American University of Armenia
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Nork Marash Medical Center

EVALUATION OF INFECTION CONTROL PRACTICES AT NORK MARASH MEDICAL CENTER

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Included in a collaborative effort with the American University of Armenia on the Quality Assurance at Nork Marash Medical Center, Yerevan, Armenia

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Table of contents

Abstract

Background: An evaluation of the infection control practices at the Nork Marash Medical Center (NMMC) was conducted in collaboration with the American University of Armenia as a component of their quality assurance project. The purpose of this study was to provide NMMC with a self-evaluation of their quality assurance and feedback on the degree of compliance with infection control practices among their healthcare workers.

Methods: Observations were made on compliance with proper hand hygiene and sterilization practices on a diverse number of healthcare workers in the Intensive Care Unit (ICU) from June 14 to July 22, 2004. Additional data was also collected on the frequency of individuals entering and exiting the Operating Room (OR) and their dangerously close proximity to patients during surgery. Behavioral observations were conducted on approximately 20 different individuals including nurses, students, residences, doctors, and visitors.

Results: A total of 26.83 hrs of observational data was collected from the ICU and a total of 12.67 hrs was collected from the OR. Compliance with proper infection control practices in the ICU ranged from 0-75% with an average of 41.4% among healthcare workers out of a total of 561 opportunities. The entering and exiting rate of individuals to the operating room during surgery was on average 34.6 times during each hour of surgery. Visitors and healthcare workers who were not directly involved in the surgery entered 67 times within close proximity to the patient during operation.

Conclusion: Rates of compliance with infection control practices at NMMC are not far behind typical US and European compliance rates. However, continual improvement and evaluation is necessary to assure appropriate adherence to infection control practices at the center.

Introduction

Approximately 10% of hospital patients acquire secondary infections, one-third of which could be prevented if proper infection control practices were followed (Rickard, 2004). Numerous studies have documented that secondary infections increase the length of hospital stay, fatality, and hospital costs (Rickard, 2004 & Boyce, 2001). In the United States, hospital-related infections contribute to the deaths of nearly 90,000 patients each year and increase annual medical expenses by approximately 4.5 billion dollars (Trampuz et al, 2004). Researchers have revealed a number of links with hand hygiene "being the single most effective means to prevent, control, and reduce infections" (Bjerke, 2004). The action of hand hygiene refers to the removal of transient microorganisms through hand washing with soap or disinfectants and water or sanitizing with hydrogen peroxide or an alcohol based hand rub (Rickard, 2004). Healthcare workers have an individual responsibility to decrease the spread of infection by adhering to proper hand hygiene and sterilization procedures. This mantra is fundamental to the field of infection prevention and control, public health, and epidemiology (Bjerke, 2004). Yet, despite the overwhelming evidence that hand-hygiene prevents infections, compliance among healthcare workers is extremely low and rarely exceeds 50% (Rickard, 2004 & Boyce, 2001). For example, many studies conducted during the past 10-15 years have demonstrated that compliance with recommended hand washing practices is at an average rate of 40% in the U.S. (Boyce, 2001).

Infection control practices at NMMC

Nork Marash Medical Center (NMMC) was established in 1993. NMMC provides inpatient and outpatient cardiovascular disease management for both the child and adult populations of Armenia and surrounding countries. In the year 2000, 5,487 patients visited the Adult Heart Clinic, while the Pediatric Heart Clinic is visited by an average of 3,000 patients per year. Since 1993, a total of 3,203 patients, including 865 children, underwent surgical operations at the Center ("Heart Clinic", 2002).

The Nosocomial Infection Control Committee at NMMC consists of 4 members: an epidemiologist, 2 surgeons (a leading and a junior surgeon), and an epidemiological nurse. These members direct the infection control activities of the hospital. The Committee members conduct staff education and enforcement of proper practices orally since the hospital possesses a limited number of officially written regulations. As a result, enforcing these policies is especially challenging for NMMC. U.S. accredited hospitals, however, fail to achieve full compliance with their policies despites their clear and rigid definition (Boyce, 2001). Furthermore, infection control practices among U.S. hospitals show a lack of consistency and fail to demonstrate any national standard.

