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Terms used for isolation practices by nurses at an academic medical center

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Abstract

Aim—This paper is a report of a study to determine if the terms used by nurses to describe isolation precautions are associated with correct identification of required personal protective equipment.

Background—Isolation measures are important in the prevention of health care-associated infections. The terms used to describe categories of isolation have changed in response to new pathogens and with advances in infection prevention.

Methods—For three months in 2009, nurses from an academic medical center on the East Coast of the United States of America completed a survey consisting of ten clinical scenarios which asked about recommended personal protective equipment and for the name of the recommended isolation type. Correct identification of required personal protective equipment was compared to use of an approved isolation category term, controlling for infection knowledge and demographic variables.

Results—Three hundred and seventeen nurses gave responses to 2,215 clinical scenarios. Use of non-approved category terms was associated with statistically significantly lower rates of correct

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personal protective equipment identification compared to use of an approved term (62.2% vs. 77.8%; $p < .001$). Specific PPE was also selected for use when not indicated—including gowns (42%), N-95 respirators (13%), fluid shield masks (13%) and sterile gloves (6%).

Conclusion—Inconsistent terminology for isolation precautions may contribute to variations in practice. Adoption of internationally-accepted and standardized category terms may improve adherence to these precautions.

Keywords

Nurses; isolation precautions; infection; personal protective equipment; terms; isolation practices; academic medical center

INTRODUCTION

Healthcare-associated infections (HAIs) occur during the process of healthcare, were not present at the time of admission, and include infections which occur among healthcare workers as a result of occupational exposure. In developed countries, it is estimated that 1 in 10 patients experiences harm while undergoing hospital care, and the rate may be up to 20 times higher in developing countries (World Health Organization 2009a). At any one time, an estimated 1.4 million people suffer from HAIs and these infections are responsible for increased direct and indirect costs, prolonged hospitalization, and significant mortality (World Health Organization 2007). In the United States of America, it has been estimated that HAIs account for direct hospital costs of \$28.4 to \$45.0 billion per year, while in the UK, HAIs cost more than £1 billion each year (Public Accounts Committee, House of Commons 2009, Scott 2009). Antibiotic resistant infections are of particular concern because they are difficult to treat and associated with poor outcomes (Aboelela et al. 2006). HAIs also present a significant threat to healthcare workers (HCWs). For example, it has been estimated that HCWs in low income countries have a 5.77 higher risk of developing latent tuberculosis and a 10.06 higher risk in high income countries, compared to non-healthcare workers (World Health Organization 2009b).

The majority of HAI cases are preventable through a combination of strategies including environmental control and cleaning, use of isolation precautions, and use of personal protective equipment (PPE) when appropriate. Despite evidence that proper isolation and hand hygiene are effective in reducing infection transmission, observational studies demonstrate that adherence to isolation precautions is low and can vary depending on the practice setting and type of isolation required (Gammon et al. 2007, Clock et al. in press). Using data from 15 studies in 5 countries, reviewers have estimated that compliance with isolation precautions ranges from 25 to 67% (Gammon & Gould 2005). Knowledge and attitudes are believed to play an important role in the adoption of infection control practices (Sax et al. 2005, Paudyal et al. 2008, Tivolacci et al. 2008, Vandijck et al. 2008), and healthcare worker education has been recommended as a strategy to improve compliance and reduce HAI rates (Yokoe et al. 2008, Cookson et al. 2009, Pittet et al. 2009).

BACKGROUND

Guidelines for isolation and the terms used to describe these practices have evolved in response to newly-identified pathogens and as knowledge of disease transmission has increased. Barrier nursing was the term used to describe the earliest isolation measures, including the implementation of aseptic technique, when caring for patients with infectious conditions (Gammon 1998). In the USA, the Centers for Disease Control and Prevention (CDC) has published recommendations for isolation practices in healthcare settings based on

