitors at the healthcare facilities. Additionally, studies have demonstrated a reduction in absenteeism in the winter due to influenza-like illness in HCWs who have received the influenza vaccine.[9,11,12] In 1997, it was estimated that the overall immunization rate of HCWs in the United States was 34%.[13] Despite recommendations by the Advisory Committee on Immunization Practices that all HCWs receive the influenza vaccine, national vaccination coverage for HCWs remains low, with an immunization rate of 36% reported in the National Health Interview Survey.[3] Little progress has been made in improving influenza immunization rates among HCWs despite a variety of interventions and incentives. Influenza immunization rates among HCWs having contact with high-risk pediatric populations are even lower, with rates of 15% to 20%

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Participating Pediatric Prevention Network hospitals included All Children's Hospital, St. Petersburg, FL; Blank Children's Hospital, Des Moines, IA; Hasbro Children's Hospital, Providence, RI; Children's Hospital of Eastern Carolina, Greenville, NC; Children's Hospital Los Angeles, Los Angeles, CA; Children's Hospital of Michigan, Detroit, MI; Children's Hospital of Wisconsin, Milwaukee, WI; Children's Hospital of the King's Daughters, Norfolk, VA; Children's Hospital, Denver, CO; Children's Hospital Medical Center, Cincinnati, OH; Children's Medical Center, Dayton, OH; Children's Medical Center of Dallas, Dallas, TX; Children's Memorial Hospital, Chicago, IL; Hospital for Sick Children, Toronto, Ontario, Canada; Kosair Children's Hospital, Louisville, KY; La Rabida Children's Hospital, Chicago, IL; Shriners Hospital for Children, St. Louis, MO; and Sioux Valley Hospital, Sioux Falls, SD.

among staff of neonatal intensive care units (NICUs).[14-17] Additionally, the delay in influenza vaccine distribution during the 2000–2001 season further threatened the success of hospital-based influenza vaccine campaigns.[18] In 1999, the Pediatric Prevention Network initiated a pilot multicenter influenza education campaign. Established in 1997, the Pediatric Prevention Network is the largest hospital-based prevention network, encompassing 87 children's hospitals in North America, South America, Europe, and the Middle East.[19]

In September 1999, the Pediatric Prevention Network distributed free educational materials to 21 member hospitals that requested them, including 40,000 influenza fact sheets, 340 color posters, and 9 electronic slide sets. Representatives from 13 hospitals participated in structured telephone interviews about their institutional influenza immunization campaigns. Twelve hospitals used materials from the Pediatric Prevention Network as one component of a hospital-wide immunization education campaign. The effects of the educational materials on influenza immunization acceptance could not be quantified. Immunization rates at participating hospitals ranged from 20% to 59%, well below the immunization rate targeted by the Centers for Disease Control and Prevention. This article describes a multicenter influenza education intervention conducted at Pediatric Prevention Network hospitals during the 2000–2001 influenza season.

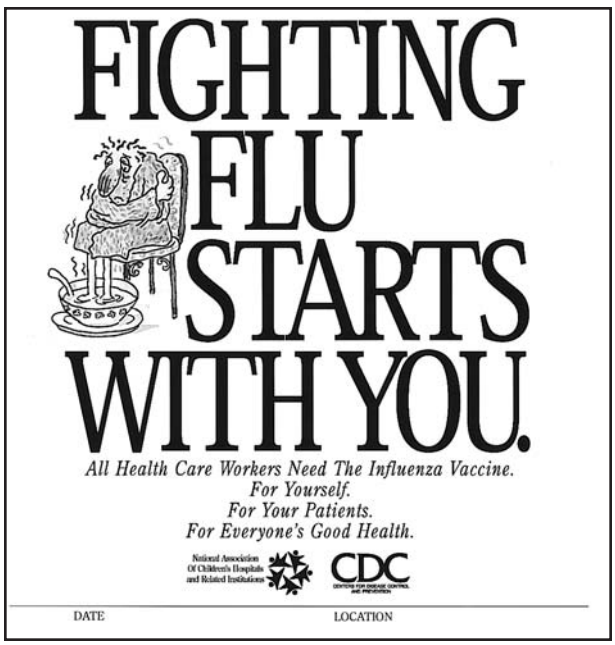

FIGURE 1. Pediatric Prevention Network poster encouraging influenza immunization for healthcare workers.

