American Journal of Infection Control 40 (2012) 309-13

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Special article

The APIC research agenda: Results from a national survey

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Key Words:
Research priorities
Infection prevention research

Background: Research is an integral component of the Association for Professionals in Infection Control and Epidemiology (APIC) Strategic Plan 2020. As the role of the infection preventionist (IP) has evolved toward consumers and implementers of research, it becomes increasingly necessary to assess which topics require further evidence and how best APIC can assist IPs. In 2010, APIC determined that the research priorities first described in 2000 needed to be re-evaluated.

Methods: A 33-question Web-based survey was developed and distributed via e-mail to APIC members in March 2011. The survey contained sections inquiring about respondents' demographics, familiarity with implementation science, and infection prevention research priorities. Priorities identified by a Delphi study 10 years ago were re-ranked, and open-ended items were used to identify new research priorities and understand how APIC could best serve its members in relation to research.

Results: Seven hundred one members responded. Behavioral management science, surveillance standards, and infection prevention resource optimization were the highest ranked priorities and relatively unchanged from 2000. Proposed additional research topics focused on achieving standardization in infection prevention practices and program resource allocation. The majority of respondents described APIC's role in the field of research as a disseminator of low-cost, highly accessible education to its members.

Conclusion: This report should be used as a roadmap for APIC leadership as it provides suggestions on how APIC may best direct the association's research program. The major research priorities described and ranked in 2000 continue to challenge IPs. APIC can best serve its members by disseminating research findings in a cost-effective and easily accessed manner. Recurrent assessments of research priorities can help guide researchers and policy makers and help determine which topics will best support successful infection prevention processes and outcomes.

Health care-associated infections (HAIs) are a costly patient safety problem affecting approximately 1.7 million patients each year.[1,2] With this knowledge, and the goal to reduce health care costs and improve quality, there have been several institutional, regional, and national initiatives put in place often expanding the role of the infection preventionist (IP) and making it more complex.[3,4] To help IPs better perform their role and understand effective strategies to prevent and control infections, relevant research findings that translate to clinical practice are needed.[5]

For these reasons, research continues to be an integral component of the Association for Professionals in Infection Control and Epidemiology (APIC) Strategic Plan 2020. Guided by a task force of expert researchers, relevant APIC leadership, and grassroots members (see list of task force members), the association coordinates research initiatives with the primary aim of identifying implementable infection prevention solutions, which will better serve the needs of IPs.

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Conflicts of interest: None to report.

0196-6553/$00.00 - Published by Elsevier Inc. on behalf of the Association for Professionals in Infection Control and Epidemiology, Inc.
doi:10.1016/j.ajic.2012.03.005

In 2010 the research task force surveyed its members to re-evaluate and update the previous APIC research agenda. Specifically, the task force aimed to establish the membership's levels of interest and understanding of implementation science and identify how APIC could best serve its members in relation to research.[6]

METHODS

A Web-based survey was developed with APIC research task force members advising on content validity. Invitations to participate in the Web-based survey hosted by APIC headquarters via the Informz software (Informz Inc, Saratoga Springs, NY) were e-mailed to all North American APIC members with valid e-mail addresses using a modified Dillman technique.[7] This group comprised nearly 95% of APIC membership. Participants were given 4 weeks to complete the survey with reminders e-mailed via the association's weekly electronic newsletter. Chapter leaders were also contacted to encourage participation. A modest incentive in the form of a random drawing among participants to receive a 1-year subscription to the APIC Text Online was offered to participants willing to provide contact information.

The survey contained sections inquiring about the respondents' demographics, familiarity with implementation science, and infection prevention research priorities. To familiarize members with previous research priorities, respondents were provided with a list of prior published priorities and asked to re-rank items by level of current importance (eg, level 1 = urgent, level 2 = relevant and important, level 3 = good to do but not urgent, and level 4 = not a priority at this time).[6] The survey also contained the following 2 open-ended items: (1) "If there are specific research topics not addressed in the above search priorities that you feel are of significant importance, please describe them by topic in the areas below"; and (2) "What is the single most important thing APIC can do for you to enhance your knowledge, awareness, and participation in dissemination and implementation research?"