current evidence and these have become widely adopted. In 1970, CDC recommended the use of seven isolation categories (strict, respiratory, protective, enteric, wound and skin, discharge, and blood); these were subsequently expanded in 1983 to include tuberculosis (AFB) isolation, drainage/secretion precautions, and blood and body fluid precautions. The category ‘universal precautions’ was added to address the threat of HIV/AIDS to healthcare workers as a result of the HIV epidemic in the mid-1980s. The category ‘body substance isolation’ was introduced in 1987 (Garner et al. 1996). In 1996, the CDC changed the term ‘universal precautions’ to ‘standard precautions’. Guidelines were developed by the Society for Healthcare Epidemiology of America and emphasized the use of isolation measures to reduce the spread of multi-drug resistant organisms (MDROs). The Association of Professionals in Infection Control issued a guideline for hand washing and hand asepsis in 1995 (Boyce et al. 2002). In 2007, CDC expanded the scope of standard precautions to include safe injection practices, respiratory/cough etiquette, and use of masks for certain invasive procedures (Siegel et al. 2007).

Current guidelines include a two-tiered approach to preventing the spread of infectious agents: standard precautions are to be applied to all patients, and transmission-based precautions are implemented based on the characteristics of known or suspected contagious diseases (Siegel et al. 2007). Standard precautions are based on the principle that all bodily fluids (except sweat), non-intact skin and mucous membranes can contain transmissible infectious agents. Hand hygiene is the critical link in infection prevention and is included as a component of standard precautions. Environmental control measures (e.g., private room, negative pressure air flow) also play a role in reducing spread of infection and are included in standard precaution recommendations (Cole & Lai 2009). In addition, standard precautions include the use of safe injection practices; these are particularly important in developing nations, which account for 90% of the estimated 75,000 cases of occupational hepatitis cases that occur each year and where deaths from unsafe injection practices are greater than those from colon and rectal cancer (World Health Organization 2003, World Health Organization 2009a).

Transmission-based precautions are recommended when infectious agents are present or suspected, and when standard precautions alone would not prevent spread of pathogens. Current recommendations include categories for contact, droplet and airborne isolation when there is evidence of a potentially contagious condition (Siegel et al. 2007). Based on the route of transmission of each pathogen, specific PPE (e.g., gloves, gowns, masks, and eye protection) is recommended to limit transmission and to protect healthcare workers from exposure to potentially infectious material. They are advised to don PPE when exposure to potentially infectious substances or patients is possible (Table 1). While PPE properly refers to barriers worn by the HCW, in this paper we refer to barrier equipment (i.e. hand hygiene, use of gloves, gowns or eye protection) combined with environmental measures (i.e. private room, negative pressure air flow, restrictions on visitors) as PPE.

In summary, although current guidelines recommend the use of four terms to describe isolation categories, over the past 50 years at least 15 terms have been used to describe these practices. As guidelines evolved, there was even controversy over whether “isolation” or “precaution” was the preferred term and over the philosophical differences underlying different methods to reduce healthcare worker risk and prevent transmission (Tafuro 1986, Jackson & Lynch 1991, Soule 1996). The variety of terms used to describe isolation precautions in the past has been suggested as a factor in misunderstanding of practice recommendations and in subsequent low adherence to isolation precautions (Gammon & Gould 2005). No previous researchers have addressed whether the variation in terminology used in written documentation reflects true differences in the implementation of isolation

precautions, including the use of PPE, or whether different terms are used to describe a similar set of practices.

THE STUDY

Aim

The aim of this study was to describe nurses' knowledge of recommended isolation practices and the association between use of an approved isolation category term with correct PPE.

Design

The current study was a cross-sectional survey of practising nurses.

Participants

The survey was conducted with Registered Nurses at three hospital campuses which are part of a major urban academic health center on the East coast of the USA, including a 700-bed tertiary care hospital, a 225-bed community hospital, and a 200-bed pediatric hospital. Approximately 2,000 nurses are employed at the hospitals. At each facility, nurses are expected to comply with standard precautions and transmission-based isolation when appropriate. Four transmission-based isolation categories are recognized in hospital policy (Table 1). Nurses were recruited through a series of email solicitations explaining the purpose and content of the study.

