American Journal of Infection Control 46 (2018) 487-91

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major Article

A systematic approach to quantifying infection prevention staffing and coverage needs

Rebecca Bartles MPH, CIC, FAPIC [a,*], Angela Dickson MN, BSN, RN, CIC [b], Oluwatomiwa Babade MD, MPH [a]

[a] Providence St Joseph Health System, Renton, WA
[b] Providence Southwest Washington Service Area, Centralia, WA

Key Words:
Infection prevention staffing
FTE
human resources
employees
needs assessment
staffing
staffing models

Background: This article describes a large nonprofit health care system's approach at quantifying the actual number of infection preventionist (IP) and relative support staff required to build and sustain effective infection prevention programs.

Methods: A list of all physical locations within the organization requiring infection prevention coverage were identified via survey, including department-level detail for 34 hospitals, 583 ambulatory sites, and 26 in-home and long-term care programs across 5 states. Required IP activities for each physical location were also tallied by task. Type of activity, frequency (times per year), hours per activity, and total number of locations in which each activity should occur were determined. From this, the number of hours per week of infection prevention labor resources needed was calculated.

Results: Quantitative needs assessment revealed actual labor need to be 31%-66% above current benchmarks of 0.5-1.0 IP per 100 occupied beds. When aggregated across the organization, the comprehensive review results yielded a new benchmark of 1.0 infection prevention full-time equivalent per 69 beds if ambulatory, long-term care, or home care are included.

Conclusions: Size, scope, services offered, populations cared for, and type of care settings all impact the actual need for IP coverage, making the survey benchmarks available in the literature invalid. A comprehensive assessment of health care organization composition and structure is necessary prior to determining the IP staffing needs for that organization.

BACKGROUND

Although the practice of hospital infection prevention and control (IPC) has roots beginning in the first half of the 18th century,[1] it was not until recent decades that the role of the infection preventionist (IP) was considered critically important in the health care environment. The professional organization for IPs, the Association for Professionals in Infection Control and Epidemiology, was founded in 1972 by a small group of infection control nurses who recognized the growing need. The group now serves >15,000 members across 48 countries.[2] This number in itself highlights the rapid growth and development of the field over the last 4 decades.

The rise of infection prevention as a career field was further accelerated by the 1999 release of the Institute of Medicine's report, *To Err Is Human: Building a Safer Health System*.[3] This report shed light on the many health care–associated errors occurring within the United States, particularly those related to infection. In the decade and a half after this report, awareness of the need for robust IPC programs has grown substantially. Most recently, the inclusion of health care–associated infections in the Centers for Medicare and Medicaid Services' Hospital-Acquired Conditions and Value-Based Purchasing programs[4] and associated financial penalties for poor performance has turned the spotlight squarely on the hospital IP. In addition, increased state reporting requirements and initiatives, movement from targeted to whole-house surveillance, and expansion of IP scope outside of the hospital walls has left the hospital IP without the resources necessary to ensure safe practices within their facility. With this awareness has come the need for

* Address correspondence to Rebecca Bartles, MPH, CIC, FAPIC, Providence St Joseph Health System, 1801 Lind Ave SW, 1st Fl Pariseau, Office 100.60, Renton, WA 98057.
E-mail address: Rebecca.bartles@providence.org (R. Bartles).
Conflicts of interest: None to report.

0196-6553/
https://doi.org/10.1016/j.ajic.2017.11.006

guidance on how to effectively determine staffing needs for IPC programs, across all care settings.

In this article, we describe a large nonprofit health care system's approach at quantifying the actual number of IPC team members required to build and sustain effective IPC programs.

METHODS

Providence Health & Services is a large, not-for-profit, Catholic health care organization comprised of 34 hospitals, ≥580 physician clinics, long-term care facilities, senior services, in-home services, supportive housing, and many other health and educational services. Providence Health & Services is divided into 9 regions across 5 states (Alaska, California, Montana, Oregon, and Washington) and includes 2 affiliates, Swedish Health System and Kadlec Regional Medical Center. The organization has a system office located in Renton, Washington, that provides the regions with support and centralized services.

In February 2016, the system infection prevention (SIP) team received a request to conduct a system-wide assessment of IPC staffing ratios. The SIP team conducted an assessment for each of the 9 regions using the following steps (in order): literature review, review of current state, regional assessment meetings, quantitative needs assessment, and staffing model development. Each step is subsequently detailed.

