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Original Article

Infection prevention and control staffing and programs in Middle Eastern Countries

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Abstract

Introduction: Infection prevention and control (IPC) programs in the Middle Eastern and North African (MENA) countries are evolving. The objective was to characterize IPC personnel and programs in MENA countries, with special emphasis on the differences between Gulf Cooperation Council (GCC) and non-GCC countries.

Methodology: A cross-sectional online survey was conducted in 2019 among IPC members of the Arab Countries Infection Control Network (AcicN). The survey focused on three domains; demographic and professional characteristics, organizational structure, and IPC program characteristics.

Results: A total of 269 participants aged 39.9 ± 8.4 years were included in the study. Majority of the participants were females (67.7%), nurses (63.7%), and of Middle-Eastern origin (57.3%). 32.2% of the participants were certified by the Certification Board of Infection Control (CBIC). Only 22.7% of participants were satisfied with their current compensation. Surveillance was the most time-consuming task (26.6%), followed by isolation (12.4%), and investigation of outbreaks (12.1%). Majority of the facilities had at least one IPC personnel per 100 beds (60.9%), supported IPC program (63.9%), a formal IPC committee (93.7%), and an IPC plan (91.4%). Compared with non-GCC countries, GCC countries had significantly more frequent CBIC certification ($p = 0.003$), training in cleaning/sterilization ($p = 0.010$), supported IPC program ($p = 0.010$), formal IPC committee ($p = 0.001$), IPC plan ($p = 0.001$), and higher number of IPC personnel per 100 beds ($p = 0.047$).

Conclusions: MENA countries had generally satisfactory IPC programs and to a lesser extent staffing, with considerable variability between countries with different resources.

Key words: Infection control; program; staff; healthcare; training; MENA.

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Introduction

Infection prevention and control (IPC) is an increasingly important aspect of the healthcare system that prevents healthcare-associated infection and maintains a safe healthcare environment [1,2]. This discipline has been rapidly evolving to keep pace with the expanding roles and responsibilities of infection prevention programs [3]. A key requirement of a comprehensive IPC program is to ensure that IPC knowledge, skills, and competencies are adequate among the members to achieve the goals of the IPC program [4].

Several professional organizations, mostly in North America and Western Europe, have outlined the core skills, professional guidelines, and training certificates that are required to achieve a high level of IPC compliance [5,6]. One of the most recognized certifications in the IPC profession is the Certification Board of Infection Control and Epidemiology (CBIC) [7,8], which is endorsed by professional organizations in the USA and Canada [8]. However, there are wide variations among countries on the necessary professional backgrounds and training of IPC personnel [2,9,10].

In developing countries, including Middle Eastern and North African (MENA) countries, IPC programs have started to gain attention [11-13]. For example, Egypt established professional diploma and IPC

programs in response to high national incidence of Hepatitis C infection [11,14,15]. Similarly, Saudi Arabia established professional diploma and IPC programs to meet the challenges of pilgrimage in Mecca, endemicity of the Middle East respiratory syndrome coronavirus, and the required hospital certification [12,13]. Yet, specific training programs in IPC in MENA countries are not well developed and vary widely based on regulations, healthcare infrastructure, available resources, and staffing [10-12].

Although previous surveys in Western countries characterized IPC workforce in terms of demographic characteristics, professional qualification, organizational structure, and practice environment [3,16-18], little is known about the current IPC situation in MENA countries. Additionally, Gulf Cooperation Council (GCC) countries have much better financial resources than the rest of the MENA countries. The objective of this study was to compare IPC personnel, practice setting, and programs between GCC hospitals and other Middle Eastern countries. This would provide updated evidence to support IPC functions in MENA countries, including research gaps and future directions.

Methodology

Setting and population

The study included IPC personnel working in MENA countries, irrespective of nationality, educational background, and professional title. All participants who were actively involved in IPC at healthcare facilities in any MENA country were eligible to participate. The MENA countries are Arab-speaking countries. Among them, the GCC countries are considered high-income countries, while the rest of the MENA countries are considered low or medium-income countries. The data were obtained mainly from Saudi Arabia, United Arab Emirates, Egypt, Kuwait, Qatar, Lebanon, Jordan, and Libya.