Data Collection

Pilot study—Nursing documentation of patients' isolation status from November 2007 through February 2009 was extracted from our commercial electronic health record (EHR). Isolation status was recorded in an electronic flowsheet within the HER, which allowed selection of pre-filled isolation categories and free-text entry of isolation category terms. These distinct terms were reviewed by a research assistant and a member of the study team. The words used to describe isolation categories were summarized into major groupings. In 81,981 nursing isolation flowsheet entries collected from November, 2007 to February, 2009, the term contact isolation appeared in 72.1% of entries. Of the other approved isolation category names, standard precautions appeared in 10.8%, airborne precautions in 3.2%, and droplet precautions in 1.0%. The facility-approved isolation category 'varicella isolation' was used in 0.2% of entries. In addition to an approved isolation category, descriptive terms and disease labels were also used, such as "MRSA" (252/81981, 0.3%) or "C. diff" (398/81981, 0.49%). Of 1,051 unique terms, 950 were used fewer than three times. Examples of uncommonly-used terms included "per unit policy," "universal isolation," and various mis-spellings of approved isolation terms. Based on the findings of the isolation documentation analysis, we developed and administered a questionnaire containing clinical scenarios that represented patient care situations which required the use of PPE.

Primary survey—Data were collected using a web-based questionnaire containing: (1) a series of patient care scenarios, (2) a previously published instrument measuring infection control knowledge and (3) demographic questions. First, participants were asked to review ten patient scenarios and identify appropriate PPE for each scenario (see "Validity and Reliability" for a description of questionnaire development and Table 2). Each scenario contained brief patient demographics and details of the care to be delivered. Next, participants were asked to select from a list of PPE (gloves, mask, etc.) that were required for that scenario, and to write the name of the isolation category in a free-textbox. If they selected all of the recommended PPE for each scenario, their overall response was scored as correct. Responses in the free text box indicating the type of isolation selected were

reviewed by two of the authors and classified as the correct term or incorrect term for that isolation category. Although standard precautions should also be added to each transmission-based isolation category, we counted as correct response identifying the main (non-standard) required isolation category. We defined excess precautions as the use of PPE that was not required by the clinical scenario, according to expert reviewers and CDC guidelines. The second section of the questionnaire contained a series of questions from a previously published instrument (Tavolacci et al. 2008); these assessed overall infection prevention knowledge in three dimensions: knowledge of HAIs, hand hygiene guidelines, and recommendations regarding standard precautions (reported Cronbach's $\alpha = 0.61$). As previously described, this instrument contained a total of 25 questions: 8 related to hand hygiene, 12 related to the use of standard precautions, and 5 pertained to nosocomial or healthcare-associated infections. We used the published answer key to score the knowledge items and calculated an overall percent correct and score for each knowledge subscale. The final section of the questionnaire requested demographic information, including years of practice, gender, age category, primary nursing unit assignment and questions about which isolation category names were approved in facility policy to describe isolation practices. Respondents were also asked to note their major sources of information about isolation and to give a free-text definition of a healthcare-associated infection. Respondents' definition of an HAI were considered to be correct if they included the word "nosocomial" or noted that HAIs are acquired in a hospital or healthcare setting. Responses which only provided examples of common HAIs (e.g., MRSA or C. diff) or included only occupational infections were considered to be incorrect. Each response was reviewed by two members of the study team, and answers which were scored differently were reviewed and discussed by three experts to reach consensus.

Ethical considerations

The pilot study and survey were approved by our medical center's Institutional Review Board. Logging in to the survey implied consent to participate. Functions of the data collection tool which allowed identification of location of the respondent (IP tracking) were disabled and no identifying information was collected.

Data analysis

Descriptive statistics were calculated using IBM SPSS Statistics 18 (SPSS, Inc., Chicago, IL). We calculated which sources of infection control information were reported as "most important" by nurses and the number of correct and incorrect definitions of an HAI. An overall infection prevention knowledge score was calculated, including the percentage of correct responses for total knowledge and by subscale. We also summarized the number of isolation categories that were recognized by respondents as approved categories.

For each scenario, the percentage of respondents who selected the required PPE for each scenario was calculated out of the number of individuals who gave responses for that example. Total correct PPE identification was calculated by counting responses which included all required elements for that scenario. We also calculated correct PPE identification type by type of PPE (e.g., gloves, gowns, etc.) when indicated. Approved isolation category names were those identified in current CDC guidelines and facility policy as recommended isolation precautions (Table 1).

