



Published in final edited form as:

Am J Infect Control. 2025 January ; 53(1): 2–7. doi:10.1016/j.ajic.2024.08.015.

Infection preventionists' current and preferred training strategies and tools

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Abstract

Background: Educating health care staff on infection prevention and control (IPC) is an essential role of infection preventionists (IPs), but the COVID-19 pandemic diverted resources away from IPC education.

Methods: Association for Professionals in Infection Control and Epidemiology members were invited to complete an online survey from spring 2023 to assess current and preferred approaches and tools for training health care personnel on IPC. Vendors, retirees, APIC staff, or those not working in health care or public health were excluded.

Results: In all, 2,432 IPs participated. IPs were more likely to report engaging in impromptu health care worker training (ie, just-in-time teaching and team huddles) versus planned educational activities (ie, learning modules, formal presentations, train-the-trainer, or simulation; Kruskal-

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Conflicts of interest: None to report.

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

APPENDIX A. SUPPLEMENTARY DATA

Supplementary data related to this article can be found at doi:10.1016/j.ajic.2024.08.015.

Wallis = 288, $P < .001$). IPs' top preferred teaching methodologies included simulation or interactive activity, and their lowest preferred approach was independent learning modules. IPC training apps were frequently requested technology.

Discussion: IPs ranked simulation as their top preferred teaching method; however, simulation was one of the least frequently used approaches. IP education should include strategies for delivering effective impromptu training and how to develop and implement interactive simulation-based education.

Conclusions: The expressed needs and preferences of IPs should be considered when developing IPC-related teaching and training tools.

Keywords

Infection prevention; Teaching; Simulation; Technology; Simulation-based learning

BACKGROUND

Educating frontline health care workers on infection prevention and control (IPC) actions is an essential component of the infection preventionist's (IP's) role, included within multiple domains of the Association for Professionals in Infection Control and Epidemiology (APIC) IP competency model¹ and Centers for Medicare and Medicaid Services Conditions of Participation for all US hospitals.² A critical goal of IPC training is to empower frontline health care workers with the knowledge and tools needed to take action to minimize health care occupational exposures and prevent health care-associated infections (HAI).

There is no standardized program or approach to providing IPC training to frontline health care workers, which creates challenges for IPs attempting to deliver IPC training. In addition, the COVID-19 pandemic created new demands on IPs and diverted resources away from IPC training to pandemic response.^{3,4} A 2021 study found that IPs perceived pandemic-related setbacks in the prevention of HAIs resulting in the need for IPs to re-teach foundational IPC principles to frontline health care workers.⁵ Epidemiological data supports this perception, with multiple studies noting increased rates of HAIs during the pandemic.^{5,6} Further, IPs' workload and stress levels increased during the pandemic due to the need to aid in response, such as developing and reviewing COVID-related protocols.⁷ This resulted in a large IP turnover, with many new IPs entering the field at a time when there was a lack of experienced IPs to mentor and train them.⁷ Additionally, IPs entering the field during the pandemic may not have had the knowledge, skills, or resources necessary to develop and implement IPC training. The primary objectives of this study were to understand the frequency with which IPs provide IPC training to health care workers, the approaches and methods used for training, and to better understand which technologies and resources they believe are needed to empower frontline health care workers to take IPC action. Secondary objectives were to describe training preferences as reported by IP position, certification, formal education, years of experience, and geographic location of practice.

METHODS

A cross-sectional study was conducted using an online survey administered via Qualtrics between May and June 2023. Participants included APIC members working as an IP in a US health care setting or public health department. Vendors, retirees, APIC staff members, or those not currently working in a health care setting or public health were excluded. Recruitment was conducted through (1) an initial email, followed by biweekly emails; (2) survey promotion in the weekly APIC eNewsletter; and (3) an advertisement published in the Infection Prevention Strategist.

