

Public health workers' knowledge, attitude and practice regarding COVID-19: the impact of Field Epidemiology Training Program in the Eastern Mediterranean Region

Sahar Samy¹, Faris Lami², Hiba Abdulrahman Rashak³, Mohannad Al Nsour⁴, Alaa Eid⁵, Yousef S. Khader⁶, Salma Afifi⁷, Maisa Elfadul⁸, Yasser Ghaleb⁹, Hajer Letaief¹⁰, Nissaf Ben Alaya¹¹, Aamer Ikram¹², Hashaam Akhtar¹³, Abdelaziz Barkia¹⁴, Hana Ahmad Taha⁴, Reema Adam⁸, Khwaja Mir Islam Saeed¹⁵, Sami S. Almudarra¹⁶, Mohamed Hassany¹⁷, Hanaa Abu El Sood⁷, Fazal ur Rahman¹⁸, Falah Abdul-kader Saeed³, Mohammed Sameer Hlaiwah³

¹Communicable Disease Control Department, Preventive sector, Ministry of Health and Population, Cairo, Egypt

²Community and Family Medicine, University of Baghdad, Iraq

³Directorate of Public Health, Ministry of Health, Baghdad, Iraq

⁴Global Health Development (GHD) | The Eastern Mediterranean Public Health Network (EMPHNET), Amman, Jordan

⁵Preventive sector, Ministry of Health and Population, Cairo, Egypt

⁶Department of Public Health, Jordan University of Science & Technology

⁷Department of Epidemiology and Surveillance, Preventive sector, Ministry of Health and Population, Cairo, Egypt

⁸Public Health Institute, Federal Ministry of Health, Sudan

⁹Field Epidemiology Training Program, Ministry of Public Health and Population, Sana'a, Yemen

¹⁰National Observatory of New and Emerging Diseases, Tunis, Tunisia

¹¹Tunisia Field Epidemiology Training Program, Tunis, Tunisia

¹²National Institute of Health, Islamabad, Pakistan

¹³Yusra Institute of Pharmaceutical Sciences, Yusra Medical and Dental Collage, Islamabad, Pakistan

¹⁴Epidemic Disease Service, Ministry of Health, Rabat, Morocco

¹⁵Afghanistan National Public Health Institute (ANPHI), Kabul, Afghanistan

¹⁶Field Epidemiology Training Program, Saudi Ministry of Health, Riyadh, Saudi Arabia

¹⁷National Hepatology and Tropical Medicine Research Institute, Ministry of Health and Population, Cairo, Egypt

¹⁸Benazir Bhutto Hospital, Rawalpindi, Pakistan

Address correspondence to Salma Afifi, E-mail: afifisalma1@gmail.com

ABSTRACT

Background This study aimed to compare knowledge, attitude and practice (KAP) regarding COVID-19 between public health workers (PHWs) attended field epidemiology training program (FETP-trained) and those who did not attend FETP (non-FETP trained).

Methods Multi-country cross-sectional survey was conducted among PHWs who participated in COVID-19 pandemic in 10 countries at EMR. Online questionnaire that included demographic information, KAP regarding COVID-19 pandemic was distributed among HCWs. Scoring system was used to quantify the answers, bivariate and Multivariate analysis performed to compare FETP-trained with non-FETP trained PHWs.

Results Overall, 1337 PHWs participated, with 835 (62.4%) < 40 years of age, and 851 (63.6%) males. Of them, 423 (31.6%) had FETP, including that 189 (44.7%) had advanced level, 155 (36.6%) intermediate and 79 (18.7%) basic level training. Compared with non-FETP trained, FETP trained were older, having higher KAP scores. FETP participation was low in infection control, and PH laboratories. KAP mean scores for intermediate level attendees are comparable to advanced level.

Conclusions FETP-trained are having better KAP than non-FETP PHWs. Expanding the intermediate level, maintain the Rapid Response training and introduce the laboratory component are recommended to maximize the benefit from FETP. Infection control, antimicrobial resistance and coordination are areas where training should include.