Using univariable logistic regression, we determined the odds ratio for correctly identifying all of the required PPE by use of the correct term compared to use of an incorrect term. Multivariate regression analysis was performed with the dependent variable of overall correct PPE identification in a model containing categorical age, years at facility, primary assignment, age, and gender.

Validity and Reliability

Of the ten clinical scenarios included on the questionnaire, half were written *de novo* and half were modified from exemplars used by the continuing education department of our facility. Each scenario contained two main elements. First, a brief patient description was given (e.g., 58-year-old with profuse watery diarrhea following antibiotic treatment). In the second part of the scenario, specific care required was described (e.g., perform a start-of-shift assessment).

A panel of content experts (nurse expert, infection preventionist, hospital epidemiologist, and informatician) reviewed each scenario and identified the appropriate isolation precaution category and appropriate PPE for each scenario as specified by CDC or institution-specific policies. Portions of the scenarios that were thought by members of the panel to be misleading -or scenarios for which there was disagreement about the recommended PPE -were revised until the group reached consensus on required PPE for each scenario. Each scenario was again reviewed independently by each member of the expert panel using the survey interface to ensure the accuracy of correct response codes.

RESULTS

In the online survey, 317 nurses responded to 2,215 total scenarios. Complete demographic variables were given by 217 participants (Table 3), and 209 provided responses to the knowledge survey.

Participants ranked written policy (84.9%) and infection preventionists/hospital epidemiologists (76.3%) as their most important sources of knowledge for infection control practices. Colleagues (41.1%), nurse managers (33.8%), self-learning (33.3%), and other sources (19.6%) were also identified, including the CDC web site, professional publications, and mandatory ongoing continuing education.

The majority of participants (79.3%) correctly defined an HAI. Of the incorrect responses, 42% only named a specific HAI or organism (typically an MDRO) and 26.7% defined an HAI as an infection acquired by a healthcare worker due to contact with patients. Cronbach's alpha for the knowledge instrument was 0.57. Mean infection prevention knowledge score was 75.0% (range: 48–92%). Mean hand hygiene knowledge was 64.0% (range: 35–87%), which was significantly lower than the mean score for knowledge regarding standard precautions (mean 88.2%, range 58.3%–100%; $p < 0.01$) and HAI (mean 60.6%, range 20%–100%; $p = 0.03$). There were no significant differences for total knowledge scores or subscales (knowledge of HAIs, standard precautions, or hand hygiene recommendations) by age, primary unit assignment, gender or years at facility in univariate tests. A multivariate linear regression model containing the dependent variables total knowledge score, age, unit assignment, gender, and years at facility was not significant. ($r = 1.67$, $F = 1.04$, 4df, $p = .387$).

The majority of respondents identified approved isolation categories, including contact (95.4%), droplet (94.5%), airborne (83.9%), standard (62.2%) and varicella (51.6). However, non-approved isolation category terms were also reported as approved isolation types by many respondents, including reverse isolation (62.7%), universal (54.8%), MRSA (44.2%), AFB (30%), C.diff. (42.9), and respiratory (11.7%) precautions.

For each scenario, the number of nurses who correctly identified all recommended barrier precautions is shown in Table 2. Overall, correct PPE identification varied by type of precaution and by PPE. Correct PPE identification was significantly higher when an

approved isolation category was selected than when a non-approved category name was selected (77.8% vs. 62.2%; $p < .01$).

The number of correct responses was 522/599 (87.1%) for scenarios which required contact precautions, 397/753 (52.7%) for droplet precautions, 227/254 (89.0%) for airborne precautions, and 42/249 (16.9%) for varicella precautions. Required barriers for standard precautions were correctly identified in 549/743 (73.9%) of scenarios which required only standard (i.e., not transmission-based) precautions (see Table 2). However, the specific term standard precaution was used infrequently to describe these practices.

The results of univariate logistic regression modeling showed that use of the correct isolation category name was associated with significantly higher odds of correct PPE identification in 8 of the 10 scenarios (Table 3). However, in a multivariate logistic regression model, significant differences were seen in only 4 out of 10 scenarios (Table 3). This indicates that the variation in correct PPE identification may be explained by the presence of other variables included in the regression.