Objectives

The purpose of this study was to evaluate the degree of compliance with proper infection control practices among the healthcare workers at NMMC.

Methods

Compliance of NMMC staff with proper infection control practices was observed by an independent investigator from June 14 to July 22, 2005 in the Intensive Care Unit (ICU) and Operating Rooms (OR) of NMMC. The study was conducted as a component of routine internal evaluations at NMMC directed by the Infection Control Committee and as a part of an undergoing Quality Assurance Project (a collaborative effort of NMMC and American University of Armenia). Since NMMC lacked official written guidelines on appropriate infection control practices, compliance rates were based on a set of proper procedures established by the members of the Infection Control Committee. The proper patient care activities which were observed are described below:

1. Washing hands with antimicrobial cleansers or antiseptic agents before and after any form of patient contact (invasive or noninvasive). Procedures defined as invasive carry high risk of cross-transmission of microbes and include those that are internal, below the skin level, at a location of a wound, or body opening such as intravenous, arterial, urinary, or respiratory. Noninvasive procedures are those behaviors that carry a low risk of infection to the patient and include contact with the patient's skin, external manipulation of intravenous devices, adjusting bedding, and cleaning equipment or a patient.
2. Wearing gloves during invasive procedures and urine collection.
3. Changing gloves between patients or between contact with a dirty and clean body area on the same patient.
4. Strong disinfection of equipment and invasive areas prior to performing procedures as well as disinfection of an ampule prior to collection or administration of medications.
5. Wearing of properly washed & cleaned scrubs by visitors of patients.
6. Limiting the entering and exiting of healthcare workers in and out of the operating room during surgery.
7. Limiting the proximity of non-surgical healthcare workers to patients during surgery.

The procedures outlined above are in agreement with those defined by several hospitals, other researchers, and the evidence-based practice project (EPIC) as appropriate infection control practices (Pratt et al, 2001).

Behavioral observations were conducted in the Intensive Care Unit (ICU) to measure the percentage of compliance among healthcare workers with procedures 1-5 described above. Procedures 6 and 7 were evaluated based on observations conducted between the two operating rooms. Data was collected on a variety of individuals including doctors, nurses, students, residents, and visitors, which were selected for observation at random. Observations were unobtrusive and conducted without the awareness of the observed healthcare workers, preventing any adjustments in behavior that may be caused by the presences of an observer. No person-specific data were recorded.

Results

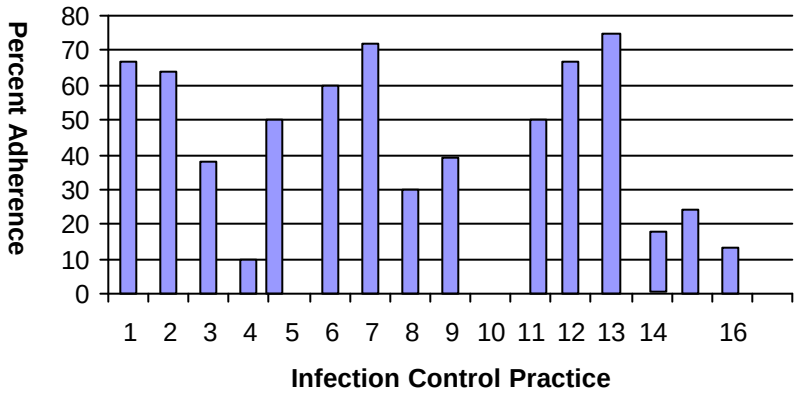
A total of 26.83 hrs of observational data was collected in the ICU on July 8, 13, 14, 16, and 20 of 2004. Sixteen different infection control behaviors were observed with an overall total of 561 opportunities for healthcare workers to comply. The overall average percentage of compliance was 41.4% with a range of 0-75%. Each individual infection control practice is identified and labeled in Table 1 with its correlating number of available opportunities and individual rates of adherence.

