Patient-days used for isolation in a community hospital

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Background: Isolation of patients with known or suspected infection strains the resources of hospitals, but little information exists on the actual utilization of isolation beds.

Methods: The infection control team of a community hospital keeps a log of hospital days used for isolation. We obtained information from this log for August 2009 through August 2010 on hospital days for isolation due to methicillin-resistant Staphylococcus aureus, vancomycin-resistant enterococci, Clostridium difficile, other multidrug-resistant organisms, and disorders necessitating droplet or airborne isolation, such as tuberculosis, meningococcal meningitis, varicella, and influenza. We also included days of isolation used to rule out the presence of these infections. All data from the medical-surgical and intensive care units were included unless the start date or end date of isolation was missing. Utilization percentages (isolation days divided by total hospital days) were calculated for the total period, for each month, and for each category of isolation.

Results: During the study period, 18.1% of hospital days were devoted to isolation (13.7% for definite infection and 4.4% to rule out infection). Monthly utilization ranged from 13.4% to 22%. Patients with confirmed methicillin-resistant S aureus or C difficile infections and patients with possible C difficile infection accounted for 75% of the isolation days.

Conclusions: Isolation beds were required for a substantial portion of total patient-days in our study. Our data may help hospitals use hospital beds efficiently and predict nursing needs, hospital supply needs, and workload for environmental services.

Over the past 10-15 years, hospitals have seen an increase in the need to use hospital rooms for isolation purposes to minimize the possible spread of infectious agents in the hospital setting.1,2 This increased need for the use of isolation may be related in part to changes in demography, policy, and epidemiology. The growing elderly population requires more care and hospitalization and is at increased risk for infections, such as influenza and Clostridium difficile.3-5 Current recommendations of the Centers for Disease Control and Prevention (CDC) include isolating patients with active methicillin-resistant Staphylococcus aureus (MRSA) infections, active C difficile colitis, a history of previous MRSA infection/colonization, or a history of C difficile infection.1,2 The presence of multidrug-resistant organisms (MDRO), such as extended-spectrum b-lactamase producers or carbapenemase producers, also requires isolation. These recommendations are in addition to the standard isolation requirements for diseases such as tuberculosis, influenza, varicella, and meningococcal meningitis. However, MRSA infections and C difficile infections have been the main drivers of isolation bed use over the past 2 decades because of a substantial increase in incidence. The estimated number of MRSA-related hospitalizations in the United States more than doubled between 1999 and 2005, from 127,036 to 278,203,6 and C difficile–related hospitalization in the US increased by 23% annually from 2000 through 2005.7 In a Canadian tertiary care center, the mean duration of isolation for MRSA-positive patients was 30.6 days.8

Little recent information exists regarding the use of hospital days for isolation purposes, particularly in community hospitals. In a multiple point-prevalence survey conducted over 14 months in 1990 and 1991 in a Canadian pediatric hospital, 13.5% of patients required isolation.9 In a prevalence survey of 7 community hospitals and 1 city-county hospital over 1 year, Garner and Kaiser10 found that 1.6% of patients in the community hospitals and 4.9% of patients in the city-county hospital needed isolation; however, this study was done in 1970, and changes in epidemiology and isolation policy in the ensuing years make it difficult to apply these results to current needs. It also is not clear whether the incidence of infections due to MRSA, C difficile, and other organisms of current
concern varies throughout the year, although some infections, such as influenza, show distinct seasonality.

Patient isolation increases the need for hospital resources. Patients in isolation usually require a single room, and hospitals with many multibed rooms may need to convert some into isolation rooms, which could be difficult during periods of high patient census. Isolation rooms also may require the use of more resources, such as gowns, gloves, and masks, depending on the specific type of isolation. Requirements for washing hands, gowning, and gloving each time the room is entered can add to the time burden for the physicians, nurses, and ancillary staff caring for patients in isolation. Environmental services may be required to do more special and time-consuming cleaning procedures. Thus, hospitals could benefit from data on the use of isolation in planning for the efficient use of beds, as well as predicting demands for nursing staff, medical supplies, and environmental services. We felt that a prospective study carried out in a community hospital over more than 1 year, using the currently recognized categories for isolation and accurately reflecting the current spectrum of infectious pathogens, would provide valuable information to help hospitals plan for their isolation needs.