Correct PPE identification for a given scenario varied by type of required PPE. Correct identification of hand hygiene recommendations across all scenarios was 94.6%, appropriate use of gloves was 92.3%, appropriate use of masks was 60.6%, and appropriate use of face PPE when required was 59.0%. Identifying proper placement of patients in a private room when transmission-based precautions are required was 62.9%, and compliance with restrictions for non-immune persons entering the patient's room was 45.4%.

We identified many cases where responses indicated excess use of PPE. In cases for which PPE was not recommended, we found excess use of gowns in 42.1% of responses, PFR 95 respirators in 13.1%, surgical masks in 6.2% and sterile gloves in 6.2%. According to current recommendations (Pittet et al. 2009), the use of hand sanitizer is preferred in most situations, but 83.7% of respondents indicated that handwashing was appropriate for these scenario.

DISCUSSION

Stud limitations

We included nurses practising in one hospital, who would have been exposed to the same basic infection control training programmes and guided by one institution's policy, and so the results may not be generalizable to other practice settings or geographical regions. Second, we assessed identification of PPE which was required in hypothetical scenarios. In practice, adherence may also be influenced by availability of PPE, work assignment, and other factors which we did not measure (Larson et. al. 2009, Clock et. al. in press). Our study was also limited because a substantial number of respondents did not complete all elements of the questionnaire. It is possible that non-responders differed from respondents in terms of important demographic characteristics or infection control knowledge. However, since nurses completed the questionnaire during their assigned work shift, the results may more closely mirror actual practice patterns compared to results obtained in a classroom or other test setting. Finally, we used a standardized knowledge questionnaire (Tavolacci et al. 2008) which was developed and tested in France and may not reflect current practices or recommendations in the USA.

Non-approved terms and PPE identification

There was considerable variation in the names of isolation categories used to describe recommended PPE for given clinical scenarios. The use of non-approved isolation category names was associated with lower rates of correct PPE identification. This observation is

consistent with the suggestion that changes in terminology may contribute to poor adherence with recommended precautions (Gammon & Gould 2005). Although the variability in terms used may be better attributed to other factors, use of non-approved isolation category names in nursing documentation or during change of shift reports might be a helpful marker for overall non-adherence and could be used to help plan targeted educational interventions. As EHRs become more widely adopted, screening of electronic records for non-approved terminology may be an efficient way to target educational interventions. One recent study highlighted the importance of this tailored approach to identifying staff training needs (Knapp et al. 2008); however, educational interventions alone may not be sufficient to improve adherence, and consistent, uniform terminology may be a key ingredient in improving adherence.

Similarly, an isolation category specific to our institution (i.e., not designated by CDC), varicella precautions, had low levels of correct name usage and low PPE identification. Although other authors have suggested that institutions adopt specific policies for specific patient populations, our results suggest that locally-developed isolation category names may be more likely to be used inappropriately and associated with poorer rates of identification of correct PPE (Gasink & Brennan 2009). This was observed, even though locally-written policies were identified as the most important source of infection control knowledge by a majority of respondents. In addition to written policies, infection preventionists and hospital epidemiologists were also identified as important sources of infection control knowledge. In the face of new infectious disease threats, the results of this study suggest that implementing internationally-accepted isolation terminology may be associated with improved adherence and should become routine.

Excess PPE

We were unable to find other studies which have addressed how often nurses employ excess PPE—for example, using gowns or gloves when not clinically indicated. A recent review has highlighted potential negative effects of the use of contact precautions, including fewer healthcare worker-patient contacts, increased delays in care, higher non-infectious adverse events, and increased depression and anxiety (Morgan et al. 2009), although no difference in patient satisfaction was found in another study (Gasink et al. 2008). Because of the risk of skin sensitivity and adverse reactions, recent guidelines from England recommend that “gloves should not be worn unnecessarily” (Pratt et al. 2007, p.7). Use of PPE when not required also increases supply costs and work demands without benefit to the patient or healthcare worker. The cost and impact of excess use of PPE should be evaluated in other settings, and programmes which aim to increase adherence to isolation precautions should include the potential over-use of PPE as an unintended consequence.