A 36-item survey was developed using the Theoretical Domains Framework, an implementation-science framework aimed at assessing multilevel factors contributing to intervention implementation and uptake.⁸ The survey was pilot-tested with 8 APIC National Committee members who were also practicing IPs; results were used to inform the finalized instrument, which assessed IPs' current, preferred, and desired health care worker training approaches. This analysis focuses on a subset of 21 survey items related to the frequency with which IPs: educate different groups of frontline health care workers (4 items); engage in various training activities (5 items); use a variety of teaching methods (5 items); implement different teaching tools (5 items); preferred teaching method (1 item); and teaching technologies, methodologies, or resources desired by IPs (1 unlimited, open-text field item). Demographics were also collected. The Western Institutional Review Board approved this study. This activity was reviewed by Centers for Disease Control and Prevention (CDC) and was conducted consistent with applicable federal law and CDC policy (see eg, 45 C.F.R. part 46.102(1)(2), 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq.).

Data analysis

Analyses were conducted using STATA/SE 16.1 (StataCorp) and SPSS 28 (IBM).⁹ Descriptive statistics were computed for each question. Responses to questions related to the frequency with which IPs educate different health care worker groups, engage in training activities, or use teaching methods and tools were dichotomized: *rarely* or *never* = 0/no, and *frequently* or *sometimes* = 1/yes. A categorical variable was created by coding participants' responses to the open-ended question regarding their desired technologies, methodologies, and/or resources. Chi-square tests were used to compare the frequency of a behavior by demographic variables. The Kruskal-Wallis (KW) test was used to examine differences between training approaches, frequency of training, and frequency of engaging in IPC training activities. A *P*-value of < .05 was considered statistically significant. Within-group comparisons included IPs to IP leaders, those with certification in infection prevention and control (CIC) credential versus those without, those with 2 years or less of experience to those with more years of experience, and those with lower levels of formal education (eg, Associate's degree) to those with higher levels of education (eg, Master's degree or higher). Rural, suburban, and urban comparisons were conducted based on the IPs' self-reported categorization. Responses to open-ended questions were grouped by preferred teaching methods and tools.

RESULTS

Overall, 2,432 (21.9%) of 11,130 eligible IPs participated. Respondent demographics are described in Table 1. Of the 2,432 respondents, 1,606 (66.0%) reported being frontline, practicing IPs; 1,991 (81.8%) had a bachelor's degree or higher; 1,214 (49.9%) had ≤ 5 years of experience; and 1,371 (56.4%) reported being IP staff versus an IP leader; and 1,156 (47.5%) were CIC-certified. Nearly equal portions of respondents reported working in rural (36.1%), suburban (31.6%), and urban (32.3%) communities, while 1,738 respondents (71.5%) worked in a hospital setting.

Training of health care worker groups

The frequency with which IPs reported training health care worker groups is presented in Table 2. Compared to all other health care worker groups, IPs were significantly more likely to report training nurses (KW = 183, $P < .001$) and significantly less likely to frequently provide training to health care staff with prescribing privileges (KW = 446, $P < .001$). IP leaders were more likely than IP practitioners to frequently provide training to staff with prescribing privileges as well as allied health care staff, and nonclinical staff ($P < .001$ for all). IPs that were CIC-certified also reported frequently training those with prescribing privileges (70.3% vs 63.3%, $P < .01$) and allied health professionals (79.2% vs 68.9%, $P < .001$) than those without certification. More years of work experience was associated with frequently training those with prescribing privileges ($P < .01$) and allied health professionals ($P < .001$). IPs with higher levels of formal education level were more likely to report frequently training allied health professionals ($P < .001$) than those with lower levels of formal education. There was no association between work location and frequency of health care worker groups trained.

Training approaches and methods

Training approaches and the likelihood with which IPs reported using them are listed in Table 2. When all IP training approaches were compared, IPs were significantly more likely to report informal training of health care workers by answering their individual questions about IPC through consults, email, or during IPC rounds (KW = 288, $P < .001$). Formal planned trainings, such as new employee orientation, were significantly less likely to be used compared to all other IPC training approaches (KW = 219, $P < .001$). IP leaders were significantly more likely to report using informal training to answer questions and respond to changes in practice and using formal training for the orientation of new employees and in response to changes in practice ($P < .05$ for all). CIC-certified IPs were more likely to report providing informal training to correct observed infection prevention lapses (98.5% vs 96.4%, $P < .001$) and to respond to concerns expressed by health care personnel (90.7% vs 87.1%, $P < .001$). IPs with 2 or fewer years of work experience were less likely to provide informal training ($P < .01$), formal training in response to a change ($P < .05$), or training groups in response to concerns ($P < .05$). IPs with more formal education (ie, Master's degree or higher) were less likely than IPs with less formal education to report providing formal planned presentations ($P < .05$). No other associations were found between IPs' demographics and frequency of engaging in each training approach.