METHODS

In August 2000, posters were distributed to 76 Pediatric Prevention Network participants, encouraging influenza immunization (Fig. 1). A letter was sent to hospital administrators at 76 Pediatric Prevention Network hospitals urging their support for achieving HCW influenza immunization rates of 50% or higher. Additional educational materials, including a fact card about influenza immunization and a 57-slide electronic presentation, were offered on request. In January 2001, infection control personnel from hospitals requesting additional educational materials completed written surveys about institutional influenza immunization campaigns.

In February 2001, we conducted a point-prevalence survey of HCWs in NICUs, pediatric intensive care units (PICUs), and oncology units. Infection control personnel at participating hospitals distributed surveys to all HCWs who worked in those three units during a specified 24-hour period. HCWs were queried about their influenza immunization status and asked to rate their reasons for acceptance or refusal of influenza immunization on a 3-point Likert scale with the additional option of "not sure."[20]

Data were collected in standardized format and entered into SPSS software (version 10.1; SPSS, Inc., Chicago, IL) for analysis. Categorical variables were analyzed using Fisher's exact test or chi-square. Descriptive statistics were used to rank the reasons HCWs gave for vaccine acceptance or refusal in the point-prevalence survey. Analysis of variance was performed to determine any differences in reasons for vaccine acceptance or refusal among HCWs in NICUs, PICUs, or oncology units. Logistic regression was performed to determine which strategies employed at hospitals predicted influenza immunization acceptance by these HCWs.

RESULTS

Personnel at 32 Pediatric Prevention Network hospitals requested additional influenza educational materials. Infection control contacts at 19 (59%) of 32 hospitals returned completed questionnaires describing influenza immunization campaigns. Participants included 11 freestanding children's hospitals, 5 children's hospitals within larger hospital systems, and 3 pediatric specialty hospitals in the United States or Canada.

Hospitals received initial shipments of the influenza vaccine between September 6 and November 18, 2000. Influenza immunization campaigns began between October 7 and December 8, 2000. Personnel at freestanding children's hospitals (11 of 11; 100%) and specialty hospitals (3 of 3; 100%) were more likely to prioritize vaccine distribution according to recommendations of the Centers for Disease Control and Prevention[18] than were personnel at children's hospitals within larger hospital systems (2 of 5; 40%); groups designated as high priority varied among institutions. Of the 16 hospitals that used any prioritization scheme, 11 included children with high-risk medical conditions in the first group to receive the vaccine. At 5 hospitals, equal priority was given to children with high-risk medical conditions and designated groups of HCWs. Others preferentially distributed the vaccine to HCWs, including those who have contact with high-risk patients

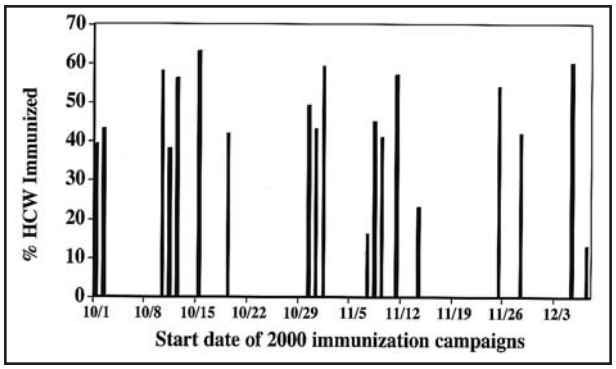

FIGURE 2. Hospital-wide influenza immunization rates reported by participating Pediatric Prevention Network hospitals by start date of the immunization campaigns. HCW = healthcare worker.