Demographic data were summarized using descriptive statistics. The research priorities were ranked based on proportion of respondents that identified an item to be levels 1 to 4. To compare these results with the list published in 2000, items from both priority lists were grouped into 3 categories: top, high, and mid-importance.

The open-ended questions were analyzed using an inductive qualitative approach. All data were coded and analyzed using qualitative analysis data software NVivo 9 (QSR International Inc, Cambridge, MA). All free text responses were examined and categorized based on content by 1 researcher. Themes and subthemes were identified. Results were discussed and reviewed with additional members of the research team.

RESULTS

A total of 701 members responded to the survey, and 623 (89%) of these respondents completed the entire survey, which required an average of 10.48 minutes to complete. Table 1 presents the demographics of the respondents. The majority of respondents (70%) had a baccalaureate degree or higher. Whereas the majority of the respondents were also very experienced (43% had 9 or more years of experience in infection prevention), nearly one quarter of the respondents had less than 4 years of experience. Less than half (44%) of the sample were certified in infection prevention.

The ranking and comparison of research priorities in 2011 and 2000 are presented in Table 2. The top priorities identified by APIC membership in both time periods included (1) application of behavioral and management science to achieve compliance; (2) development of meaningful surveillance indicators for HAI measurement; (3) identification of specific components of infection prevention and control programs in staffing; (4) development of methods to improve antimicrobial use; (5) determination of risk factors for and effective interventions to decrease resistance; and (6) identification of the cost, morbidity, and mortality from surgical site infection (SSI), ventilator-associated pneumonia (VAP), bloodstream infection (BSI), and urinary tract infection, as well as research on the cost benefit and effectiveness of interventions aimed at these HAIs. The development of methods to improve clinical diagnosis, prevention, and management of VAP increased in rank from a priority of high importance to a top level priority, whereas the use of multicenter evaluations to determine the economic impact of HAIs and other adverse events dropped in the ranking of priorities. Previously considered to be of mid-importance, the investigation of HAIs in nonhospital settings, creation of financial packaging systems for infection control programs, and optimization of community-wide or regional infection control networks were ranked as priorities of high importance in the current survey. Evaluation of the impact of waterborne HAIs and the need for randomized clinical trials to decrease and measure the outcomes around occupational exposures and injuries decreased in rank from high to mid-importance.

Table 1
Demographics of respondents: N = 701

	No.	Percent
Education		
No degree	34	5
Associate degree	95	14
Baccalaureate	281	40
Master's	193	27
Doctoral	21	3
Unknown	79	11
Years of experience in infection prevention		
Less than 4	156	22
4-8	161	23
9-12	83	12
13-20	104	15
>20	114	16
Unknown	77	11
Certification		
No	316	45
Yes	309	44
Unknown	78	11
Employment setting		
Hospital/acute care	460	65
Ambulatory	50	7
Long-term care	37	5
Public health	18	3
Other	60	9
Unknown	78	11

Two hundred five free text responses were analyzed in response to the first open-ended question, which asked IPs to describe priority research topics. Although responses were discrete, 2 major themes emerged: (1) HAI prevention and (2) IP work environment. These themes and their subthemes are described in descending order of frequency in Table 3. The theme standardizing HAI prevention pertained to multiple drug resistance organisms, *Clostridium difficile* (*C difficile*), central line-associated bloodstream infection (CLABSI), catheter-associated urinary tract infection (CAUTI), VAP, and SSI and had 4 subthemes: (1) technique-specific recommendations, (2) evidence for existing practice, (3) specific guidelines and research, and (4) equipment and environment. Technique-specific recommendations pertained to explicit guidance for HAI prevention techniques. For example, regarding the maintenance of intravenous catheters, an IP asked, "Scrub the hub—how many seconds of scrubbing are required . . .?" Evidence for existing practice asked whether current practice is supported by the literature and sought