Design

A cross-sectional online survey was conducted in 2019 targeting IPC personnel working in MENA countries. The study obtained the required approvals from the ethical committee of the Arab Countries Infection Control Network (AcicN) [19].

Sample size

It was estimated that at least 269 patients would be required to detect 50% prevalence, using 5% margin of error and 95% confidence level. This would allow detection of slightly less than 20% differences between groups. The estimated sample size was based on the population size in the AcicN database.

Recruitment

Participants were recruited using a convenience sampling technique. The electronic database of AcicN was the main source for reaching IPC personnel in MENA countries. On February 01, 2019, all members of the AcicN database were invited through a link for online survey, which was accessible until the end of April 2019. A total 269 participants responded out of the 895 participants invited, with a 30% response rate. The actual response rate was probably higher if we had excluded those who missed the invitation.

The study questionnaire

After consenting to the participation, participants answered a series of 20 questions covering three areas of the study. These included demographic and professional characteristics, organizational structure, and IPC program characteristics. The survey content was a combination of already developed APIC MegaSurvey questions [17,20] and additional questions suggested by a board of subject matter experts. Demographic and professional characteristics included age, gender, nationality, qualifications, professional background, year of experience, title, previous training, and compensation. The organizational structure of the facilities where IPC personnel were working included questions about the healthcare sector, setting, number of beds, and number of IPC personnel per 100 beds. IPC program characteristics included IPC committee, plans, risk assessment, time spent on different tasks, stakeholders, and support.

Validation of the study questionnaire

Content and face validity were achieved through reviewing and suggesting questions by three experts in IPC, including an epidemiologist. Additionally, a pilot study conducted among 15 participants currently practicing IPC in MENA countries received positive feedback. Cronbach's alpha for all questionnaire questions that had yes/no answers was 0.76, which indicated good reliability.

Statistical analysis

The questionnaire had different types of questions; continuous (e.g., age), binary (e.g., presence of committee), Likert scale (e.g., satisfaction with compensation), ordinal (e.g., IPC personnel per 100 beds), and nominal (e.g., qualifications). Data normality was checked using visual methods

(histogram and boxplot) and statistical test (Kolmogorov-Smirnov statistic). Categorical variables were presented as frequencies and percentages. Continuous variables were presented as means and standard deviations (SD) or median and interquartile range (IQR), as appropriate. The three domains (above) were compared between GCC and non-GCC countries. Chi-squared test or Fisher's exact test, as appropriate, was used to compare categorical variables. t-test or Mann Whitney, as appropriate, was used to compare continuous variables. All *p* values were two-tailed. A *p* value < 0.05 was considered significant. Statistical Package for the Social Sciences software (SPSS version 25.0, IBM Corp Armonk, NY) was utilized for statistical analysis.

Results

Demographic and professional characteristics

A total of 269 participants were included in the current analysis. As shown in Table 1, the mean age was 39.9 ± 8.4 years and the majority of the participants were females (67.7%), nurses (63.7%), and of Middle Eastern origin (57.3%). The most frequent nationalities were Egyptian (21.8%), Filipinos (16.8%), and Indian (15.3%). The average years of experience was 16.4 ± 8.2 years, including 8.1 ± 5.6 years working in IPC programs. Compared with non-GCC countries, GCC countries had significantly more Asian professionals (< 0.001), more nurses but less doctors ($p = 0.006$), more participants with CBIC certification ($p = 0.003$) and more participants with other IPC certificates ($p = 0.004$).

Table 1. Demographic and professional characteristics of the infection control personnel.