(2 of 16; 13%) or all HCWs with patient contact (3 of 16; 19%). At 19 hospitals, free vaccine was offered to HCWs. No hospital mandated influenza immunization of HCWs. At 15 hospitals, free vaccine was offered to attending physicians and residents. Personnel at only 2 hospitals reported insufficient supplies of influenza vaccine during the 1999–2000 influenza season to meet their needs. One hospital was unable to assess the adequacy of vaccine supplies.

Strategies used by hospital personnel during immunization campaigns included mobile carts (10 of 19; 53%) and vaccine deputies (7 of 19; 37%). Hospital personnel also provided influenza vaccine during evening (17 of 19; 89%), overnight (12 of 19; 63%), or weekend hours (12 of 17; 71%; data from 2 hospitals were unavailable). Some hospital personnel used educational interventions during their campaigns, including distribution of fact cards supplied by the Pediatric Prevention Network to employees (11 of 19; 58%) or display of Pediatric Prevention Network posters (12 of 19; 63%).

Hospital personnel reported HCW influenza immunization rates ranging from 12% to 63% (median, 43%); 7 hospitals achieved hospital-wide rates of 50% or higher (Fig. 2). Specific strategies to enhance availability and convenience, such as the use of mobile carts, vaccine deputies, or distribution of vaccine during evening or weekend hours, were not associated with higher immunization rates in hospital-wide immunization campaigns. In addition, the start date of immunization campaigns did not influence subsequent immunization rates. Although the hospital with the lowest immunization rate (12.5%) reported inadequate supplies of vaccine, another hospital achieved an overall HCW immunization rate of 54% despite a shortage of vaccine.

During the point-prevalence survey, 1,123 HCWs at 15 hospitals returned completed questionnaires (Table 1). Participating HCWs worked in 12 NICUs, 15 PICUs, and 13 oncology units. The median proportion of all HCWs employed in given hospital units who completed the point-prevalence survey was 29% for NICUs (range, 11% to 44%), 38% for PICUs (range, 6% to 77%), and 31% for oncology units (range, 10% to 68%). The influenza immunization rate among survey respondents was 53%; among HCWs in high-risk units at 11 (73%) of the hospitals, the HCW influenza immunization rate exceeded 50% (Fig. 3). At 8 (53%) of the hospitals, the HCW influenza immunization rate was greater than 50% in all high-risk patient care subpopulations surveyed. In one PICU and one oncology unit, the HCW influenza immunization rate was 100%.

TABLE 1
DEMOGRAPHIC CHARACTERISTICS OF POINT-PREVALENCE SURVEY RESPONDENTS OF PEDIATRIC PREVENTION NETWORK HOSPITALS, FEBRUARY 7, 2001

Characteristic	No.
Occupation	
Nurse	1,003 (70%)
Respiratory therapist	53 (5%)
Secretary	50 (5%)
Female	801 (73%)
Median age, y (range)	36 (20–69)
Median no. of years employed (range)	8 (0–41)
Work site	
NICU	438 (39%)
PICU	397 (35%)
Oncology unit	269 (24%)
Not specified	19 (2%)
HCWs immunized	597 (53%)

NICU = neonatal intensive care unit; PICU = pediatric intensive care unit; HCWs = healthcare workers.

The probability of immunization among HCWs in NICUs, PICUs, and oncology units was assessed with hospital use of posters, fact sheets, mobile carts, and deputies as predictors (Table 2). Both fact cards and mobile carts were associated with increased vaccination rates (model chi-square, 68.27; $P < .001$). Use of vaccine deputies was associated with lower immunization rates.