Table 2
Research priorities ranked for importance, year 2000 and 2011

Research priority	2011 Priority level	2000 Priority level comparison*
1. Top importance		
Apply behavioral and management science to achieve compliance with infection prevention (eg, hand hygiene, isolation precautions, sharps injury prevention)	1	-
Develop meaningful surveillance indicators for measuring HAIs and noninfectious complications in health care settings and define standards for each indicator	2	-
Identify specific components of infection prevention and control programs in staffing in health care settings and define standards for each indicator	3	-
Develop methods to improve the appropriateness of antimicrobial use	4	-
Determine the risk factors for resistance, including the relationship between the use/volume of antibiotics, and the introduction of antibiotic-resistant organisms from the community and which interventions decrease the prevalence of antimicrobial resistance in health care institutions	5	-
Identify cost, morbidity, and mortality (attributable) from SSI, VAP, BSI, and UTI in current dollars, controlling for severity of illness, research on cost benefit and cost-effectiveness of interventions to decrease SSI, CAP, BSI, and UTI	6	-
Develop methods to improve the clinical diagnosis, prevention, and management of ventilator-associated pneumonia, including timing of tube changes, effect of weaning schedules, mouth care, bed position, and other factors among patients of all ages	7	↑
2. High importance		
Improve hospital information systems for seamless review of appropriateness of infection control-related care based on diagnosis	8	-
Evaluate the utility of computerized health care information systems as a resource for conducting surveillance for infections and related processes of care in health care settings	8	-
Determine standard indices for measurement of effectiveness and cost of infection control measures	9	-
Investigate HAIs in nonhospital settings (eg, home care, dialysis centers, long-term care), including studies to determine the magnitude and epidemiology of infections in these settings, development of standardized surveillance definitions and systems, and ultimately development of evidence-based prevention guidelines	9	↑
Use multicenter evaluation to develop satisfactory data for economic impact of HAIs and other adverse events and resulting return of investment for prevention methods	10	↓
Creation of financial packaging systems for infection control program use These systems should help ICP display to organizational leadership the financial and medical benefits realized from infection control and hospital epidemiology.	11	↑
Optimize community-wide or regional-wide infection control networks	11	↑
3. Mid-importance		
Study the relationship between health care workers' workload and the skill mix (RNs, LPNs, assistants) and risk for HAIs and cross transmission of pathogens that cause HAIs	12	-
Measure effect of managed care (reduced personnel and use of unlicensed personnel) on patient outcomes such as SSI, CLABSI, and colonization with MDROs	13	-
Assess safety of prolonging duration of peripheral IV lines from 72 to 96 hours; the study must address safety and cost.	14	-
Conduct randomized clinical trials to decrease occupational exposures, injuries, and illnesses and measure morbidity, cost of occupational exposures, and illness	15	↓
Extend the study of HAIs to the home-based population	16	-
Evaluate the impact of waterborne HAIs	17	↓
Evaluate hospital infection control in developing countries: what elements provide the greatest benefits?	17	-

BSI, blood stream infection; *CLABSI*, central line blood stream infection; *HAIs*, health care-associated infections; *ICP*, infection control personnel; *LPN*, licensed professional nurse; *MDROs*, multiple drug-resistant organisms; *RNs*, registered nurse; *SSI*, surgical site infection; *UTI*, urinary tract infection; *VAP*, ventilator-associated pneumonia.
*Comparison calculated by subtracting individual priority ranks of 2011 from 2000: ↑, priority ascended 1 level; ↓, priority descended 1 level; –, no change in level of importance and/or change in level of importance insufficient to change priority level.

modified recommendations based on newfound research findings. Specific guidelines and research reflected the IP's desire for particular HAI prevention guidance based on setting environment (eg, nonacute care) and populations (eg, pediatric and psychiatric). Equipment and environment accounted for IPs desire to understand the role equipment and environmental factors have on HAI prevention. The theme of IP work environment had 2 subthemes: (1) IP staffing, which referred to the evaluation and recommendations of effective IP staffing patterns; and (2) data collection, which addressed variation in IP collection data techniques and the desire for the validation of findings.