	GCC	Non-GCC	Total	*p* value
Gender				
Male	67 (31.0%)	17 (38.6%)	84 (32.3%)	0.325
Female	149 (69.0%)	27 (61.4%)	176 (67.7%)	
Age groups (years)				
Mean ± SD	39.7 ± 7.6	41.4 ± 11.4	39.9 ± 8.4	0.209
< 35	65 (30.0%)	11 (25.0%)	76 (29.1%)	0.722
35-44	94 (43.3%)	19 (43.2%)	113 (43.3%)	
≥ 45	58 (26.7%)	14 (31.8%)	72 (27.6%)	
Race				
Middle Eastern	107 (49.3%)	43 (95.6%)	150 (57.3%)	< 0.001
Asian	95 (43.8%)	1 (2.2%)	96 (36.6%)	
Others	15 (6.9%)	1 (2.2%)	16 (6.1%)	
Nationality				
Egypt	37 (17.1%)	20 (44.4%)	57 (21.8%)	< 0.001
Philippines	44 (20.3%)	0 (0.0%)	44 (16.8%)	
India	40 (18.4%)	0 (0.0%)	40 (15.3%)	
Saudi Arabia	31 (14.3%)	0 (0.0%)	31 (11.8%)	
Lebanon	9 (4.1%)	7 (15.6%)	16 (6.1%)	
Jordan	8 (3.7%)	6 (13.3%)	14 (5.3%)	
Pakistan	10 (4.6%)	1 (2.2%)	11 (4.2%)	
Others	38 (17.5%)	11 (24.4%)	49 (18.7%)	
Professional background				
Nurse	151 (68.0%)	19 (42.2%)	170 (63.7%)	0.006
Medical doctor	45 (20.3%)	16 (35.6%)	61 (22.8%)	
Laboratory	19 (8.6%)	6 (13.3%)	25 (9.4%)	
Others	7 (3.2%)	4 (8.9%)	11 (4.1%)	
Qualifications				
CBIC*	80 (36.0%)	6 (13.3%)	86 (32.2%)	0.003
Master degree in infection control	11 (5.0%)	3 (6.7%)	14 (5.2%)	0.712
Diploma in infection control	57 (25.7%)	20 (44.4%)	77 (28.8%)	0.011
Others certificates in infection control	117 (52.7%)	13 (28.9%)	130 (48.7%)	0.004
Master's degree in nursing	15 (6.8%)	4 (8.9%)	19 (7.1%)	0.538
Bachelor's degree in nursing	127 (57.2%)	18 (40.0%)	145 (54.3%)	0.035
Doctor of medicine	31 (14.0%)	12 (26.7%)	43 (16.1%)	0.035
Postgraduate degree in health-related field	37 (16.7%)	13 (28.9%)	50 (18.7%)	0.055
Others	27 (12.2%)	5 (11.1%)	32 (12.0%)	0.843
Number of years of job experience (mean ± SD)				
Before joining infection control	8.3 ± 5.7	8.9 ± 5.9	8.4 ± 5.7	0.466
In infection control	7.9 ± 4.9	9.4 ± 8.2	8.1 ± 5.6	0.893
Overall	16.1 ± 7.6	18.1 ± 10.6	16.4 ± 8.2	0.531

GCC: Gulf Cooperation Council states; CBIC: Certification Board of Infection Control and Epidemiology; SD: Standard Deviation.

Table 2. Work-related characteristics of the infection control personnel.