Keywords attitude, COVID-19, Field Epidemiology Training Program, knowledge, practice

Sahar Samy, Program Director	Salma Afifi, Public health consultant	Hashaam Akhtar, Associate professor	Mohamed Hassany, Public health advisor
Faris Lami, Professor	Maisa Elfadul, Researcher	Abdelaziz Barkia, Director	Hanaa Abu El Sood, Executive Director
Hiba Abdulrahman Rashak, Researcher	Yasser Ghaleb, Researcher	Hana Ahmad Taha, Assistant Professor	Fazal ur-Rahman, Professor
Mohannad Al Nsour, Executive Director	Hajer Letaief, Program Head	Reema Adam, Researcher	Falah Abdul-kader Saeed, Researcher
Alaa Eid, Head Preventive sector	Nissaf Ben Alaya, Program Director	Khwaja Mir Islam Saeed, Professor	Mohammed Sameer Hlaiwah, Researcher
Yousef S. Khader, Professor	Aamer Ikram, Professor	Sami S. Almudarra, Director	

Introduction

There is a growing need for public health (PH) professionals skilled in preventing and responding to disease epidemics worldwide to combat the surge of emerging and re-emerging infectious diseases.¹ Worldwide, public health workers (PHWs) were instrumental to prepare for and respond to the current COVID-19 pandemic. They are detecting and monitoring new COVID-19 cases, conduct investigations, trace contacts, ensure those who need to be tested are being tested, apply isolation and quarantine protocols, provide up-to-date information and educate community, and produce statistics and models to track disease progression.^{2,3}

Since 1980, the US centers for Disease Control and Prevention has helped to establish the field epidemiology training program (FETP) around the world to expand the global public health workforce.⁴ The program was designed to increase the number of field epidemiologists with the necessary skills for timely detection, investigation of, and response to public health emergencies in addition to improve their capacities to implement disease surveillance systems and use the data effectively.

FETP provides basic, intermediate and advanced level courses for PHWs at all levels of the health system to address the need for well-trained workforce capable of prompt response to public health threats, implement effective surveillance and use evidence-based recommendations in public health decision-making.⁵

FETP is a three-tiered program with the first tier targeting local health workers with the aim of training them on basic epidemiological methods and is conducted over a period of 3–5 months. The intermediate tier is conducted over a period of 9 months with participants gather in the classroom for 3-day workshop once each month and conducts their fieldwork during the succeeding periods. The advanced, 2-year FETP third tier is a 2-years model that includes a 3-week introductory module and several 1- to 2-week modules, totaling about 360 hours, with a major research project required to receive the degree.^{6,7}

Candidates are selected based on their potential to make careers in regional or local health systems, motivation to work in epidemiology and public health, relevance of their work experience and technical qualifications. Selection criteria usually include: age < 40 years, medical background, working for Ministries of Health (MoH), experience in public health or epidemiology.⁸ Currently, there are 72 established training programs with more than 14 000 graduates and 4770 current trainees⁹.

The COVID-19 pandemic has significantly stressed public health systems around the world especially in the countries

with limited PH capacities.¹⁰ The Eastern Mediterranean countries are facing emergencies and are exposed to increased public health risks on an unprecedented scale during the COVID-19 pandemic. Many of these countries are in need of capacity development in the areas of surveillance, rapid response to public health threats, and communication to direct the public to actions for self- and community protection.¹¹

Although there has been some progress in PH capacity in the region over the last two decades, there is still limited capacity available in many countries that did not match the tremendous public health challenges the region faces.¹² FETP has achieved critical role in national and regional capacity building in the Eastern Mediterranean Region (EMR). Currently, there are 10 field epidemiology country training programs with more than 400 FETP graduates in the region, with most of them working as government officials, and many have obtained leadership positions in the national health systems.^{9,11}

There is an urgent need for evaluation of the public health agencies and FETPs response to COVID-19 pandemic to improve public health capacity at country, regional and global level. This study aimed to compare knowledge, attitude and practice (KAP) regarding COVID-19 between PHWs who attended FETP and those who did not attend FETP.