Three hundred eighty-eight free text responses were analyzed in response to the second open-ended survey question, which asked how APIC may facilitate IP knowledge, awareness, and participation in dissemination and implementation research. Whereas responses were distinct, several themes and subthemes emerged, described in descending order of frequency in Table 4. Predominant themes were: (1) education, (2) research, (3) dissemination and implementation, and (4) advocacy of IPs. The theme of education included 4 subthemes: (1) modes of delivery, in which IPs described preferred methods of education delivery (namely Internet-based methods, such as Web-casts); (2) cost, where IPs emphasized the need for low-cost or free education; and (3) timeliness, in which IPs emphasized the importance of staying up-to-date in regards to new findings. The theme of research included 2 subthemes: (1) updates, in which IPs expressed a desire to stay current in regards to research findings (similar to the subtheme of timeliness in education); and (2) education, in which IPs expressed a desire to be educated in research methodologies, ranging from how to understand and critique research to how to participate and perform research studies. The theme of dissemination and implementation had 2 subthemes: (1) IPs expressed a desire to learn of and participate in implementation research, and (2) IPs sought to know of the most effective implementation methods. The theme of advocacy of IPs mainly concerned the development of business models, which would describe IPs effect on infection prevention and cost savings.

DISCUSSION

In this paper, we have reported the results of a 2010 survey of APIC's membership. The respondents were highly educated with both those new to the field of infection prevention, as well as seasoned experts. Less than half of this seasoned, educated

Table 3
Suggested research topics

Themes	Subthemes	Representative quotes
Standardizing HAI prevention	Technique-specific recommendations	Scrub the hub—how many seconds of scrubbing are required. There is no set standard; some hospitals are using 15 seconds, some 30 seconds, and others do not specify. Does length of scrub matter?
	Evidence for existing practice	Re-examine evidence and make solid recommendations regarding necessity of Contact Precautions for patients who are colonized but not infected with each of the MDROs
	Specific research and guidelines	Pediatric research—all kinds, we need to know how HAIs are the same or different in children
	Equipment and environment	Investigate whether inanimate objects, eg, keyboards, serve as fomites for the harboring and transfer of microorganisms and nosocomial colonization or infection
IP work environment	IP staffing	Publish recommendations for IC Department staffing in hospitals (use FTE numbers broken down by clinical vs clerical/data entry). Separate other responsibilities such as employee health or quality
	Data collection	Data validation and what it takes to improve consistency in IPs correctly using NHSN definitions

FTE, full-time employee; *HAI*, hospital-associated infection; *IC*, infection control; *IP*, infection preventionist; *MDROs*, multiple drug-resistant organisms; *NHSN*, National Healthcare Safety Network.

Table 4
APIC as facilitator of knowledge, awareness and participation in dissemination and implementation research

Themes	Subthemes	Representative quotes
Education	Modes of delivery	Offer education either through the journal or Web-based education
	Cost	Provide accurate and timely infection prevention-related updates and information at low cost via e-mail and Webcasts
	Timeliness	Continue to share information as soon as it becomes available so that we are informed
Research	Updates	Present summary data as well as full research articles. There is so much happening and so much information coming out daily in so many fields that it is extremely difficult to keep up
	Education	The most important thing you can do for the general membership is increase understanding of interpreting published research results. Few practicing IPs have this skill. As for the IPs who actually could find time to be a part of a research study, there are skill sets APIC could provide to help them understand their roles and participation in clinical trials or empiric research. Additionally, an understanding of qualitative research would be helpful because most of medical research is based on the very quantitative clinical trial. IPs (and MDs) need to understand that social science study designs can provide meaningful findings without "a control group"
Dissemination and implementation	Desire	Educate me regarding this type of research so that I can become an active participant and/or increase my ability to analyze the research and apply it to my particular setting
	Efficacy	Time is a valuable commodity: Need methods to effectively change infection prevention behavior of the direct care provider
Advocacy of IPs	Measured performance	Provide hard data as to the cost/benefit of an effective and well-followed IP program. Show how a little investment in an IP program can greatly reduce cost

IP, infection preventionists.

workforce was certified in infection prevention, which is consistent with current estimates.[8]