When we assessed reasons for vaccine acceptance or refusal by HCWs in NICUs, PICUs, and oncology units, a desire to protect one's patients was the most common reason cited by HCWs in high-risk units who received the influenza vaccine, followed by prior receipt of influenza vaccine. Interestingly, HCWs in oncology units were more likely than other HCWs to describe a desire to protect patients as being important in their decision to obtain influenza vaccine (oncology unit, 93%; NICU, 81%; PICU, 77%; $P < .001$). Other reasons for vaccine acceptance included a recommendation from one's personal physician or a high-risk medical condition, as well as a desire to protect one's family members, avoid influenza infection, and avoid missing work.

The most common reasons described as "extremely important" for vaccine refusal varied by work site. In NICUs, the three most commonly cited reasons for refusal included a belief that vaccine causes influenza

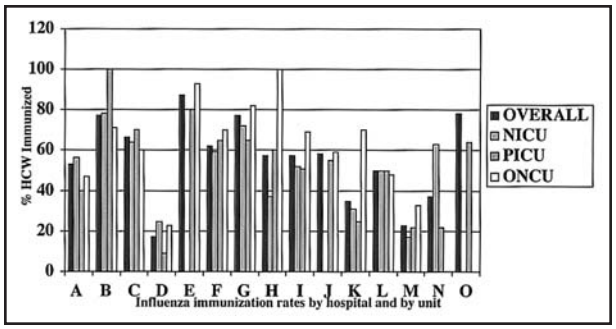

FIGURE 3. Rates of influenza immunization among healthcare workers (HCWs) caring for high-risk patients obtained from a point-prevalence survey of Pediatric Prevention Network hospitals, February 7, 2001. NICU = neonatal intensive care unit; PICU = pediatric intensive care unit; ONCU = oncology unit.

TABLE 2
IMMUNIZATION STRATEGIES AND INFLUENZA IMMUNIZATION RATES AMONG HEALTHCARE WORKERS IN NEONATAL INTENSIVE CARE UNITS, PEDIATRIC INTENSIVE CARE UNITS, AND ONCOLOGY UNITS OF PEDIATRIC PREVENTION NETWORK HOSPITALS

Immunization Strategy	Proportion Immunized (%)	*P*	Odds Ratio
Influenza fact cards			
Yes	378 of 633 (60)	< .001	1.8
No	219 of 483 (45)		
Mobile cart			
Yes	361 of 575 (63)	< .001	2.2
No	236 of 541 (44)		
Vaccine deputy			
Yes	206 of 467 (44)	< .001	0.5
No	391 of 649 (60)		

(61%), an allergy to the vaccine (57%), and inconvenience (53%). HCWs in PICUs refused influenza immunization because of concerns about vaccine side effects (41%), prior adverse reactions to the vaccine (41%), or fear of injections (41%). HCWs in oncology units refusing vaccine claimed they never catch the flu (33%), they believed the vaccine arrived too late to be effective (28%), or they had a vaccine allergy (24%). Only the proportion of HCWs who refused vaccine because of allergy differed significantly among the groups (NICU, 57%; oncology unit, 26%; PICU, 17%; $P = .031$).

DISCUSSION

During the 2000–2001 influenza season, problems with the manufacture of influenza vaccine delayed shipments to many hospitals, forcing the postponement of annual influenza immunization campaigns. Our study suggests that the impact of this delay was small at participating Pediatric Prevention Network hospitals. Hospitals where immunization campaigns were begun in November or later were just as likely to immunize high numbers of HCWs as were those where campaigns began earlier (Fig. 2). However, late receipt of influenza vaccine by hospitals and associated delays in the start of influenza vaccination campaigns appear to have adversely affected influenza vaccine acceptance, as a subset (4%) of HCWs reported vaccine refusal, in part, because they thought it arrived too late to be effective. In future years, when delays occur in the shipment of influenza vaccine, it may be important to inform HCWs that it is not too late to obtain vaccination or that immunization is still recommended even if the date is later than desired. Monitoring the local influenza activity is especially important when delivery of influenza vaccine is delayed. In 21 (84%) of the past 25 influenza seasons (1976 to 2001), the peak of influenza activity was in January or later.[3]