Step 1: Literature review

The SIP team began the assessment by attempting to identify current staffing benchmarks. A comprehensive literature review was conducted and 6 sources were identified and reviewed. Staffing ratios suggested in these 6 sources included data gathered through historical survey and data gathered through quantitative modeling of a hypothetical care setting. The ratios ranged from 0.5-1.0 IP per 100 beds.[5-10] The most recent document found was a survey published in 2011,[9] and substantial changes to the role and scope of infection prevention have occurred since that time. In addition, many of the sources focused on current program composition, not identification of an ideal program staffing model. Those sources that did attempt to identify an appropriate staffing ratio using a quantitative method were outdated. These sources did not offer the level of detail necessary to determine the actual number of IPC staff needed to run an effective program.

Step 2: Review of current state

The SIP team collected information regarding all physical locations within the health system via survey. An electronic survey was sent to the infection prevention lead at each hospital, long-term care facility, and ambulatory clinic. A separate survey format was used for each of these 3 care settings. Each survey requested information specific to that care setting, including demographic information about the facility and a comprehensive list of all departments and settings which required infection prevention coverage. Responses were received from 100% of locations.

The SIP team compiled the results of the survey into a spreadsheet. The infection prevention leader within each region verified the contents of the spreadsheet and ensured that all physical care locations within that region were accounted for. Care settings were identified that did not fall into the 3 outlined categories of hospitals, long-term care, and ambulatory clinics, including assisted living, infusion pharmacies, rehabilitation facilities, lab draw stations, ambulatory surgery centers, and in-home services. Each of these additional location types were added to the spreadsheet.

Each IPC team member within the region also completed a comprehensive survey regarding distribution of time among their current work activities. Participants were asked to respond with current state rather than ideal state to allow the SIP team to better understand which tasks were being prioritized at each facility and which tasks were not being conducted.

Step 3: Regional assessment meetings

The SIP team scheduled full-day, on-site meetings within each region to conduct a comprehensive, quantitative needs assessment based on the information gathered via survey. Key stakeholders were invited at the discretion of the regional IPC leader, but generally included hospital or regional clinical leadership (chief nursing officer or chief medical officer), quality and patient safety, all IPC department employees, representatives from ambulatory care settings and long-term care settings, representatives from in-home care settings, and any other key stakeholders with significant infection prevention ties. At the beginning of each regional assessment meeting, participants were provided with the current staffing levels and a graphical depiction of the current staffing model for their region. Participants were also provided with an estimate of attributable costs associated with health care–associated infections for the region, including Value-Based Purchasing penalties assessed, if applicable.[11,12] This background information was provided to ensure that all participants had a working knowledge of current staffing models for the region and the risk to patient and institution caused by health care–associated infections. Although a numerical association between health care–associated infection rates and staffing ratios could not be identified in the literature, the SIP team assumed that this association exists.

Step 4: Quantitative needs assessment

Using the information collected via survey and compiled into spreadsheets, a comprehensive list of all physical locations within each care setting that required IPC oversight was presented to participants. The list was reviewed during the meeting with all key stakeholders, at which time edits and additions were made. This was a critical step to ensure that the subsequent list was fully inclusive of all care settings within the scope of the IPC program in that region.

Once the list of physical locations was finalized, the team was asked to consider the IPC-related activities that should occur at each physical location. The team was instructed to consider those activities that should occur within an ideal IPC program.

In hospital and long-term care settings, isolation-rounding to influence was identified as a priority activity in inpatient and emergency department care settings. This involves the IP being physically present in the patient care department to ensure isolation is being carried out as intended and to answer any patient-specific questions that caregivers might have. This is seen as an important opportunity for collaboration and trust building with caregivers.

In all non-homecare settings in which care is provided to a patient, or patient supplies and equipment are stored, environment of care (EOC) rounding was identified as a priority activity. EOC rounding is a formal inspection of a patient care area. During EOC rounds, IPs review the safety of the physical environment while monitoring patient care and disinfection and sterilization practices. Table 1 provides an example of how these data were collected and quantified.