This report builds upon a Delphi survey of experts conducted a decade ago and identifies the current research priorities for infection prevention from the memberships' perspective.[6] The prior study included a significant number of participating physicians (21%), whereas this update did not. The 2010 survey had 3% of the respondents self-reporting as having a doctoral degree, including PhDs. Despite the expanding and changing role of the IP,[9] most of the topic areas identified as the highest priority (top importance) for research 10 years ago, such as the application of behavior and management sciences to achieve compliance with infection prevention polices, continue to be high priorities today. This may reflect the general nature of some of the priorities, which may be applied to many different clinical problems (eg, hand hygiene and isolation) as well as the estimated average of 17 years needed for research findings to be translated into practice.[10]

Respondents identification of multidrug-resistant organisms, *C difficile*, CLABSI, CAUTI, VAP, and SSI as high priority clinical issues that require better understanding aligns well with APIC's proposed second and third strategies for promoting research. IPs have clearly identified the specific HAIs that are in need of additional infection prevention research, and the prioritization of these topics is in agreement with recent reports from the Society of Healthcare Epidemiology of America as well as a recent European symposium.[11,12] Not coincidently, these same HAIs are currently being targeted by governments, regulatory agencies, and other non-government organizations domestically and internationally in major prevention initiatives. The involvement of APIC members in large-scale research efforts involving improved understanding of the preventability of these specific conditions has the potential to redefine, maximize, and revolutionize the core business and impact of infection prevention programs globally.

Respondents of the survey clearly articulated a desire for education about how to evaluate and keep up with current research findings as well as how to translate the findings into practice. At APIC's September 2011 Strategic Planning Workshop and in the following months, APIC Board of Directors committed to promote and facilitate the development and implementation of scientific research to prevent infection. Listening to the membership and in congruence with the survey results, APIC intends to achieve these goals by (1) defining implementation science (IS) and demonstrating the value of implementing the science of prevention to members, partners, and stakeholders; (2) identifying gaps in the research agenda and addressing the gaps; and (3) collaborating with related disciplines and organizations in promoting IS research.

The sample of 701 IPs is similar to many other APIC membership surveys conducted. Also, it is larger than a recent survey of the Society of Healthcare Epidemiology of America.[11] However, APIC membership is much larger with the overall participation rate

representing approximately 5% of total membership. The relatively low response rate may indicate survey fatigue, competing demands on time, and/or the duration of time required to complete the survey (>10 minutes).[13] Nevertheless, the results are informative.

Although the ranking of these research priorities changed modestly in comparison with the prior study, the free-text proposals for additional topics of interest were robust and highlighted emerging needs in the field of infection prevention. As IPs are encouraged to become more engaged with IS, the need for timely assessment of these emerging needs becomes more important. At a minimum, this should occur once a decade as the science of infection prevention continues to evolve.

The National Institutes of Health has defined IS as the study of methods to promote the integration of research findings and evidence into health care policy and practices (see http://www.fic.nih.gov/News/Events/implementation-science/Pages/faqs.aspx). Furthermore, the National Institutes of Health has identified challenges with IS as a new and developing field that needs an interdisciplinary approach with collaborations among researchers, implementers, and others as well as clear communication channels and forums. IPs, working in clinical settings, are in a prime position to act as implementers and APIC has the ability to provide its members the necessary education and resources to do so.

This report should be used as a roadmap for APIC leadership as it provides suggestions on how APIC may best develop its research program and meet the evolving needs of its members. IPs are clearly hungry for education and information on current research findings and how best to translate evidence to practice. While there has been little variation in the research priorities over the past 10 years, new priorities have emerged. We encourage APIC to assess members periodically to better understand the concerns and priorities of its members.

Acknowledgment

The authors gratefully acknowledge the members of the 2009-2011 APIC Research Task Force during the study period (Russell Olmsted, Jerome E. Granato, Susan Slavish, Claire Kilpatrick, Anne Marie Pettis, Sanjay Saint, Elaine Larson, Irena Kenneley, Denise Graham, and Kathy Warye) as well as all the survey respondents.

APIC Research Taskforce Members: M.-O. Wright, C. Murphy, M. Hanchett, P.W. Stone, E. Larson, S. Saint, A.M. Pettis, R. Olmsted, S. Slavish, J.E. Granato, C. Kilpatrick, I. Kenneley, and D. Graham.

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