	GCC	Non-GCC	Total	*p* value
Current job title				
Infection control practitioner	60 (27.1%)	2 (4.4%)	62 (23.3%)	< 0.001
Infection control nurse	31 (14.0%)	3 (6.7%)	34 (12.8%)	
Infection control manager	18 (8.1%)	12 (26.7%)	30 (11.3%)	
Infection control director	26 (11.8%)	3 (6.7%)	29 (10.9%)	
Infection preventionist	27 (12.2%)	1 (2.2%)	28 (10.5%)	
Infection control coordinator	20 (9.0%)	3 (6.7%)	23 (8.6%)	
Infection control officer	10 (4.5%)	5 (11.1%)	15 (5.6%)	
Hospital epidemiologist	3 (1.4%)	4 (8.9%)	7 (2.6%)	
Others	26 (11.8%)	12 (26.7%)	38 (14.3%)	
Preferred title for junior infection control personnel				
Infection control practitioner	49 (34.3%)	10 (32.3%)	59 (33.9%)	0.017
Infection control officer	24 (16.8%)	12 (38.7%)	36 (20.7%)	
Infection preventionist	70 (49.0%)	9 (29.0%)	79 (45.4%)	
Receiving any formal infection control training				
No	4 (2.7%)	3 (9.7%)	7 (3.9%)	0.098
Yes	146 (97.3%)	28 (90.3%)	174 (96.1%)	
Topics of received training				
Surveillance	139 (92.7%)	25 (80.6%)	164 (90.6%)	0.082
Outbreak investigation	109 (73.6%)	24 (77.4%)	133 (74.3%)	0.662
Education	124 (83.8%)	21 (67.7%)	145 (81.0%)	0.038
Management/communication	106 (72.6%)	20 (66.7%)	126 (71.6%)	0.511
Quality improvement	119 (80.4%)	20 (64.5%)	139 (77.7%)	0.053
Cleaning/sterilization	113 (76.4%)	16 (53.3%)	129 (72.5%)	0.010
Employee/occupational health	105 (71.4%)	23 (74.2%)	128 (71.9%)	0.756
Research	101 (68.2%)	22 (71.0%)	123 (68.7%)	0.766
Planning to get CBIC*				
No	29 (20.4%)	7 (17.9%)	36 (19.9%)	0.732
Yes	113 (79.6%)	32 (82.1%)	145 (80.1%)	
Satisfaction with current compensation				
Extremely satisfied	13 (5.9%)	1 (2.3%)	14 (5.3%)	0.298
Very satisfied	41 (18.6%)	5 (11.4%)	46 (17.4%)	
Somewhat satisfied	90 (40.9%)	19 (43.2%)	109 (41.3%)	
Not satisfied	50 (22.7%)	16 (36.4%)	66 (25.0%)	
Extremely not satisfied	26 (11.8%)	3 (6.8%)	29 (11.0%)	

* For those who do not have Certification Board of Infection Control and Epidemiology (CBIC).

Table 3. Characteristics of the facilities where the infection control personnel were working.

	GCC	Non-GCC	Total	*p* value
Healthcare sector				
Governmental	132 (59.7%)	25 (56.8%)	157 (59.2%)	0.720
Private	89 (40.3%)	19 (43.2%)	108 (40.8%)	
Settings of infection control services				
Ambulatory care center	134 (60.4%)	26 (57.8%)	160 (59.9%)	0.747
Hemodialysis	125 (56.3%)	32 (71.1%)	157 (58.8%)	0.066
Acute care setting	164 (73.9%)	36 (80.0%)	200 (74.9%)	0.387
Intensive care setting	174 (78.4%)	41 (91.1%)	215 (80.5%)	0.049
Medical and surgical wards	177 (79.7%)	42 (93.3%)	219 (82.0%)	0.030
Home health care	52 (23.4%)	7 (15.6%)	59 (22.1%)	0.246
Long term care	91 (41.0%)	8 (17.8%)	99 (37.1%)	0.003
Academic center	63 (28.4%)	17 (37.8%)	80 (30.0%)	0.209
Others	22 (9.9%)	2 (4.4%)	24 (9.0%)	0.390
Number of beds in your facility				
Median (interquartile range)	250 (133-450)	196 (120-499)	250 (124-450)	0.511
≤ 100	39 (20.2%)	4 (12.1%)	43 (19.0%)	0.148
101-250	58 (30.1%)	16 (48.5%)	74 (32.7%)	
251-500	65 (33.7%)	7 (21.2%)	72 (31.9%)	
> 500	31 (16.1%)	6 (18.2%)	37 (16.4%)	
Number of IPC personnel per bed				
1/50	42 (20.2%)	11 (27.5%)	53 (21.4%)	0.047
1/100	90 (43.3%)	8 (20.0%)	98 (39.5%)	
1/150	47 (22.6%)	14 (35.0%)	61 (24.6%)	
1/200	13 (6.3%)	4 (10.0%)	17 (6.9%)	
1/250	5 (2.4%)	2 (5.0%)	7 (2.8%)	
Others	11 (5.3%)	1 (2.5%)	12 (4.8%)	