METHODS

Setting

To determine the number of patient days devoted to isolation due to confirmed or suspected infection, we instituted a prospective study from August 2009 to August 2010 at a community hospital that is part of a health maintenance organization. The medical center serves a population of approximately 250,000. The hospital has a total of 160 medical-surgical beds, including 20 intensive care unit (ICU) beds for adults. The majority of the rooms are for single patients only. Obstetric-gynecologic, pediatric, and neonatal nursery beds were excluded from the study, because these beds were added to the medical center in the earlier part of 2009, just before study commencement.

Sample

In the hospital, a log of isolation days is maintained by the Infection Control Department. For each patient, the log includes the patient’s name and medical record number; date of admission; date of discharge, transfer, or demise; start and end dates of isolation; and reason for isolation. Staff obtains the information for the log from daily chart review, daily rounds, and interviews with nursing staff.

The hospital’s isolation policy follows the current CDC recommendations for the management or prevention of transmission of infections in the hospital specifically related to MDROs. In addition, since January 2009, the hospital has had an active MRSA surveillance program in place, as mandated by state law. Patients with documented current infection or history of infection or colonization with MDROs, such as MRSA, vancomycin-resistant enterococci (VRE), extended-spectrum ß-lactamase (ESBL), and other multidrug-resistant gram-negative organisms, are put on contact isolation on hospital admission. Patients with documented C difficile infection or a history of a positive C difficile result within the last 3 months are also put on contact isolation on admission. Patients with suspected (rule out) C difficile infection are placed on contact isolation until the infection is ruled out. Patients tested for MRSA with nasal swabs as part of the mandated surveillance testing or tested for VRE with rectal swabs as part of surveillance testing performed on admission to the adult ICU are placed on contact isolation only if they test positive. Patients are not placed on isolation while being ruled out for MDRO unless they have draining wounds or lesions highly suspicious of MRSA infection. Patients with suspected tuberculosis, influenza, meningococcal meningitis, and varicella are placed on droplet/airborne isolation. Isolation is continued if infection is confirmed. In response to an outbreak of H1N1 influenza in our area for most of 2009, all patients with influenza-like symptoms were placed on droplet/airborne isolation while respiratory material was tested.

Study design and analysis

The number of hospital days used for isolation between August 2009 and August 2010 was obtained from the Infection Control Department logs. The total number of isolation days was determined for adult patients who were isolated because of current infection or suspected infection (rule out) with MRSA, VRE, C difficile, other MDROs such as ESBL, and diseases or conditions necessitating droplet or airborne precautions, including tuberculosis, meningitis, influenza, and varicella, in accordance with CDC guidelines. Patients with a history of infection or colonization with MRSA, VRE, other MDRO, or C difficile were also isolated for the duration of their admission, in accordance with hospital policy.

Isolation days were counted from the time that the patient entered isolation until he or she was discharged from the hospital or tested negative for the condition being ruled out. The isolation days for the “rule out” patients who subsequently tested positive were included in the count for the documented infection category. The isolation days for those patients in whom infection was subsequently ruled out were included in the count for rule out isolation days. Isolation days for patients isolated for multiple reasons, such as concurrent MRSA and C difficile infections, were counted only once and were attributed to the initial reason for isolation. Patients with an undocumented isolation start date or end date were excluded from the study. A total of 16 patients (0.9% of the patients in the study) meeting these criteria were excluded.

The isolation days during the study period were counted for each of the following categories: number of isolation days for confirmed infection, colonization, or history of MDRO (including MRSA, VRE, and other MDROs); number of isolation days for C difficile; number of rule out isolation days for suspected C difficile and MDRO; number of droplet and airborne isolation days; and number of rule out isolation days for conditions necessitating droplet and airborne isolation.

The isolation utilization percentage (number of patient isolation days divided by the total number of patient days and multiplied by 100) was calculated for each month of the study period, as well as for the entire study period. The number of total patient days for each month of the study period was obtained from the records kept by the hospital’s business and finance office.

RESULTS

A total of 10,001 isolation days were identified during the study period, involving 1,761 patients. Based on 55,397 total hospital days for the study period, the isolation utilization percentage was calculated as 18.1% (Table 1).

For known infections (MRSA, VRE, other MDRO, C difficile, droplet, and airborne), 7,586 days were used for isolation, representing 75.9% of isolation days. Days of isolation while these infections were being ruled out accounted for 2,415 of the 10,001 days, or 24.1% of all isolation days.