Implications for nursing

Lack of consistent terminology has been cited as a factor in the marginalization of certain concepts in contemporary nursing practice (Webber 2009). Other authors have identified the importance of standardized nursing language in improving patient safety, increasing quality, enhancing visibility of nursing care, and improved evaluation of the impact of nursing care on outcomes (Lu et al. 2006, Jiang et al. 2007, Rutherford 2008). Our findings are consistent with the suggestion that variations in terminology can contribute to variations in practice.

CONCLUSION

Isolation precautions are an important part of strategies to prevent HAIs, reduce the threat of antibiotic resistant infections, and in responding to new and emerging infectious disease threats throughout the world. Rather than developing a new category of isolation for each

newly-identified pathogen, use of internationally-accepted isolation category terms in describing appropriate practice may improve adherence to these precautions.

SUMMARY STATEMENT

What is already known about this topic:

- Isolation precautions including the use of personal protective equipment --are important measures to reduce the transmission of healthcare-associated infections.
- As knowledge about transmission of healthcare-associated infections has evolved, different terms have been used to describe recommended isolation practices.
- Four isolation categories are widely recognized --standard, contact, airborne, and droplet precautions.

What this paper adds:

- Use of non-approved isolation category terms by nurses was associated with significantly lower correct identification of appropriate personal protection equipment in given clinical situations.
- Certain items of personal protective equipment, particularly gowns, were often selected when not clinically indicated, suggesting that over-use is likely.

Implications for practice and policy:

- Use of non-approved isolation categories may be useful to identify overall noncompliance with recommended precautions, indicating the need for additional training and practice improvement.
- Uniform terminology should be used to describe types of isolation in national and international practice recommendations, facility policies, clinical documentation, and in research studies on the effectiveness of these interventions.

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Table 1

Approved CDC* isolation category and locally developed isolation category⁺ SARS: Severe adult respiratory syndrome

Precautions Strategy/Isolation Category	Types of Personal Protective Equipment/ Environmental Controls	Examples of Diseases
Standard*	Respiratory Hygiene/Cough Etiquette, Safe Injection, Practices for Lumbar Puncture Hand Hygiene, aseptic technique, gloves, cleaning and sterilization, disposal of non-reusable materials and equipment, cleaning items used between patients	For all patient care situations for the prevention of disease transmission and healthcare worker protection.
Contact*	Gown and gloves, hand hygiene before and after patient contact	Seasonal Viruses, Avian Influenza, C. diff, Cholera, E. coli, Ebola, Gastroenteritis, Hepatitis A, Herpes Simplex, Lice, MRSA, MDR gram negatives, Norovirus, Poliomyelitis, Respiratory Syncytial Virus, Typhoid.
Droplet*	Fluid shield mask with visor, Droplet/ Contact: Fluid Shield Mask with visor, gown and gloves	Influenza, Avian Influenza & Influenza, Diphtheria (pharyngeal), Ebola, German Measles (Rubella), Meningococcus, Mumps, Pertussis, Pneumonia, Rhinovirus, SARS, Streptococcal, Whooping Cough
Airborne*	PFR 95 Mask Airborne/Contact: PFR 95 Mask, gown and gloves	Avian Influenza, Ebola, Measles, SARS, Tuberculosis,
Varicella ⁺	Gloves	Chicken Pox, Herpes Zoster, Shingles

Table 2

Participant demographics (total n=317), valid responses only. HAI: Healthcare associated infection.

	Participants	
	N	%
Age (years, n=208)		
Under 25	5	2.40
25–35	37	17.79
36–45	49	23.56
46–55	79	37.98
Over 55	38	18.27
Gender (n=209)		
Male	15	7.18
Female	194	92.82
Primary Assignment (n=201)		
Medicine-Surgery	83	41.29
Intensive care unit	33	16.42
Surgery	19	9.45
Outpatient	34	16.92
Pediatric	32	15.92
	Mean	SD
Years at facility (n=164)	12.5	10.0
HAI Knowledge Score (n=214)	.75	.09
HAI Knowledge	.88	.23
Standard precautions	.60	.20
Hand hygiene	.67	.16

Table 3

Summary of clinical scenarios, recommended isolation category, PPE, number of responses and correct responses by scenario. PPE: Personal protective equipment, MRSA: Methicillin-resistant *Staphylococcus aureus*.