As shown in Table 2, the most frequent working profile was infection control practitioners (ICPs, 23.3%), followed by infection control nurses (12.8%), infection control managers (11.3%), infection control directors (10.9%), and infection preventionists (IPs, 10.5%). Almost all (96.1%) participants received some kind of training, especially in surveillance (90.6%), education services (81.0%), and quality improvement (77.7%). The majority (80.1%) of the participants who were not CBIC-certified were planning to be CBIC-certified. Only 22.7% of participants were 'very' or 'extremely' satisfied with their current compensations. Compared with non-GCC countries, GCC countries had significantly more ICP profiles but less infection control managers ($p < 0.001$), more training in educational services ($p = 0.038$), and more training in cleaning/sterilization ($p = 0.010$). Figure 1 shows the average percentage spent on different IPC tasks every week. Surveillance was the most time-consuming task (26.6%), followed by isolation (12.4%), investigation of outbreaks (12.1%), and identification of infection (11.4%). There were no significant differences in time spent on different IPC tasks between regions.

Figure 1. Average weekly time percentage spent on different infection control tasks.

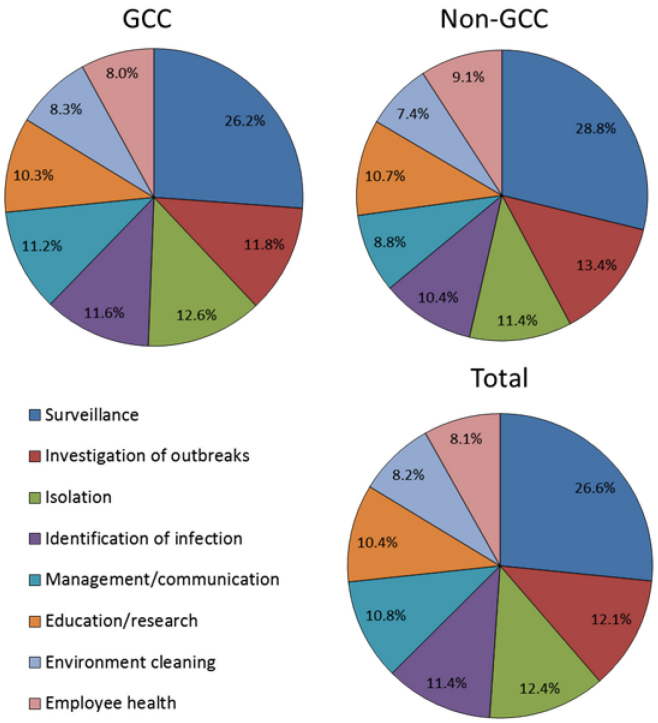

Table 4. Characteristics of infection control program at the facilities where the infection control personnel were working.