Methods

Study design

A multi-country cross-sectional survey was conducted among PHWs—including FETP residents and graduates—who participated in COVID-19 pandemic control in 10 countries in the EMR including Egypt, Sudan, Jordan, Iraq, Lebanon, Yemen, Pakistan, Morocco, Saudi Arabia and Tunisia. Ethical approvals were obtained from the Institutional Review Boards at the Eastern Mediterranean Public Health Network (EMPHNET) and Jordan University of Science and Technology. Confidentiality was preserved as no personal identifiers were collected. We used KoBoToolbox application developed by the Harvard Humanitarian Initiative and licensed for use under the GNU license to collect online data. Data were stored and maintained on password protected computers. All survey participants signed an online consent before participation.

Subjects

The study included mid-level public health professionals at MoH of participating countries and governmental public health agencies and frontline PHWs who were involved in

detection and monitoring new COVID-19 cases, contacts tracing, applying isolation and quarantine protocols, patients' referral to available hospitals, following up with home isolated patients and community education.

Sampling

Stratified sampling method was used to involve PHWs serving in different health system levels, i.e. central, intermediate and peripheral levels in the participating countries. The primary sampling units (PSUs) were MoH directorates, departments and units providing PH services at central, intermediate and peripheral levels, and agencies engaged in COVID-19 epidemic control. For each country, a list was developed to include all PH institutes and agencies participated in the pandemic control. Lists included national schools and institutes of public health, associations for public health and Field Epidemiology, societies of infectious diseases and vaccinology, teaching hospitals, public health surveillance, rapid response, public health laboratories, information, education and communication, and primary healthcare. PHWs within each listed PSU were contacted and invited to participate in the survey.

Data collection tool

An online questionnaire was developed using KoBoToolbox (© 2020 GitHub, Inc.). The knowledge and attitude sections of the tool were developed by modifying the standard questionnaire developed, pretested and evaluated in a previous study.¹³ While the practice section was developed using the WHO National capacity review tool.¹⁴ The content validity of the study tools was established by three public health experts. The tools were pilot tested and revised and approved by the FETP directors and advisers at Ministries of Health in participating countries.

The questionnaire was divided into four sections. The first section included respondents' demographic characteristics including country of residence, age, gender education, place of work and FETP course attendance. Section two included questions on knowledge about COVID-19 including its common symptoms, mode of transmission, incubation period, complications, preventive measures at healthcare and household settings, diagnostic laboratory testing and type of specimens required for disease confirmation. Section 3 included questions about PHWs attitude regarding job satisfaction, worries about COVID-19 infection and willingness for participation in response to COVID-19 and future epidemics, whereas section 4 included data on the specific roles and practice of respondents during the current epidemic. This last section is subdivided into seven components namely: Surveil-

lance and risk assessment, rapid response to the epidemic, risk communication, public health laboratories, command and coordination, points of entry and infection prevention and control (IPC). Each subsection included questions on the activities recommended in the WHO pandemic preparedness plan in the related area.⁴

The questionnaire composed of multiple-choice questions where respondents required to select the most appropriate answer(s). A scoring system was developed to quantify the KAP questions as follows: a score of (0,1) was given to correct answers to the knowledge questions. Five-points Likert scale was used to evaluate the attitude of study participants (1–5 points), whereas practice questions were scored on 0–1–2 scale based on participation in the activity and number of times performed during the COVID-19 epidemic. Total scores were calculated and means compared between different groups.

Data collection process

Each country principal investigator contacted director/manager or focal person in each listed PH institute/agency to explain study objectives and provide the online questionnaire link. Directors were requested to share the link via internet or distribute the paper form among their fellow workers in case internet services were unreliable.