Once the type of IPC activities required were identified, the team was asked to consider the frequency in which each activity should occur. Although some variance occurred between sites, most regions determined that IPC teams should conduct brief rounding on

Table 1
Sample quantitative needs assessment for inpatient settings and long-term care

Setting	Activity	Times per year	Hours per each activity	Total no. of units	Hours per week
Inpatient units and step-downs	Isolation-rounding to influence	260	0.25	15	18.75
ICU	Isolation-rounding to influence	260	0.5	4	10.00
ED	Isolation-rounding to influence	260	0.5	1	2.50
Special pathogens	Isolation-rounding to influence	4	4	1	0.31
Inpatient units and step-downs	EOC	2	4	15	2.31
ICUs	EOC	2	4	4	0.62
ED	EOC	4	4	1	0.31
Comprehensive diagnostic imaging	EOC survey	16	2	1	0.62
Endoscopy	EOC survey	4	2	1	0.15
Interventional radiology	EOC survey	4	2	1	0.15
Pharmacy	EOC survey	3	2	2	0.23
Radiation oncology	EOC survey	3	2	1	0.12
Wound care/enterostomal therapy	EOC survey	3	2	1	0.12
Comprehensive laboratory	EOC survey	8	2	1	0.31
Respiratory therapy	EOC survey	2	2	1	0.08
Outpatient infusion	EOC survey	3	2	1	0.12
IV therapy	EOC survey	2	2	1	0.08
Inpatient dialysis	EOC survey	4	2	1	0.15
Outpatient maternity clinic	EOC survey	2	2	1	0.08
Ronald McDonald family rooms	EOC survey	1	2	1	0.04
Outpatient Pediatric Oncology/Infusion	EOC survey	8	2	1	0.31
Continence clinic (pediatrics)	EOC survey	2	2	1	0.08
Drawing stations	EOC survey	2	2	3	0.23
Cardiac OR	EOC survey	8	2	1	0.31
C-section OR	EOC survey	3	2	1	0.12
Main OR	EOC survey	16	2	1	0.62
Ambulatory day surgery	EOC survey	8	2	1	0.31
Pediatrics OR	EOC survey	8	2	1	0.31
Cath laboratory	EOC survey	8	2	1	0.31
High level disinfection locations	EOC survey	4	4	2	0.62
Sterilization locations	EOC survey	8	4	2	1.23
Kitchens	EOC survey	6	2	1	0.23

C-section, cesarean section; *ED*, emergency department; *EOC*, environment of care; *ICU*, intensive care unit; *OR*, operating room.

Table 2
Sample quantitative needs assessment for ambulatory settings

Clinic name	No. of rooms	High-level disinfection	Sterilization	Endoscopes	TB	Surgery	Patient visits per month	Travel time (h)	Visits per year	Hours per visit	Hours per week
1	2	No	No	No	No	Yes	106	0	2	2	0.75
2	3	Yes	Yes	No	No	No	76	0	2	4	0.15
3	3	No	No	No	No	Yes	304	0.25	2	2	0.08
4	4	No	No	No	No	No	192	0.25	2	2	0.08

TB, tuberculosis.

inpatient units daily if possible (5 d/wk), EOC rounding on inpatient and ancillary units at least twice per year, and EOC rounding in ambulatory facilities at least annually.

Each region also agreed that EOC rounding should be increased for care settings as necessary based on an annual risk assessment. Each team made adjustments to EOC rounding frequency for inpatient settings at this time. Given the unique nature of ambulatory care settings, additional risk factors were addressed when assessing the frequency at which EOC surveys should occur. Each clinic was surveyed to determine if they used endoscopes, conducted surgery, performed high-level disinfection or sterilization, or routinely cared for patients with tuberculosis. Because each of these factors increase the complexity of the survey and risk to patients, it was determined that facilities with a higher number of risk factors would be surveyed more frequently than once annually (Table 2).

Finally, the team was asked to estimate the amount of time each activity would take to complete each time it was conducted. Each of these parameters (activity type, frequency [in times per year], estimated time per activity [in hours], and total number of units) were then added to the spreadsheet. From this, the number of hours per week of full-time equivalent (FTE) resources necessary to meet the IPC need was calculated using the formula (times per year × hours per activity × total number of units)/52 for each care setting, as demonstrated in Tables 1 and 2.