	GCC	Non-GCC	Total	*p* value
Presence of formal infection control committee				
No	8 (3.8%)	8 (19.5%)	16 (6.3%)	0.001
Yes	203 (96.2%)	33 (80.5%)	236 (93.7%)	
Regular meetings of infection control committee (at least every 3 months)				
No	17 (8.1%)	6 (15.0%)	23 (9.2%)	0.227
Yes	192 (91.9%)	34 (85.0%)	226 (90.8%)	
Members of infection control committee				
Nursing	194 (87.4%)	32 (71.1%)	226 (84.6%)	0.006
Laboratory	184 (82.9%)	33 (73.3%)	217 (81.3%)	0.134
Medical services	179 (80.6%)	33 (73.3%)	212 (79.4%)	0.270
Pharmacy services	167 (75.2%)	32 (71.1%)	199 (74.5%)	0.564
Facilities/maintenance/support	171 (77.0%)	19 (42.2%)	190 (71.2%)	< 0.001
Administrators	159 (71.6%)	29 (64.4%)	188 (70.4%)	0.336
Environmental services	165 (74.3%)	22 (48.9%)	187 (70.0%)	0.001
Infectious Disease	148 (66.7%)	20 (44.4%)	168 (62.9%)	0.005
Epidemiologist	82 (36.9%)	14 (31.1%)	96 (36.0%)	0.458
Quality and safety	12 (5.4%)	5 (11.1%)	17 (6.4%)	0.177
CSSD	11 (5.0%)	1 (2.2%)	12 (4.5%)	0.697
Operating room/surgical department	9 (4.1%)	0 (0.0%)	9 (3.4%)	0.364
Clinical departments	6 (2.7%)	0 (0.0%)	6 (2.2%)	0.594
Others	14 (6.3%)	2 (4.4%)	16 (6.0%)	> 0.99
Presence of infection control plan				
No	13 (5.9%)	10 (22.2%)	23 (8.6%)	0.001
Yes	209 (94.1%)	35 (77.8%)	244 (91.4%)	
Infection control plan is developed based on a risk assessment				
No	20 (9.0%)	10 (22.2%)	30 (11.2%)	0.010
Yes	202 (91.0%)	35 (77.8%)	237 (88.8%)	
Infection control plan required communications with stakeholders				
No	24 (10.8%)	17 (37.8%)	41 (15.4%)	< 0.001
Yes	198 (89.2%)	28 (62.2%)	226 (84.6%)	
Infection control receives enough support from leadership				
No	48 (32.0%)	17 (56.7%)	65 (36.1%)	0.010
Yes	102 (68.0%)	13 (43.3%)	115 (63.9%)	

CSSD: Central Sterile Services Department.

Organizational structure

As shown in Table 3, the majority (59.2%) of participants were working in governmental facilities. The most frequent setting was wards (82%), followed by intensive (80.5%) and acute (74.9%) care settings. The median number of beds per facility was 250 (IQR, 124-450). Approximately 60.9% of the facilities had at least one IPC personnel per 100 beds. Compared with non-GCC countries, GCC countries had a slightly higher number of IPC personnel per 100 beds (p = 0.047), more participants working in long-term care (p = 0.003), and less participants working in ward (p = 0.030) and intensive care (p = 0.049) settings.

IPC program

As shown in Table 4, the majority of facilities had formal IPC committees (93.7%), which had regular meetings (90.8%). The most frequent members of the IPC committee included nurses (84.6%), laboratory personnel (81.3%), and medical services personnel (79.4%). The majority of facilities had an IPC plan in place (91.4%). The plan was largely developed based on risk assessment (88.8%) and required communication with stakeholders (84.6%). Most (63.9%) participants thought that their IPC program received enough support from leadership. Compared with non-GCC countries, GCC countries had significantly more supported IPC programs (p = 0.010), more formal IPC committees (p = 0.001), and more frequent IPC plans (p = 0.001). The committees in GCC countries had higher number of members specialized in nursing (p = 0.006), facilities/maintenance/support (p < 0.001), environmental services (p = 0.001), and infectious diseases (p = 0.005). The plans in GCC countries were more likely to depend on risk assessment (p = 0.010) and to require communications with stakeholders (p < 0.001).

Discussion

This study provides updated information related to the current situation of IPC staffing and programs in MENA countries. This is especially important given the limited regional data and the continuous evolution of IPC activities in the region. Healthcare professionals with a nursing background dominated the IPC teams in this survey. This finding is consistent with previous surveys from countries outside the MENA region [3,21,22]. Compared to US hospitals, a relatively higher percentage of medical doctors and laboratory scientists working in IPC programs were observed in this study, especially in non-GCC countries [21,22]. This may reflect the long standing shortage of qualified nurses in these countries, who are usually substituted by junior physicians [23]. Additionally, the European models followed in some countries traditionally give more importance to microbiology in IPC teams and leadership [2]. Nevertheless, the current expansion of IPC responsibilities and changing roles of IPC personnel mandate the inclusion in IPC team of experts from various professional backgrounds [22,24].