Table 1. Summary of infection control practices observed in the ICU by total number of opportunities, frequency, and percent of compliance among workers

	Description of Proper Infection Control Practice Observed	Total Observed Opportunities	Total Frequency of Compliance	Percent of Compliance (%)
1	Wearing of gloves when collecting urine	33	22	67
2	Wearing gloves while conducting invasive procedures on patients	50	32	64
3	Wearing gloves when cleaning patients, bedding, or equipment	21	8	38
4	Changing gloves between patient interactions or collecting urine	19	2	11
5	Wearing of scrubs and proper attire by visitors	36	18	50
6	Disinfection of medication before administration (ex: cleaning ampule with alcohol)	43	26	60
7	High disinfection of equipment and location before conducting invasive procedures	44	32	73
8	Washing hands with disinfectant and water before conducting an invasive procedures	100	30	30
9	Washing hands with disinfectant and water after conducting an invasive procedures	87	34	39
10	Washing hands with disinfectant and water before cleaning patients, bedding, or equipment	3	0	0
11	Washing hands with disinfectant and water after cleaning patients, bedding, or equipment	4	2	50
12	Disinfecting hands with 1.5% Hydrogen Peroxide before conducting invasive procedures	3	2	67
13	Disinfecting hands with 1.5% Hydrogen Peroxide after conducting invasive procedures	4	3	75
14	Washing hands with disinfectant and water after collecting urine	29	5	17
15	Washing hands with disinfectant and water after noninvasive activities or minor interactions with patients (touching, adjusting bedding, or patient tubing)	46	11	24
16	Washing hands with disinfectant and water before noninvasive activities or minor interactions with patients (touching, adjusting bedding, or patient tubing)	39	5	13
	Overall	**561**	**232**	**41.4**

The individual percentages of compliance for each of the 16 behaviors observed are illustrated in Figure 1.

Figure 1. Percentage of adherence with observed infection control practices in the ICU at NMMC numbered and described in Table 1.



The least frequently observed practice was washing hands before cleaning equipment or patients which occurred only twice during the observation period (Figure 1). A low percentage of compliance at 24% and 13% was also observed in association with minor interactions of healthcare workers with patients such as touching and adjusting tubing or bedding (Figure 1). Lastly, a very low percentage of compliance was also observed in association with the collection of urine by cleaning personnel. For example, if gloves were worn during collection, which occurred 67% of the time, only one glove was worn. Gloves were only changed on 2 occasions between patient's urine collection, and hands were washed only 5 times after collecting, with no washing observed between patients (Figure 1).

High risk behaviors were associated with a much greater rate of compliance. Healthcare workers at NMMC were 72% compliant with the disinfection of equipment and invasive areas prior to conducting procedures as well as 64% compliant of wearing gloves while performing an invasive procedure on a patient (Figure 1). Compliance rates of 30% and 39% were observed with washing hands prior to and following the performance of invasive procedures (Figure 1).

In the operating rooms A & B, observations were conducted on July 6, 7, 15, and 20, 2004 at varying times for a total of 760 minutes. The frequencies of observed behaviors are illustrated in Figure 2 with descriptions identified in the corresponding key. The frequency of individuals entering and exiting the operating room during surgery demonstrated an average rate of 34.6 times for each hour of surgery. Seven occurrences of surgeons leaving the operation room and 5 occurrences of surgeons leaving the inner area during surgery and returning without repeating proper sterilization preparations was recorded during the total observational period (Figure 2).

Non-surgical healthcare workers entered within close proximity to the patient 67 times (10 of those occurrences being for a prolonged period of more than 6 minutes) during the operation. These individuals were not appropriately prepared to enter within close proximity to the patient and lacked proper attire and correct sanitization. Individuals described in the Figure 2 Key as being "unprepared and uninvolved" include anesthesiologists, nurses, nurses' assistants, visitors, students, and interns which were appropriately prepared to enter the OR but not within close proximity to the patient.