Table 3
Sample regional quantitative needs calculation

Care setting	Quantitative assessment results (h/wk)	Education at 30% (h/wk)	Total (h/wk)	FTE
Facility 1	189.44	56.83	246.28	6.16
Facility 2	64.38	19.32	83.70	2.09
Facility 3	36.13	10.84	46.98	1.17
Rehabilitation facility	50.54	15.16	65.70	1.64
Long-term care facility	38.94	11.68	50.63	1.27
Ambulatory clinics	44.34	13.30	57.65	1.44
Home care	3.93	1.18	5.11	0.13
Adult day center	0.59	0.18	0.77	0.02
Total	429.50	128.85	558.35	13.96

FTE, full-time equivalent.

In the in-home service locations, EOC and isolation-rounding to influence were substituted with day visits spent accompanying caregivers into patient homes in 1 of the 9 regions.

The previously completed IPC team member survey data were then combined with the quantitative needs assessment data for each

physical location. This survey included the amount of time spent on all other tasks conducted by each IPC team member except for daily rounding and EOC survey activity. These tasks included surveillance and reporting, policy and procedure, consultation, case review, exposure response, regulatory preparation, scheduled meetings, literature review, professional development, and project work. Although it was acknowledged that education is an important element of IP practice, most of the IPs surveyed could not accurately estimate the amount of time they spent each week on education of caregivers and patients. The Barnes and Spencer article[13] suggests that 30% of an IP's time should be spent on education; therefore, this number was used to calculate the amount of hours per week needed for education.

For each region, the estimated IP task-related hours per week needed were then added together to create a regional result (Table 3).

Step 5: Staffing model development

The total IPC FTE need identified during the quantitative assessment was compared with the current IPC FTE status within the region. Gaps were highlighted based on care setting, and each regional team determined where and how the needed IPC resources should be applied. A model of an ideal program was created for each region based on the discussion and gaps identified. Figure 1 provides an example of a model created by 1 of the 9 regions. Solid lines indicate direct reporting relationships, whereas dotted lines represent indirect or consultative reporting relationships.

Finally, the SIP and regional IPC teams worked together to prioritize the gaps and created 3 coverage plans (current, better, and ideal) to facilitate an incremental approach to improvement. After the comprehensive regional assessment meeting, the SIP team summarized the information into a more concise format and then shared with each regional leadership team in the form of an executive summary.

RESULTS

A quantitative needs assessment was conducted for all physical locations within the health care system that required IPC oversight, including 34 critical access, community, and tertiary hospitals, 1 rehabilitation hospital, 13 in-home care programs, 13 long-term care facilities, and 583 ambulatory locations.

Table 4 represents the low and high staffing ratio benchmarks available in the literature[5-10] compared with the staffing needs identified during the quantitative assessment process. The IPC FTE needs of the system as a whole were underrepresented by 66% when using the lower staffing ratio benchmark of 0.5 FTE per 100 beds and by 31% when using the higher staffing ratio benchmark of 1.0 FTE per 100 beds. When aggregated across the organization, the comprehensive review results yielded a new benchmark of 1.0 IPC FTE per