Immunization rates at participating Pediatric Prevention Network hospitals generally exceeded the rate of 38% reported in the 2000 National Health Interview Survey.[3] Seven hospitals achieved hospital-wide rates that exceeded the goal of the National Association of Children's Hospitals and Related Institutions of 50% (Fig. 2), as did 11 high-risk units participating in the point-prevalence survey (Fig. 3). HCW influenza immunization rates in NICUs, PICUs, and oncology units observed in the point-prevalence survey were generally higher than the hospital-wide immunization rates reported at the same institutions.

A desire to protect patients was the primary motivational factor for HCWs with contact with patients at high risk for complications from influenza. The finding that HCWs in oncology units are more likely to articulate a desire to protect patients as a reason for receipt of influenza vaccine is provocative. Studies describing high mortality rates associated with nosocomial viral respiratory infection in immunocompromised patients, especially bone marrow transplant patients, may have led to a heightened awareness among HCWs in oncology units.[21-23] The second most common reason for obtaining influenza vaccine cited by HCWs in high-risk units was that the individuals always get the vaccine. Education of HCWs during their training years or as they enter the healthcare field about influenza transmission risks and serious consequences associated with nosocomial influenza may influence new HCWs to become immunized for the first time and establish the desired tradition of annual influenza immunization.

Despite participation in this Pediatric Prevention Network influenza immunization initiative, there were exceedingly low rates of immunization in some hospitals and among HCWs in some high-risk units as demonstrated by the point-prevalence survey. The major reasons listed for vaccine refusal by each group of HCWs in a high-risk unit differed; however, reasons for vaccine refusal in this study mirrored those in previous reports, including inconvenience, perceived vaccine side effects, a belief that vaccination may cause influenza, and a fear of needles.[24-27] Intranasal influenza immunization has been suggested as an attractive alternative for HCWs with a fear of needles.

An intranasal (live attenuated) influenza vaccine was licensed in June 2003 for use in healthy individuals 5 to 49 years old. Transmission of the live attenuated vaccine virus to other nonvaccinated individuals has been demonstrated in studies in day care centers.[28] Because of a theoretical risk of transmission of live attenuated vaccine virus, the Advisory Committee on Immunization Practices has recommended that inactivated influenza vaccine be given preferentially to household contacts of and HCWs who have contact with severely immunosuppressed patients.[29] However, no preference exists for HCWs who do not have contact with severely immunosuppressed patients. The increased cost of the intranasal vaccine could be prohibitive for occupational and employee health services that provide the vaccine free of charge to HCWs.

This study, like prior studies, demonstrates the utility of immunizing HCWs at their work site rather than at a central location within a hospital.[30] Strategies such as the use of mobile carts may enhance convenience, particularly for those in ICU settings. Interestingly, the use of vaccine deputies, another technique thought to enhance convenience, predicted lower immunization rates among HCWs in NICUs, PICUs, and oncology units (Table 2). Although some institutions that employed this technique did achieve high influenza immunization rates, our study suggests that the effectiveness of this technique may vary with the motivation and commitment of individual deputies. An educational program for deputies may be valuable when this strategy is employed in future campaigns.

Our study demonstrates that high levels of influenza immunization can be achieved when HCWs are motivated to protect their patients, appropriate education is provided, and access to vaccine is facilitated. The proportion of those immunized who indicated prior receipt of vaccine suggests that high influenza immunization rates are sustainable. Harbarth et al. previously demonstrated the effectiveness of immunization campaigns tailored to the specific concerns of HCWs in different departments with high-risk patients (geriatrics, obstetrics, and pediatrics).[31] The data presented here suggest that even within a pediatric hospital, knowledge about influenza vaccine and reasons for vaccine refusal vary among HCWs providing care to different patient populations. Further increases in influenza immunization rates may demand an individualized approach.