Figure 2. Infection control practices of Operating Room A & B illustrated as total number of occurrences by behavior during 760 minutes of observation

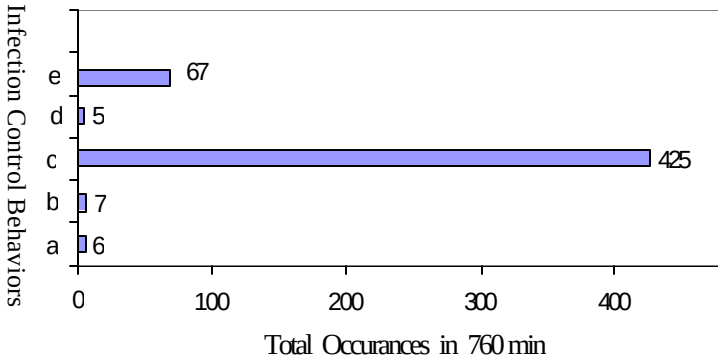


Figure 2 Key: Infection Control Behaviors

a = Properly prepared involved individual left operating room
b = Properly prepared involved individual returned to operating room
c = Uninvolved / unprepared individual left or returned to operating room
d = Number of scrub-wearing visitors in operating room
e = Uninvolved / unprepared individuals entering within close proximity to patient

An isolated but notable incident occurred in operating room B at approximately 15:41 on 7/6/04. A tube from the blood circulation machine was accidentally & improperly disconnected, causing the patient's blood to spill on the floor of the operating room. The nurse overseeing the monitoring of the machine cleaned the spill inadequate with poor techniques using dry rags (no soap, or disinfectant), disposing of the waste in an open unlabeled container, and not using gloves when coming into direct contact with bodily fluids. The 'cleaning' of this spill also served as a great source of distraction for the monitoring nurse endangering the patient. Following completion of the 'cleaning,' the patient's blood still remained on the floor, on equipment, and on the surgeon's clothing and shoes.

Although the data reported in Table 1 and Figures 2 & 3 is not organized according to individual healthcare workers, special attention was given to observe as many different workers as possible for an equal amount of time. Data was collected from a minimum of 20 different workers including doctors, nurses, assistants, students, and cleaning personnel estimated to cover more than 40% of the staff at NMMC. Several obvious patterns of compliance among healthcare workers emerged through this research. The same group of individuals continually carried out proper practices while other workers frequently failed to follow proper procedures. Newer and less experienced workers demonstrated better compliance than older, more experienced workers.

Therefore adherence to infection control practices was not randomly & equally dispersed among workers.

Lastly, it is also worthy to mention that upon several occasions, NMMC did not have running water. This limitation is very common in Armenia occurring for approximately 1-3 hrs each day. Water tanks have been designed by NMMC to provide water for the OR and ICU in the event that their public supplies is withdrawn. Buckets of water were also noticed under each sink as an additional alternative method for healthcare workers in ICU to wash their hands. Neither backup method, however, was ever observed to be used. A lack of running water most certainly has an understandably large influence on the ability of healthcare workers to adhere to proper hand hygiene and infection control practices. Likewise, the percentage of compliance reported at NMMC is truly influenced by this limitation, which should be taken into account when assessing compliance rates.

Limitations

The results of this study were influenced by a number of limitations. It has been assumed that the data collected during this study is a randomized collection, which represents the average behavior of healthcare workers at NMMC. The accuracy of this research is directly proportional to the amount of data that has been collected. Because this study was conducted under a time restraint, a restricted amount of data was collected which may inaccurately portray the true average behavior of healthcare workers at NMMC. Therefore, it is questionable if the results of this study can be used to generalize the compliance rates of the institution as a whole. Furthermore, although all observations were unobtrusive and conducted without the subjects' awareness, the observer's presence may have still affected the behaviors of the workers. These limitations, however, are expected for this type of research and are unavoidable inaccuracies caused by small sample size, reduced time, and influences of an observer.

Discussion

The average overall compliance rate of 41.4% being met at NMMC is approximately equivalent to the 40% (Boyce, 2001) being achieved in US hospitals. A slightly higher percentage of 57% compliance was reported by a study conducted in a large Swiss university hospital on 163 medical students, residents, and staff physicians during 573 patient-care episodes, which provided 887 opportunities for hand hygiene over 125 hours of observation (Pittet et al, 2004). Therefore, NMMC is not far behind typical US and European compliance rates. This study has however revealed some noticeable areas both in the operating room and the intensive care unit that are especially in need of improvement.