When teaching methods were compared, all IPs were significantly more likely to report a preference for using just-in-time (JIT) training or immediate feedback than other teaching methods ($P < .001$) and were significantly less likely to use a train-the-trainer (TTT) approach ($P < .001$; Table 2). IP leaders were significantly more likely to report using all other types of teaching methods. CIC-certified IPs were more likely to report using independent learning modules (76.7% vs 72.7%, $P < .05$), team huddles (89.9% vs 86.9%, $P < .05$), formal presentations (74.7% vs 69.6%, $P < .01$), and a TTT approach (65.7% vs 56.6%, $P < .001$).

IPs with 2 or fewer years of work experience were less likely to report using formal presentations ($P < .05$) or TTT ($P < .001$). IPs with a Master's degree or higher formal education were less likely to report using simulation as a teaching approach ($P < .01$). In comparison, IPs with an Associate's degree or less education were less likely to provide formal presentations ($P < .01$). IPs in rural settings were more likely to use independent learning modules ($P < .01$) and less likely to use formal presentations and the TTT method ($P < .001$). No other associations were found between IPs' demographics and frequency of using each teaching approach.

Rank ordering of preferred teaching methods indicated that simulation or demonstration, followed by having a brief discussion in a team huddle were preferred methods (Table 3). Learning modules done independently by health care workers was the teaching method most frequently ranked lowest (rank 6), followed by TTT.

Tools, technology, and resources

IPs were asked to indicate how often they use a variety of teaching tools and resources to deliver training (Table 2). When all tools and resources were compared, IPs were significantly more likely to report using a handout (KW = 49, $P < .001$) and significantly less likely to use a smartphone or application (KW = 293, $P < .001$). CIC-certified IPs, those with more formal education, those with more work experience, and those practicing in urban or suburban settings ($P < .01$) were more likely to use PowerPoint (Microsoft) slide presentations. No other associations were found between IPs' demographics and the frequency of using each teaching tool or resource.

Resource gaps and desired technology

Overall, 1,083 IPs (44.5% of respondents) provided useable responses to the unlimited, open-field text about currently unavailable but needed or desired resources, technologies, or methodologies. On average, IP respondents ($n = 1,083$) identified 1.3 needed or desired resources, technologies, or methodologies (1,450 coded responses). Table 4 outlines the frequency with which IPs expressed the desire for each identified technology, methodology, and resource.

Resources desired to aid in training health care workers fell into 3 categories: technological resources, methodological resources, and other types of resources. Of these, technological resources were desired most often (20.4%; $n = 320$). IPs identified 3 technologies they would like to have to aid in training frontline health care workers; these included computer applications (apps), IPC compliance monitoring technologies, and surveillance software.

Apps aimed at assisting with training, education, and learning were the most frequently desired type of technology (4.3%; n = 62). Simulations were the most frequently desired training methodology (10.3%; n = 149). Interactive training experiences were mentioned most frequently among the desired training resources (2.9%, n = 42). Videos and simulation tools, such as mannequins or virtual reality-based training, were the most frequently desired teaching tools (6.8% and 5.9%, respectively).

DISCUSSION

This study found that IPs frequently train diverse frontline health care worker groups on IPC actions, and they use a variety of teaching approaches and tools when doing so. IPs reported that they spend much more of their time engaged in JIT and preferred impromptu training of health care staff compared to using planned, formal training sessions. The need to provide high-quality effective impromptu training is included in the APIC IP Competency Model.¹ In contrast to providing formal training, JIT and impromptu training require IPs to think critically, advance their knowledge of IPC, and effectively communicate the scientific rationale behind the guidance. Incorporating strategies for providing effective JIT and impromptu training into education and support provided to IPs may help them deliver effective messages.