The most frequent reason for isolation was known MRSA infection (43.1% of all isolation days), followed by rule out C difficile (17.4%), known C difficile infection (14.3%), and known VRE (8%).
Drplet/airborne infections (3.8%) and rule out MDRO (0.7%) prompted the lowest demand for isolation (Table 1).

To identify any seasonal patterns in isolation utilization, we calculated the number of patient and isolation days and utilization percentage for each month of the study period. The mean number of isolation days per month for all categories of isolation was 770 days (Table 1). The average monthly isolation utilization percentages were 13.7% (range, 9.5%-16.8%) for known infections and 4.4% (range, 2.1%-6.7%) for rule out infections. For the known and rule out categories combined, the utilization percentage ranged from 13.4% to 22% (mean, 18.1%). In each month there were patients in isolation for known MRSA, C difficile, and VRE infections and rule out C difficile, but in some months only few or no days were used for isolation due to other MDRO infections, droplet/airborne infections, rule out droplet/airborne infections, and rule out MDRO. The overall number of hospital days used for isolation varied from month to month, but no definite patterns or trends were seen over time in the number of isolation days or the utilization percentage for all infections (Fig 1) or for the 4 most frequent causes of isolation (Fig 2). In contrast, rule out isolation for conditions requiring droplet/airborne isolation showed a definite peak in the winter months (Fig 3), and hospital days used for droplet/airborne isolation for known conditions were much higher in the first half of the study period than in the second half (Fig 3). Positive tests for influenza were also high early in the study period and declined after November 2009 (Fig 3). Testing for influenza ended after February 2010, when no positive cultures were obtained.

DISCUSSION

Our data show that over the 13-month study period, 18.1% of hospital days in the medical-surgical and ICU wards of our community hospital were devoted to isolation. The majority of isolation days were for patients with known infections, which accounted for 13.7% of total hospital days. The present study also included a category for patients who were isolated until infection was ruled out. These patients eventually tested negative for infection, but their isolation accounted for 4.4% of total hospital days.

Given the large increases in incidence of MRSA11,12 and C difficile infections7,13,14 over the last 2 decades, our finding that these 2 organisms were responsible for the majority (75.5%) of isolation days for documented infections came as no surprise. Of interest was the finding that the patients placed on isolation while C difficile infection was ruled out and who eventually tested negative for C difficile accounted for more isolation days than patients with documented C difficile infections (1,741 days vs 1,425 days). Using a more rapid diagnostic test for C difficile, such as the newer molecular assay tests to detect C difficile toxin A and B genes in the stool, would allow for earlier return of a negative test and thus earlier discontinuation of isolation.

We were able to document monthly variability in the number of isolation days around a mean of 770 isolation days/month. However, we could detect no definite pattern to this variability for any categories except droplet/airborne and rule out droplet/airborne. For droplet/airborne isolations, the number of isolation days was high from August 2009 through November 2009, and then began to decline, although it remained somewhat elevated through March 2010. One possible source of this variability was the outbreak of H1N1 influenza in 2009, which might have led to more airborne/droplet isolations than usual. The presence of H1N1 influenza in our community was documented by an increase in respiratory samples positive for H1N1 virus on polymerase chain reaction analysis at our regional laboratory. The number of positive specimens declined substantially by January 2010.

Influenza is generally seasonal and usually appears in our region between October and March; the H1N1 epidemic was unusual in that it persisted in the United States from April 2009 until the end of the year. Despite the epidemic, droplet/airborne isolations represented a small percentage of overall hospital days used for isolation in our study, although an influenza epidemic affecting a larger portion of the population might result in greater demand for this category of isolation. A multiyear study would be needed to detect any substantial seasonality in the use of isolation for infection control for any of the categories of isolation.

Two previous studies examined the use of isolation in patients with MRSA. In a study from 1995 to 1998, Cooper et al15 found that 3,000 isolation days were required for isolation of patients infected or colonized with MRSA out of a total of 1,385,167 bed days, for an overall rate of 0.22%. In 2002, Chaberny et al16 published a prospective multicenter study of 4 university hospitals in Germany that reported 21,665 isolation days for MRSA, or 1.52% of all patient days.15 In contrast, in the present study, isolation due to MRSA accounted for 7.8% of all hospital days. Our results are not directly comparable to those from the earlier studies, which examined isolation days across all hospital services, because our study was confined to medical-surgical and ICU beds. However, the incidence of MRSA infections has increased over the last 10-15 years,6 and our data on the isolation days required for MRSA support the importance of this organism for infection control practitioners. An oft-cited reference on isolation demand by Garner and Kaiser10 using a prevalence survey method found an isolation rate of 1.6% for a group of 7 community hospitals and 4.5% for a city-county hospital. However, that study addressed only the number of patients requiring isolation and did not examine the actual hospital days required for isolation. Although we found that patients with confirmed or suspected C difficile infection accounted for the second-largest number of hospital days devoted to isolation after MRSA, we have identified no other studies specifically examining the effect of C difficile infection on isolation days.