First, NMMC should strive to decrease the frequency of individuals entering and exiting the operating room during surgery. This rate is dangerously high and presents an elevated risk of infection to patients. A negative pressure in the OR forces air to exit whenever the door is opened which prevents the potential for airborne pathogens to enter the room and maintains a higher level of sterilization. The risk of infection to the patients is, however, increased by individuals entering the room that have not been properly disinfected and may be carrying microbes on their clothing and skin. It is, of course, understood that entry in and out during

surgery is sometimes necessary. Yet the number of visitors and healthcare workers entering the operating room simply to observe is excessively high and must be reduced. In order to decrease the risk of infection, movement in and out of the operating room should be limited to only those times when it is absolutely necessary. Furthermore, movement determined to be essential could even be reduced by increasing the use of the telephone in the OR for communication and consultation between doctors. According to the NMMC Infection Control Committee members the high rates of movement by uninvolved individuals are mainly due to human factors such as low self-control of personnel or poor of supervision. A second reason may include a lack of full preparation for surgery resulting in a need for additional supplies while the operation is in progress. Strict regulations with appropriate supervision and preparation are simple solutions to decrease the rate of entrances into the OR.

Furthermore, the frequency of individuals entering within close proximity to the patient presents an even higher risk of infection for multiple reasons. It is of course understood that the operating surgeons and assistants would be within this area. A surgeon should, however, never leave this inner area while surgery is in progress and then return. A surgeon should especially never leave the operating room and return to surgery without repeating proper sterilization preparations. Furthermore, visitors or healthcare workers who are not directly involved in the surgery and likewise have not been appropriately prepared and sanitized should never enter within close proximity to the patient once operation has begun for the obvious threat of infection they cause to the patient. The frequency of these behaviors must be reduced in order to decrease the risk of infection to patients.

Several more interesting patterns of infection control practices among healthcare workers were observed in the intensive care unit (ICU) of Nork Marash Medical Center. The first of these was a clear correlation between the level of compliance and the risk of infection. Those behaviors that present a higher risk of infection to patients corresponded to a higher percentage of compliance by healthcare workers. For example, the practice of hand washing before cleaning equipment or patients carries a low risk of infection and likewise the lowest frequency of occurrence was observed for this behavior (Figure 2). A low percentage of compliance at 24% and 13% was also observed in association with the minor interaction of healthcare workers with patients including touching, adjusting tubing, or bedding (Figure 2). Lastly, a very low percentage of compliance was also observed in association with the collection of urine by cleaning personnel. For example, if gloves were worn at all during collection, only one glove was worn. This pattern of compliance is most likely due to the discomfort caused by gloves and low consciousness of cleaning personnel. A reasonable explanation for the extreme lack of compliance in these areas is most likely the failure of healthcare workers to see the importance and value of fulfilling these behaviors to prevent infections.

The reverse of this pattern was also observed. Behaviors that healthcare workers believed to carry a high risk of infection to patients were associated with a much greater rate of compliance. For example, healthcare workers at NMMC were extremely consistent showing 72% compliance with the disinfection of equipment and invasive areas prior to conducting procedures as well as a 64% compliance rate of wearing gloves while performing an invasive procedure on a patient (Figure 2). Failure to comply with these practices clearly carries a heightened risk of infection.

Therefore the importance of adherence is understood and compliance is met among healthcare workers more consistently.

However, a drop in compliance of 30% and 39% was observed with washing hands prior to and following the performance of invasive procedures, respectively (Figure 2). This decrease in compliance is mostly likely a result of healthcare workers wearing gloves during invasive procedures. Most workers do not believe there is a need to wash hands if gloves are being worn. For example, a survey conducted at the University of Geneva Hospital reported less than 30% of workers had a positive attitude toward hand washing in addition to wearing gloves (Pittet et al, 2004). The Center for Disease Control and Prevention of the US, however, declared that the use of gloves does not eliminate the need for hand washing.

There is one additional opposition to this pattern. Healthcare workers that assisted in invasive procedures rarely wore gloves or washed their hands prior to assisting despite the fact that their involvement of blotting wounds, preparing and handling equipment and medications, and assisting in the activities of the procedure posed a very high risk of infection to the patients. A possible cause for this surprisingly low level of compliance may include that workers are called to assist without proper warning or time to complete the necessary preparations. A true determination of possible reasons for noncompliance should be further explored through future studies and surveys.