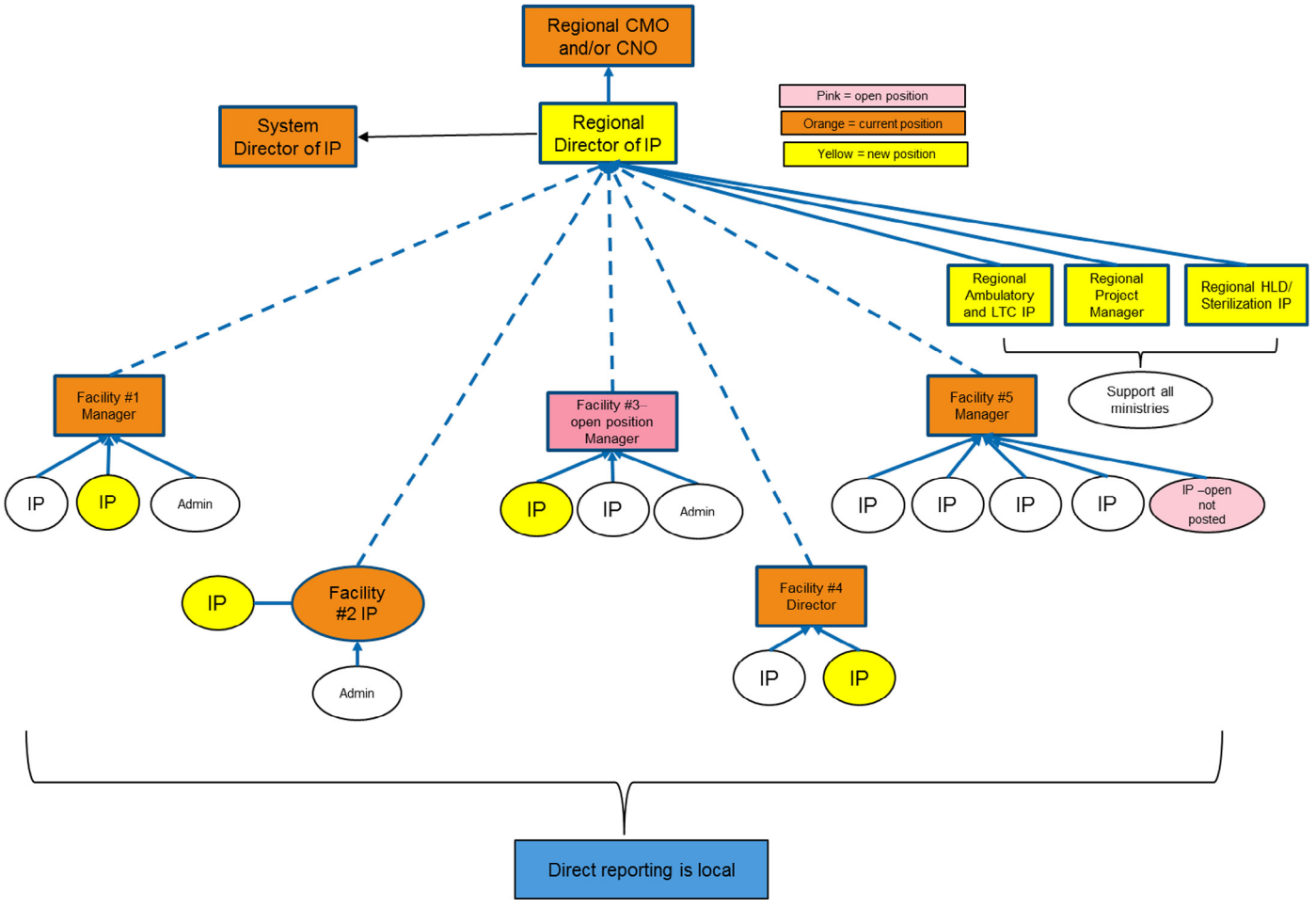

Fig 1. Sample staffing model with gaps identified for a large region. *Admin*, Administrative assistant; *CMO*, chief medical officer; *CNO*, chief nursing officer; *HLD*, high level disinfection; *IP*, infection preventionist; *LTC*, long-term care.

Table 4
Staffing needs assessment results compared with benchmark staffing ratios by region

Region	No. of FTEs calculated using literature review results of 0.5 FTE per 100 beds	No. of FTEs calculated using literature review results of 1.0 FTE per 100 beds	Calculated actual FTE need using quantitative assessment method
1	3.5	7	11.52
2	9.775	19.5	28.67
3	2.5	5	6.52
4	7.465	14.93	16.41
5	4.25	8.5	14.37
6	0.7	1.4	2.40
7	5.28	10.56	14.20
8	2.585	5.17	11.16
9	1.38	2.76	3.15
Total	37.435	74.82	108.40

FTE, full-time equivalent.

69 beds for the enterprise, including all care settings requiring IPC oversight.

In addition, the actual percentage of time IPs spent conducting surveillance took up an average of 51% of current working hours with <1 h/wk spent on professional development.

DISCUSSION

The current resources available to assist an IPC leader in determining appropriate staffing are largely based on surveys of historical IPC program staffing within the United States and Canada. When diving deeper, the actual demand for IPC services is significantly higher than even the highest staffing ratio benchmark, revealing a gap of which most IPs are acutely aware. All available peer-reviewed literature presents staffing as a ratio of IPs to inpatient beds, which does not take into account the complex nature of the work and the varying degree of acuity and risk in different care settings. Because of the lack of a quantitative methodology in the literature for determining IP staffing needs based on actual services required, many health care organizations are still staffing to an antiquated, insufficient standard, with many staffed below even this mark.

The categories of rounding, education, and professional development are where the greatest gaps appear between current and ideal practice. All IPs interviewed agreed that although most of their time was spent on surveillance and reporting, the most valuable use of their time is conducting environmental rounding and caregiver education activities. All group participants agreed that having an IPC presence on each inpatient unit at least 5 d/wk, even for as few as 5-10 minutes, was of great value to the program.