The current finding showed inadequate IPC certifications in MENA countries, and only one-third of the IPC personnel had CBIC. Additionally, one-third of IPC personnel had no IPC certification of any type. In the USA and Canada, 40% to 60% of IPC personnel have CBIC [3,22,25]. Moreover, there was wide international variability in the type of certification in this study and there were more CBIC in GCC countries. The latter can be explained by the differences in the regulations governing job recruitment and resource utilization in the two regions. In modern IPC functions, certification is very important to increase employment opportunity, compensation, and institutional recognition [26]. Therefore, MENA countries are in need of strong initiatives to promote communication, training, and certification. This step is fundamental to improve the competency and accountability of IPC programs [27]. The AcicN is a local example that started this initiative in MENA countries [19].

The data showed that approximately 40% of the facilities had less than one IPC personnel per 100 beds, with better staffing in GCC countries compared to non-GCC countries. Recent recommendations suggested 1.0 to 1.2 IPC personnel per 100 beds, which is more than double of what had been accepted three decades earlier [16, 28]. Therefore, the current IPC staffing is still inadequate in MENA countries, especially in non-GCC countries. Additionally, it is much less than seen in recent reports from USA and Europe [16,21]. Given the lower certification rates and lower prevalence of computerized IPC activities, the staffing problem in MENA countries is probably bigger than what the current numbers indicate.

The current findings show a generally good IPC program, with better program in GCC countries compared with non-GCC countries. This represents a normal evolution of IPC programs across the world. Additionally, it reflects increasing interest in IPC, accreditation requirements, and local infection challenges in MENA countries [11-13]. The program structures were better in GCC countries and reflect better resources that attract IPC personnel from across the world, and follow the recommendations of Western accreditation agencies [29].

Surveillance activities in the current study represented the main time-consuming duty of IPC personnel in both GCC and non-GCC countries, followed by patients' isolation, investigation of outbreak, and identification of infections. Similarly, previous studies consistently showed that surveillance makes up the bulk of IPC tasks [20,21,30]. On the other hand, patients' isolation and identification of infections were the second most time-consuming tasks in more recent studies [20,21] while policy development, teaching, and investigation of outbreak were the second most time-consuming tasks in relatively older studies [30]. The variation may be attributed to the difference in organizational structure, changing role of IPC personnel, and available resources [3].

Although this study is one of the few studies that examined the current IPC situation including staffing and programs in MENA countries, some limitations exist. For example, IPC personnel included in the current study were a convenient sample of the IPC personnel registered in the AcicN. Additionally, those registered in the AcicN may not accurately represent IPC personnel in MENA countries, which traditionally have highly variable and fragmented healthcare systems. Therefore, generalization of the findings should be made with caution. Nevertheless, in the light of lack of similar regional organizations, AcicN is considered the best available data source to study IPC personnel and programs in MENA countries. Additionally, being a self-reported survey, bias cannot be excluded. However, this is an inherent problem of all similar surveys and its impact should be minimal

Conclusions

In conclusion, the current study provides updated evidence about the profile of IPC staffing and programs in MENA countries. The findings showed generally satisfactory IPC programs with limited staffing. Numbers and certification of IPC personnel were the main challenges. There was considerable variability in IPC staffing and programs between countries with different resources. The current findings justify an urgent call upon governmental and non-governmental stakeholders to provide more resources, better training and educational opportunities, and better communication facilities for IPC personnel and programs in MENA countries, especially in non-GCC countries. Future studies should focus on the IPC situation in MENA countries within different healthcare settings (e.g., intensive care vs ward) and different levels of care (e.g., primary versus tertiary care).

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