An additional unique pattern of behavior observed in ICU among healthcare workers was the disparity in compliance between the frequencies of hand washing prior to versus following patient interaction. There are many possible explanations for this disparity in compliance. First, healthcare workers may be more concerned with protecting themselves from contracting microbes from patients than the risk they have on passing an infection to a patient. Secondly, healthcare workers may also believe that washing after contact with one patient is sufficient cleansing until their interaction with another patient. Healthcare workers will, however, frequently touch other objects, leading to the chance of contracting microbes, before they interact with the next patient. Furthermore, it was also frequently observed that when healthcare workers moved directly from an interaction with one patient to another patient, they failed to comply with hand washing policies until all patient interactions were completed. The movement of hospital workers from one patient to the next without proper hand hygiene, despite the amount of time between interactions, is the number one cause (Bjerke, 2004) for the spread of infection through hospitals and must be corrected immediately.

An extremely evident trend towards better adherence among younger and less experienced workers was also observed. First, this difference in compliance may be correlated to a disproportionate level of education among healthcare workers about infection control practices and knowledge about the modes of microbe transmission. Newer, less experienced workers are more likely to have recently received an education that stressed the importance of secondary infections and focused on the value of understanding proper practices to prevent them. On the contrary, years of experience and tradition may cause resistance to changing behaviors among older workers (Osborne, 2003). It is therefore more challenging to enforce new policies and communicate their importance to individuals that have already been working for several years in a fixed pattern of behavior. Secondly, newer workers may also be more conscious of their

behavior and actions compared to more experienced workers in order to insure the security of their job and impress their supervisors. Older workers have also developed poor habitats from working during the early 90s, when the harsh condition in Armenia made it nearly impossible to maintain proper infection control practices. An additional study conducted in Swiss hospitals also pointed out a similar pattern of medical students and internists washing their hands most often showing 87% compliance compared to anesthesiologist, critical care physicians, and surgeons that only showed 23% compliance (Pittet et al, 2004). A second study conducted in Australia, exposed a compliance rate that was significantly greater for nurses with fewer than 2 years of scrub experience. Several studies have confirmed relationships between variations in compliance rates and specific demographic characteristics such as "age, years of scrub nurse experience, type of employment, and state of employment" (Osborne, 2003). Future improvement programs must take into account the age and experience of participants so that material is presented in a manner that addresses the needs and preconceived perceptions of all learners to achieve an equal degree of compliance throughout NMMC.

Lastly, compliance among healthcare workers was demonstrated to be habitual. Workers that adhered to infection control practices did so the majority of the time, while those that failed to follow proper procedures also did so with regularity. This consistency implies that these behaviors are not random but are habits of healthcare workers that once learned and established are rigidly adhered to. Research has also reported that doctors who value hand hygiene and considered themselves role models also washed their hands often (Pittet et al, 2004). These unique patterns communicate to NMMC that a small number of healthcare workers are continually failing to comply with infection control practices and with special attention and increased enforcement, compliance among this group of individuals would drastically enhance the overall quality of infection control at NMMC.

Additional future research to complement this study should focus on an evaluation of the healthcare workers' understanding of hygiene policies. Such an evaluation will allow the Quality Assurance Project to focus their efforts by exposing the individuals most in need of education. If healthcare workers are unaware of the established policies than improvements must begin with educating the staff followed by later enforcement of policies. If the questionnaire reveals that staff workers are aware of proper procedures but fail to adhere to them, then improvements can initiate with enforcing policies and assuring compliance among healthcare workers.