A strength of the present study is that the data presented reflect what infection control practitioners are seeing today in the setting
of a community hospital. The data were collected prospectively over a 13-month period as part of the daily routine of our Infection Control Department and included all of the isolation categories used today, including patients isolated while infection was being ruled out. Thus, our results should be applicable to other community hospitals. However, many factors may affect the need for isolation, potentially limiting the generalizability of our data to other settings. Hospital and public health policies, both local and national, can affect the demand for isolation. Our hospital follows the Healthcare Infection Control Practices Advisory Committee Guidelines for Isolation Precautions, and an active MRSA surveillance program as mandated by state law was initiated in January 2009. The program calls for testing patients for MRSA carriage who are admitted to the ICU, readmitted within 30 days of a stay in hospital, admitted from a skilled nursing facility, or receiving hemodialysis. Any patient with a positive culture is placed on isolation. Hospitals in other states without such policies would likely use fewer days for isolation.

As noted earlier, the present study was limited to the medical-surgical and ICU wards of our hospital. Neonatal nursery, pediatric, and obstetric/gynecology patients were not included because these services were not available at our facility until shortly before study commencement, when a new Women’s and Children’s Hospital opened on our campus in a separate building. The general impression of our infection control practitioners, based on experience after the end of the present study, is that the demand for isolation days from neonatal nursery, pediatric, and obstetric/gynecology patients in our community hospital setting is substantially less than for our medical-surgical and adult ICU patients. However, a 1987 study by Kim et al at a university-affiliated pediatric hospital found that isolation days accounted for 15.3% of hospital days over 12 months, similar to the percentage in our adult patient population. Kim et al also noted that during one-third of the year, the hospital was unable to provide adequate numbers of single rooms for anywhere from 1 to 20 patients, underscoring the need for adequate planning for isolation. Additional studies of isolation...
within the pediatric, obstetric-gynecologic, and neonatal nursery populations are needed to clarify the current needs.

Our hospital is a primary care community hospital and has general oncology, general orthopedic, and general surgery patients, but does not offer tertiary care specialties, such as spinal surgery, neurosurgery, cardiac surgery, and trauma care. Because tertiary care hospitals include patients who are sicker and have more complicated illnesses, these sites might have isolation needs that differ from ours. Similarly, hospitals that have problems with endemic MRSA, VRE, or other MDRO, or that have a higher incidence of C difficile infections, might find that more hospital days are required for isolation. Nonetheless, we believe that our results can serve as a guide for isolation needs in community hospitals and possibly could be extended to other settings if these additional factors are taken into consideration. The field would benefit from further research of isolation needs in a variety of settings.

The present study has several limitations. Although the study was prospective, the data that we collected were descriptive and relied on information entered into a log by our nursing staff and infection control practitioners. These data did not include observations of compliance with isolation guidelines or evaluations of whether isolation start and end times were appropriate. The data log also could not identify whether any patients who should have been isolated were not isolated, or whether some patients who were isolated were not isolated, or whether some patients who were isolated for only a brief period on a weekend or holiday were overlooked, because information on isolation was entered into the log only on business days. We feel that the numbers of such patients is likely small, and note that only 16 patients included in the log (0.9% of the total study patients) were excluded from the analysis because of missing start or end dates. Our Infection Control Department is well staffed, and regular active surveillance of isolation patients through daily weekday rounds and the use of the log book is an important part of the routine. Despite the limitations noted, we feel that the data collected accurately reflect the isolation demands in our setting. If any days of isolation were missed, then our data would be a conservative estimate of hospital days devoted to isolation.

This study thus provides useful information on the substantial number of hospital days devoted to isolation in the medical-surgical ward and adult ICU of a community hospital. The data presented reflect isolation bed utilization based on current isolation guidelines and the current epidemiology of infectious disease pathogens. Hospitals may find this information helpful in planning for bed utilization and resource allocation for staff and supplies.

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