Data analysis

A descriptive data analysis was conducted for the demographic data of survey respondents using frequencies and percentages. Total scores were summed up and means of KAP scores were calculated. Means of KAP scores were compared between PHWs received FETP training (FETP-trained) to those who did not (non FETP-trained), to evaluate the effectiveness of FETP in developing PH and epidemiologic capacities in outbreak investigation and response. Practice scores were converted into percentages out of total scores for each component to assess level of participation in epidemic control. The mean scores of KAP scales were compared between FETP-trained and Non-trained PHWs using independent *t*-test. One way ANOVA was used to test the differences in the mean scores of KAP scales between FETP residents and graduates according to FETP modality (basic, intermediate and advanced FETP training). When the normality assumption was not met, Mann–Whitney/Wilcoxon non-parametric test was for testing the differences between means wherever appropriate. The General Linear Model (GLM) procedure, in which factors and covariates are assumed to have a linear relationship to the dependent variable, was used to test the

differences in the mean scores of KAP scales after adjusting for possible confounders including country of work, age, gender, level of employment, years of experience in public health field and years of experience at ministry of health. All significant variables with $P < 0.05$ in the bivariate analysis were included in the GLM analysis. Epi info 7 and SPSS ver. 20 were used to perform the analysis.

Results

Demographic characteristics of survey participants

Overall, 1337 PHWs participated in the survey, 835 (62.4%) of them were <40 years of age and 851 (63.6%) were males. Rate of participation differed by country where approximately two-third of respondents were from Iraq and Egypt (37.9 and 23.6% of participants, respectively) (Table 1). Almost one-third of study participants were healthcare professionals, while epidemiologists and sanitarians represented 18.2 and 14.4%, respectively. Of all participants, 366 (27.4%) had post-graduate PH degree including 17.9% master and 9.5% Doctorate, while 513 (38.4%) had Medical or science bachelor's degree. More than $\frac{1}{2}$ of participants were having >10 years of experience at MoH and more than $\frac{1}{4}$ have >10 years of experience in the field of PH.

Of all participants, 423 (31.6%) had FETP training, including 189 (44.7%) had advanced level, 155 (36.6%) intermediate and 79 (18.7%) basic level training and 352 (83.2%) of them had their FETP training during the last 10 years. Table 1 compares the demographic characteristics, education and experience of FETP-trained participants to the non-FETP-trained (Table 1). FETP-trained participants were found to be significantly older, had post-graduate degrees compared with the non-FETP-trained. While no significant difference encountered in experience at MoH and in PH field between the two groups.

Overall KAP

No significant difference was found between mean knowledge scores of FETP-trained compared with non-FETP-trained survey participants (P -value = 0.451), whereas FETP-trained had significant higher scores in attitude and practice regarding COVID-19 pandemic control (P -value < 0.001) (Table 2).

Among FETP-trained participants, the mean KAP scores were significantly higher in those attended the advanced or intermediate level compared with those attended the basic level of training (MVA P -values ≤ 0.05 , <0.001 and <0.001, respectively) (Table 3).

The pooled mean of knowledge scores for all survey participants was 33.83 out of 45.00, an attitude mean was 17.19

out of 25.00 and a practice mean was 48.83 out of 116 (Tables 4–6).

Knowledge scores

Although there was no significant difference in the overall mean of knowledge scores between FETP-trained and non-FETP trained survey participants ($P = 0.451$), yet the mean knowledge scores for FETP-trained were significantly higher for the effective preventive measures of COVID-19 at households and public places (5.35 versus 5.23 out of 7 and 4.98 versus 4.90 out of 6, $P < 0.05$) (Tables 2 and 4). Whereas there was no difference between the two groups knowledge regarding COVID-19 symptoms, complications, mode of transmission, length of incubation period and preventive measures at healthcare setting (Table 4).

Attitude scores

FETP-trained were more satisfied with their job career, were going to choose the same career if having the chance for change and are willing to participate in future epidemics more than non-FETP-trained participants (Table 5), whereas the non-FETP-trained have insignificantly higher positive attitude scores toward feeling worried from getting or transmitting COVID-19 infection to their families (Table 5).