During the staffing model development process, many regions determined that a percentage of surveillance activities could be accomplished by a lesser-skilled individual, leaving additional time for the IP to interact in patient care areas. Some regions chose to add support positions to support the work of the IPC team, including project managers, data analysts, and administrative support. Other facilities determined that their needs would best be met by having their IPC staff specialize in a single care setting, including acute care, ambulatory care, long-term care, or in-home care. Still, other facilities determined that having their IPC staff focused on a particular service line or activity would be the most beneficial (eg, reprocessing, surveillance, rounding). Staffing models and needs varied widely based on size and structure of each region.

There are limitations to this quantitative staffing approach. Inherent error likely occurs when caregivers are asked to estimate the number of hours historically spent conducting a task or the amount of time it might take to conduct a future task. Additionally, there are no recent studies available that correlate increases in staffing with decreases in hospital-acquired infections; therefore, the threshold at which these 2 relate is not known. Finally, priorities for IPC services will vary at each entity. Although this assessment does not fully take into account potential changes to IPC programs in the future, the tool itself is intended to do just that. Used on a routine basis, this method will allow an organization to continue to understand their staffing needs as they evolve.

In summary, it is necessary to conduct a comprehensive assessment of the composition of a health care organization prior to determining the IPC staffing needs for that specific organization. Hospital size, scope, services offered, populations cared for, and type of care settings all impact the actual need for infection prevention coverage. A one-size fits all model cannot be developed because of the significant variation from facility to facility and system to system; however, a better proxy could be developed if enough large health care systems pooled together quantitative needs assessment data for analysis.

References

1. Forder AA. A brief history of infection control—past and present. S Afr Med J 2007;97:1161-4.
2. APIC. History. Available from: www.apic.org/about-APIC/history. Accessed September 28, 2016.
3. Institute of Medicine. To err is human: building a safer health system. National Academy Press; 1999.
4. Centers for Medicare & Medicaid Services. Hospital Value Based Purchasing. 2015. Available from: https://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/downloads/Hospital_VBPurchasing_Fact_Sheet_ICN907664.pdf. Accessed November 21, 2017.
5. Haley RW, Quade D, Freeman HE, Bennett JV. The SENIC Project. Study on the efficacy of nosocomial infection control (SENIC Project). Summary of study design. Am J Epidemiol 1980;472-85.
6. Morrison J; Health Canada, Nosocomial and Occupational Infections Section. Development of a resource model for infection prevention and control programs in acute, long term, and home care settings: conference proceedings of the Infection Prevention and Control Alliance. Can J Infect Control 2001;6:35-9.
7. O'Boyle C, Jackson M, Henly SJ. Staffing requirements for infection control programs in US healthcare facilities: Delphi project. Am J Infect Control 2002;30:321-33.
8. Stone P, Dick A, Pogorzelska M, Horan TC, Furuya EY, Larson E. Staffing and structure of infection prevention and control programs. Am J Infect Control 2009;37:351-7.
9. Krein SL, Kowalski CP, Hofer TP, Saint S. Preventing hospital-acquired infections: a national survey of practices reported by U.S. hospitals. J Gen Intern Med 2011;27:773-9.
10. Stone PW, Dick A, Furuya Y, Horan T, Larson E, Raveis V, et al. Prevention of nosocomial infections & cost effectiveness refined: The P-NICER Study. Columbia University website. Available from: http://www.cumc.columbia.edu/studies/pnice/background.html. Accessed November 11, 2017.
11. Zimlickman E, Henderson D, Tamir O, Franz C, Song P, Yamin CK, et al. Health care-associated infections: a meta-analysis of costs and financial impact on the US health care system. JAMA Intern Med 2013;173:2039-46.
12. Filice GA, Nyman JA, Lexau C, Lees CH, Bockstedt LA, Como-Sabetti K, et al. Excess costs and utilization associated with methicillin resistance for patients with Staphylococcus aureus infection. Infect Control Hosp Epidemiol 2010;31:365-73.
13. Barnes S, Spencer M. Reliable design of infection prevention programs. Infection Control Today. 2015. Available from: http://www.infectioncontroltoday.com/articles/2015/09/reliable-design-of-ip-programs.aspx. Accessed December 5, 2017.