Further observational studies or surveys should also be performed to determine the reasons for noncompliance, which will allow NMMC to clearly focus their efforts to improve the practices. Studies have revealed that possible hindering factors may include lack of time, poor facilities and materials, drying of the skin, forgetfulness, or disagreement with the regulations (Rickard, 2004). Further possible reasons for noncompliance as reported by Pittet (2000), include: inaccessible hand washing supplies, failing to see a need for washing hands when wearing gloves, "being too busy," or "not thinking about it". A study conducted in Australia reported that noncompliance among healthcare workers was caused by a "lack of time" in 71-74% of the time and a perception of "low risk" to patients in 50-57% of the time (Osborne, 2003). Making workers aware of the rationale and application of infection control policies is a significant component in achieving better compliance rates (Hoods and Olesen, 2000). The patterns of behaviors reported

through this study strongly suggest that similar reasons for noncompliance are present at NMMC.

Methods suggested to improve compliance include: increasing continual training and education, improving facilities by increasing the number of washing or sterilization stations, providing frequent and rapid feedback on observed improvements and decreased rates of infections, conducting active research to focus on problem areas, and changing to the use of waterless hand disinfectants in place of hand washing (Pittet, et. al. 2004). Adjusting salary to be proportional to merit along with reinforcing the conviction that each individual can influence the group behavior may also improve compliance rates. Patient empowerment is also an effective method of improving compliance by bestowing the responsibility of holding healthcare workers accountable for their behaviors to the patient themselves (Pittet et al, 2004). Patient empowerment, however, can only be effective when the patient is conscious, aware, and capable of assessing the practices of healthcare workers. Therefore such a theory is not practical for patients in the operation room or the intensive care unit and is only applicable for hospital wards. If proper practices are strictly enforced and supervised, compliance rates will be positively influenced. For example, a study conducted in Australia revealed that variations in compliance rates between different states can be attributed to the differences in infection control policies enforced by each state. Higher rates of compliance were reflected in states were adherence was strictly mandated (Osborne, 2003). Therefore, stronger enforcement of policies with corresponding penalties forcing healthcare workers at NMMC to be accountable for their behaviors will result in a higher degree of compliance.

The most valuable of the improvements described above for NMMC is to increase the use of hydrogen peroxide based waterless hand rubs in place of traditional washing with an iodine-based disinfectants (Rickard, 2004). This study exposed the extremely low rate of only 5 occurrences using hydrogen peroxide based disinfectants compared to the 98 times healthcare workers were recorded to use disinfectant washes before patient interaction (Table 1). Alcohol-based hand sanitizers have several benefits and NMMC should progress towards their use for multiple reasons.

First, studies have proven that excessive hand washing increases the risk of infection to patients as well as workers. Skin damaged caused by irritation from excessive washing is an occupational risk for workers with a prevalence of 10% to 45%. Washing and scrubbing changes the natural ecology and health of the skin as a protective barrier while increasing the resistance of skin flora to antibiotics. A recent survey reported that nurses with damaged hands were twice as likely to be colonized by a greater number of bacterial species then other workers. The use of skin creams and lotions following washing may also help to reduce irritations but using waterless disinfectants, which are much milder, is a better solution. Since waterless hand rubs require no washing or drying, damage caused by the mechanical friction of washing is avoided (Larson, 2001).

Disinfectants are also more convenient and take less time. For example, hand cleansing through washing carried out 30 times in an 8-hour shift for a sufficient amount of time to kill microbes would take a total of 45 minutes which is approximately 15% of the shift (Rickard, 2004). It has been estimated that 15% more staffing would be required to cover these hand-cleansing duties

(Weeks, 1999). On the other hand, disinfectants rubs take only 20 seconds, resulting in a drastic decrease of time. Lastly, waterless hand rubs would also prevent the challenges of having continual access to running water faced by NMMC from being a cause for noncompliance.

Conclusion

- The overall average compliance rate of 41.4% with the infection control practices at NMMC is not a great deal lower than levels being reached in the U.S. NMMC must, however, increase its compliance rates in order to improve quality of care.
- The most significant of the recommended improvements is adhering to hand hygiene practices, especially through the increase use of waterless disinfectants.
- NMMC should work on reducing the amount of movement during surgery in order to decrease infection rates.
- Studies like these should be continued with regularity in order to give NMMC continual feedback on their methods of improvement, allowing them to adjust their measures to be most effective.
- Additional studies and surveys should also be conducted to evaluate the reasons for noncompliance among workers in order to clearly focus future improvement efforts.

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