Our study has several limitations. Participation by Pediatric Prevention Network hospitals was voluntary. Only 32 (42%) of the Pediatric Prevention Network hospitals requested educational materials. Use of materials varied by hospital. Only 25% provided feedback through the hospital influenza campaign survey and 19% participated in the point-prevalence survey, making comprehensive evaluation of individual educational interventions challenging. The data on influenza immunization campaigns may not be representative of other Pediatric Prevention Network hospitals or non–Pediatric Prevention Network children's hospitals. Nevertheless, this study does provide comparative data on a diverse group of children's hospitals throughout North America and is one of the few studies to describe the impact of delayed influenza vaccine availability on immunization campaigns during the 2000–2001 season.

Like other point-prevalence studies, our study of HCWs in NICUs, PICUs, and oncology units captured only a subset of all of the HCWs employed in a particular unit. According to information provided by the personnel of participating Pediatric Prevention Network hospitals, 3,529 individuals were employed in the units surveyed during the study period. Nearly one-third (32%) participated in the point-prevalence survey, which attempted to reach only HCWs who worked during a specific 24-hour period. Most of the respondents were female and employed as nurses, which may limit the applicability of the results to other groups of HCWs, including physicians.

One novel component of this project was the letter sent to hospital administrators urging their support for achieving HCW influenza immunization rates of 50% or greater. Hospital administrators are in a unique position to help create a culture in which influenza immunization is not only encouraged but expected.

Our study demonstrated that pediatric HCW influenza immunization rates of greater than 50% are achievable. Educational initiatives tailored for specific HCW groups combined with increased accessibility to influenza vaccine can result in increased and sustainable vaccine coverage of HCWs. Increased immunization among HCWs decreases risks for nosocomial influenza among both HCWs and patients, and the subsequent societal burden associated with costs, morbidity, and mortality from influenza.[9,11,31,32] Further study of the variables associated with vaccine acceptance or refusal is required to design more effective interventions. The contribution of an administrative requirement of influenza vaccination of HCWs in units with high-risk patients as a strategy to consistently achieve immunization rates of 80% and greater needs to be assessed.

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Medical News

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Hand Hygiene Perceptions Among Physicians

Research has shown that physician adherence to hand hygiene remains low in most hospitals. Pittet and colleagues from University of Geneva Hospitals, Geneva, Switzerland, reported on research to identify risk factors for nonadherence and assess beliefs and perceptions associated with hand hygiene among physicians using a cross-sectional survey of physician practices, beliefs, and attitudes toward hand hygiene in a large university hospital in Geneva. Individual observations were made of 163 physicians' hand hygiene practices during routine patient care with documentation of relevant risk factors and a questionnaire to measure the physicians' beliefs and perceptions. Logistic regression identified variables independently associated with adherence. Adherence averaged 57% and varied markedly across medical specialties. In multivariate analysis, adherence was associated with the awareness of being observed, the belief of being a role model for other colleagues, a positive attitude toward hand hygiene after patient contact, and easy access to handrub solution. Conversely, high workload, activities associated with a high risk for cross-transmission, and certain technical medical specialties (surgery, anesthesiology, emergency medicine, and intensive care medicine) were risk factors for nonadherence. The authors concluded that physician adherence to hand hygiene is associated with work and system constraints, as well as knowledge and cognitive factors. At the individual level, strengthening a positive attitude toward hand hygiene and reinforcing the conviction that each individual can influence the group's behavior may improve adherence among physicians. Physicians who work in technical specialties should also be targeted for improvement.

FROM: Pittet D, Simon A, Hugonnet S, Pessoa-Silva CL, Sauvan V, Perneger TV. Hand hygiene among physicians: performance, beliefs, and perceptions. *Ann Intern Med* 2004;141:1-8.