IPs in this study identified many types of teaching tools and strategies that they would like to use but to which they do not currently have access. Simulation or demonstration was ranked as the most preferred method for teaching and the most frequently desired strategy for the training of health care workers but was one of the least likely to be in use. Past research on the use of simulation as a method of IPC training found this method to be effective in most situations.^{10–13} Incorporation of simulation-based techniques into IPC training seems advisable given IPs' desire to use this teaching methodology and evidence that it is generally more effective than traditional lecture-based training. Incorporation of simulation and apps into IPC training is likely to be delivered through planned formal education approaches because these methodologies often require setup and physical resources versus impromptu training that can often be accomplished through conversation or verbal interaction alone. Project Firstline, a national collaborative for health care infection prevention training initiated during the COVID-19 pandemic, offers free educational materials in multiple languages and formats.¹⁴ It is now situated within a new branch, the Healthcare Systems Strengthening Resilience Training Branch within the Division of Healthcare Quality Promotion at CDC. This branch will remain focused on the creation of accessible, ready-to-use training for all levels of health care personnel.

The need for more interactive teaching tools was also apparent in the study results. IPs expressed the desire to receive interactive training experiences and learn how to create more interactive training experiences to implement with health care workers. Apps desired by IPs might be one example of interactive training. Existing research on IPC-related apps is limited, and results are mixed, with studies showing gains in knowledge and confidence.^{15–17} Multiple health training and assessment apps were developed during the COVID-19 pandemic, but they focused on contact tracing or personal health assessment for public health settings versus health care.¹⁸

Some limitations should be noted. This study only involved APIC members working in the United States and may not be generalizable to IPs who are not APIC members or who work outside of the United States. The response rate for this study was nearly 22%; however, this rate is not unusual for online surveys across disciplines, as they tend to have response rates approximately 12% lower than phone, mail, or in-person surveys.¹⁹ There may be selection bias, with IPs who are most interested in IPC training more likely to have participated in the study. This potential bias may result in a falsely high percentage of IPs currently engaging in IPC training of health care workers and different preferences for teaching approaches and methodologies. Nevertheless, this is, to our knowledge, the first national survey of IPs to assess current approaches and preferences for IPC-related training and resources for frontline health care workers and reflects practice during the third year of the COVID-19 pandemic.

CONCLUSIONS

IPs frequently provide IPC-related training to various groups of frontline health care workers, and they use a variety of teaching approaches and tools. IPs spend more of their training time engaged in impromptu versus planned training sessions and need assistance learning how best to implement the JIT training approach. IPs expressed the desire for app-based training programs as well as tools and resources to aid in incorporating simulation and interactive learning. The development of IPC-related training apps, especially those that involve an interactive component, may be beneficial and should be considered. Future studies using qualitative methodologies could help elicit more detailed information about IPs' needs related to tools that provide interactive learning or training apps. To improve an IP's ability to provide quality IPC training for frontline health care workers, the development of future IPC-related tools should take these expressed needs and preferences into account.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

The authors would like to thank Dr Shanina Knighton and Robin Hughes for assisting with survey instrument development (both) and data coding (Robin Hughes).

Funding/support:

This project was funded by the Division of Healthcare Quality Promotion (DHQP) as part of the National Center for Emerging and Zoonotic Infectious Diseases (NCEZID) of the Centers for Disease Control and Prevention under award number 75D30122C15498.