Scenario	Required Precaution	Personal Protective Equipment/Infection Prevention Strategy	Responses		
			Total n	Correct PPE n (%)	Correct Term n (%)
1. Patient with possible <i>C. difficile</i> diarrhea	Contact	Non-Sterile Gloves Gown Handwashing	317	266 83.9%	298 94.0%
2. Patient with 3-day cough, fever, sore throat, body aches	Droplet	Handwashing or Hand Sanitizer Surgical Mask and Eye Protection/Goggles or Fluid Shield with Mask	286	138 48.3%	150 52.4%
3. Patient with wound previously cultured for MRSA	Contact	Non-Sterile Gloves Gown Handwashing or Hand Sanitizer	282	256 90.8%	270 95.7%
4. Procedure with risk of blood/body fluid splash	Standard	Non-Sterile Gloves Gown Handwashing or Hand Sanitizer Surgical Mask & Eye Protection/Goggles or Fluid Shield with Mask	269	202 75.1%	29 10.8%
5. Patient with urinary tract infection	Standard	Handwashing or Hand Sanitizer	247	233 94.3%	39 15.8%
6. Patient with chronic cough, weight loss & possible tuberculosis	Airborne	Handwashing or Hand Sanitizer PFR 95 Mask Negative pressure room?	254	226 89.0%	75 29.5%
7. Patient admitted with varicella	Varicella	Non-Sterile Gloves Private Room (if available) Surgical Mask Handwashing or Hand Sanitizer No non-immune visitors	249	42 16.9%	27 10.8%
8. Patient with fever and cough during spread of a new flu- like condition	Droplet	Handwashing or Hand Sanitizer Surgical Mask & Eye Protection/Goggles or Fluid Shield with Mask	238	132 (55.5%)	138 58.0%
9. Patient with stiff neck, headache, petechia & possible meningococcal meningitis	Droplet	Handwashing or Hand Sanitizer Surgical Mask & Eye Protection/Goggles or Fluid Shield with Mask	229	127 55.5%	73 31.9%
10. Patient requiring suctioning, causes coughing	Standard	Sterile Gloves Handwashing or Hand Sanitizer	227	114 50.2%	34 15.0%

Table 4

Use of correct isolation category name and overall correct personal protective equipment identification by use of approved vs. non-approved name. p-values are for chi-square comparison. OR: Odds ratio, aOR: adjusted Odds ratio in model containing categorical age, years at facility, infection control knowledge, primary assignment, age, and gender, CI: Confidence interval.

		Correct personal protective equipment by term					
		Correct term	Incorrect term	OR (95% CI)	p	aOR (95% CI)	p
1	Contact	85.2%	63.2%	3.37 1.26, 9.02	.016	1.29 .21, 8.14	.783
2	Droplet	66.7%	27.9%	6.61 4.03, 10.83	<.001	6.48 2.91, 14.44	<.001
3	Contact	91.9%	66.7%	54.96 22.8, 132.10	<.001	11.71 1.04, 131.7	.046
4	Standard	82.8%	74.2%	2.97 1.10, 8.00	.032	5.42 .63, 46.95	.125
5	Standard	90.7%	95.1%	2.61 1.06, 6.42	.036	1.97 .34, 114.7	.453
6	Airborne	94.7%	15.5%	9.96 3.52, 28.21	<.001	2.34 .53, 10.30	.261
7	Varicella	7.4%	18.0%	.50 .114, 2.19	.358	.253 .03, 2.27	.22
8	Droplet	68.1%	38.0%	8.51 5.05, 14.36	<.001	4.40 2.00, 9.71	<.001
9	Droplet	47.9%	59.0%	1.52 .90, 2.58	.119	2.09 1.01, 4.30	.047
10	Standard	52.9%	49.7%	2.19 1.07, 4.49	.03	1.79 .68, 4.73	.241