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Table 1

APIC participant demographics

Characteristic	N = 2,432 Frequency (%)
Current IPC-related position	
Front line/practicing infection preventionist	1,606 (66.0)
Infection prevention administrator/director	628 (25.8)
Educator or researcher (academic role)	29 (1.2)
External consultant (consulting is primary role)	41 (1.7)
Public health practitioner	122 (5.0)
Other	6 (0.3)
Level of current role in infection prevention	
Coordinator/practitioner	1,371 (56.4)
Manager	517 (21.3)
Director	437 (18.0)
Senior management	107 (4.4)
Years worked in infection prevention	
<1 year	213 (8.8)
1 to 2 years	473 (19.5)
3 to 5 years	528 (21.7)
6 to 10 years	522 (21.5)
11 to 15 years	318 (13.1)
≥16 years	378 (15.5)
Highest level of education	
High school	5 (0.2)
Technical/vocational degree or certificate	59 (2.4)
Associate's degree	377 (15.5)
Bachelor's degree	1,002 (41.2)
Master's degree	891 (36.6)
PhD, MD or equivalent	98 (4.0)
Currently certified in infection prevention and control	1,156 (47.5)
Location of work setting	
Rural	877 (36.1)
Suburban	769 (31.6)
Urban	786 (32.3)
Practice setting (Respondents could select more than 1)	
Hospital	1,738 (71.5)
Long-term care or skilled nursing facility	493 (20.3)
Outpatient clinic (dialysis, dental office, etc.)	440 (18.1)
Ambulatory surgery	364 (15.0)
Public health	153 (6.3)
Urgent care	147 (6.0)

Characteristic	N = 2,432
	Frequency (%)
Home health care	130 (5.4)
Other (eg, dialysis, dental office, etc.)	4 (0.2)
Hospital bed size	N = 1,639
	Frequency (%)
≤50 beds	430 (26.2)
51 to 99 beds	156 (9.5)
100 to 199 beds	260 (15.9)
200 to 299 beds	218 (13.3)
300 to 399 beds	168 (10.3)
400 to 499 beds	106 (6.5)
≥500 beds	301 (18.4)

APIC, Association for Professionals in Infection Control and Epidemiology; *IPC*, infection prevention and control; *MD*, Medical doctor; *PhD*, Doctorate of philosophy degree.

Table 2

Leaders' versus practitioners' training approach, frequency by health care worker group and training method

	All respondents N = 2,432	IP in Manager or Director role (leader) vs practitioner		P value *
		Leader N = 1,061	Practitioner N = 1,371	
	Frequently or sometimes % (n)	Frequently or sometimes (n)	Frequently or sometimes % (n)	
Frequency of training by health care worker group				
Nursing staff (except for nurse practitioners)	96.0 (2,335)	96.3 (1,022)	95.8 (1,313)	NS
Nonclinical staff	84.8 (2,062)	87.7 (930)	82.6 (1,132)	<.001
Allied health care staff	73.8 (1,794)	78.2 (830)	70.3 (964)	<.001
Health care staff with prescribing privileges	66.7 (1,621)	71.3 (757)	63.0 (864)	<.001
Training approach				
Informal training (eg, answering staff's individual questions through consults, email, or rounds)	97.4 (2,369)	98.3 (1,043)	96.7 (1,326)	<.05
Informal training in response to lapses (eg, speaking with an individual when improper IPC practice is witnessed)	89.6 (2,180)	90.6 (961)	88.9 (1,219)	NS
Training for groups in response to concerns (eg, speaking with a unit about an IPC issue or concern)	88.8 (2,159)	89.9 (954)	87.9 (1,205)	NS
Formal planned training (eg, new employee orientation)	85.4 (2,078)	89.8 (953)	82.1 (1,125)	<.001
Formal training in response to a change (eg, educating staff on new IPC guidance or protocols)	93.4 (2,272)	95.8 (1,016)	91.6 (1,256)	<.001
Training method				
Just-in-time training (eg, immediate feedback based on observation or audit)	91.1 (2,216)	92.1 (977)	90.4 (1,239)	NS
Team huddles	88.3 (2,148)	91.3 (968)	86.1 (1,180)	<.001
Learning modules done independently by health care workers	74.6 (1,815)	79.4 (842)	71.0 (973)	<.001
Formal presentation	72.0 (1,751)	75.4 (800)	69.4 (951)	<.001
Simulation or demonstration	61.1 (1,486)	66.0 (700)	57.3 (786)	<.001
Train-the-trainer	60.9 (1,482)	65.7 (697)	57.3 (785)	<.001
Technology and resources				
Handout (eg, fact sheet, brochure, leaflet, etc.)	86.8 (2,110)	89.0 (944)	85.0 (1,166)	<.01

	All respondents N = 2,432	IP in Manager or Director role (leader) vs practitioner N = 2,432		P value *
		Leader N = 1,061	Practitioner N = 1,371	
	Frequently or sometimes % (n)	Frequently or sometimes (n)	Frequently or sometimes % (n)	
PowerPoint slides	86.1 (2,093)	87.6 (929)	84.9 (1,164)	NS
Photos or videos	78.9 (1,919)	81.8 (868)	76.7 (1,051)	<.01
Training tool or supplies for simulation or demonstration	54.2 (1,318)	55.9 (593)	52.9 (725)	NS
Smartphone or tablet app for training	26.8 (652)	30.6 (325)	23.9 (327)	<.001

IP, infection preventionist; IPC, infection prevention and control; NS, not significant.

* Determined by the X2 test.

Table 3

Ranking of infection preventionists’ preferred teaching methods

Teaching method	Rank					
	1	2	3	4	5	6
Percent noting each rank						
Frequency (%)						
Independent learning modules	346 (14.2)	213 (8.8)	244 (10.0)	274 (11.3)	428 (17.6)	927 (38.1)
Brief discussion with team/huddle	600 (24.7)	660 (27.1)	490 (20.2)	369 (15.2)	231 (9.5)	82 (3.4)
JIT, immediate feedback	492 (20.2)	603 (24.5)	506 (20.8)	405 (16.7)	277 (11.4)	149 (6.1)
Formal presentation	235 (9.7)	281 (11.6)	375 (15.4)	454 (18.7)	554 (22.8)	533 (21.9)
Simulation or demonstration	610 (25.1)	374 (15.4)	469 (19.3)	452 (18.6)	358 (14.7)	169 (7.0)
Train-the-trainer	149 (6.1)	301 (12.4)	348 (14.3)	478 (19.7)	584 (24.0)	572 (23.5)

NOTE. Ranking: 1 = highest/most preferred; 6 = lowest/least preferred.
JIT, just-in-time.

Table 4

Technological, methodological, and other training resources desired by infection preventionists

Resource	N* = 1,450 Frequency (%)
Technological resource	
Apps	208 (14.3)
IPC Compliance Monitoring Technology	90 (4.6)
Software	22 (1.5)
Methodological resource	
Simulations	149 (10.3)
Interactive experiences (ie, polls, zooms, games, etc.)	83 (5.7)
Train-the-trainer materials	8 (0.6)
Training to help the IP create interactive training experiences	20 (1.4)
Other resources	
Finite resources (ie, time, staff, budget)	135 (9.3)
Equipment (Tablet, smartphone, computer, etc.)	102 (7.0)
Physical equipment or furniture (desk, supplies for demonstration, etc.)	23 (1.6)
Physical space for training	8 (0.6)
Training tools	
Interactive training tools	42 (2.9)
Specific training programs	16 (1.1)
Department-specific training (ie, EVS/Corporate/Dietary/Nurse/Education)	13 (0.9)
Online training	11 (0.8)
Standards, guidelines, or educational sources (AORN, AAMI, FGI, Nursing manuals, etc.)	7 (0.5)
Just-in-time training tools	6 (0.4)
Unspecified tools	16 (1.1)
Training materials	
Videos	99 (6.8)
Visual learning materials (ie, posters, handouts, PowerPoints, etc.)	82 (5.7)
Easily accessible learning materials (ie, learning modules, polls, FAQ, etc.)	78 (5.4)
Simulation tool (mannequin, virtual reality/AI, etc.)	86 (5.9)
Hand hygiene teaching tool (ie, Glo Germ, etc.)	81 (5.6)
Training materials not specified in the response	45 (3.1)
Hand hygiene not specified in the response	12 (0.8)

AAMI, Association for the Advancement of Medical Instrumentation; *AI*, artificial intelligence; *AORN*, Association of periOperative Registered Nurses; *EVS*, environmental services; *FAQ*, frequently asked questions; *FGI*, Facility Guidelines Institute; *IP*, infection preventionist; *IPC*, Infection prevention and control.

* Respondents could identify more than 1 technology, methodology, or resource desired.