Most of participants (84.4%) mentioned that they were going to continue doing their jobs in case of death of a colleague from COVID-19 infection, 16.1% mention that they will ask to work from home, 13.2% will ask for demonstration, whereas only 6.9% mentioned that they will contact psychiatrist and 5.5% will stop going to work without notification. There was no difference between the two groups in answering this question (Table 6).

Practice scores

The highest pooled mean of scores gained by all participants was in the field of Rapid response to the epidemic (5.24/10 = 52.4%), followed by Surveillance and risk assessment (10.59/22 = 48.1%), risk communication (13.14/28 = 46.9%), Command and coordination (4.47/10 = 44.7%), IPC (6.10/14 = 43.6%) and Points of entry (5.05/14 = 36.1%), while the least scores were given to Public health laboratories (4.23/18 = 23.5%) (Table 7).

There was a significant difference in practice scores between FETP-trained and non-FETP-trained with $P < 0.001$ in the fields of rapid response to the epidemic (mean scores 5.84 versus 4.81), surveillance and risk assessment (12.31 versus 9.38), risk communication (14.96 versus 11.86), command and coordination (5.48 versus 3.76), IPC (7.00 versus 5.50), points of entry (6.23 versus 4.24) and public health laboratories (5.38 versus 3.41) (Table 7).

Table 1 Demographic characteristics of survey respondents for PHWs attended FETP and those who did not attend FETP

Characteristic	Category	n	%	Attended FETP (n = 423)		Did not attend FETP (n = 914)		P-value*
				No	%	No	%	
Country	Iraq	507	37.9	106	25.1	401	43.9	<0.001
	Egypt	316	23.6	86	20.3	230	25.2	
	Sudan	93	7.0	29	6.9	64	7.0	
	Yemen	90	6.7	47	11.1	43	4.7	
	Jordan	88	6.6	46	10.9	42	4.6	
	Tunisia	76	5.7	25	5.9	51	5.6	
	Pakistan	67	5.0	19	4.5	48	5.3	
	Morocco	50	3.7	26	6.1	24	2.6	
	Afghanistan	28	2.1	23	5.4	5	0.5	
	Saudi Arabia	18	1.3	15	3.5	3	0.3	
	Others	4	0.3	1	0.2	3	0.3	
Age in years	<30	284	21.2	60	14.2	224	24.5	<0.001
	30–39	551	41.2	182	43.0	369	40.4	
	40–49	321	24.0	132	31.2	189	20.7	
	≥50	181	13.5	49	11.6	132	14.4	
Gender	Male	851	63.6	292	69.0	559	61.2	0.005
	Female	486	36.4	131	31.0	355	38.8	
Occupation	Healthcare professionals	396	29.6	89	21.0	307	33.6	<0.001
	Physician	249	18.6	66	15.6	183	20.0	
	Epidemiologist	244	18.2	149	35.2	95	10.4	
	Sanitarian	192	14.4	62	14.7	130	14.2	
	Nurse	156	11.7	42	9.9	114	12.5	
	Paramedical	100	7.5	15	3.5	85	9.3	
Education	Bachelor	513	38.4	146	34.5	367	40.2	<0.001
	Diploma	339	25.4	90	21.3	249	27.2	
	Master	239	17.9	105	24.8	134	14.7	
	Other	119	8.9	35	8.3	84	9.2	
	PHD	127	9.5	47	11.1	80	8.8	
Years of experience at MoH	<5	283	21.2	79	18.7	204	22.3	0.257
	5–10	379	28.3	133	31.4	246	26.9	
	11–20	428	32.0	132	31.2	296	32.4	
	>20	247	18.5	79	18.7	168	18.4	
Years of experience in public health field	<5	665	49.7	178	42.1	487	53.3	0.001
	5–10	336	25.1	124	29.3	212	23.2	
	11–20	233	17.4	88	20.8	145	15.9	
	>20	103	7.7	33	7.8	70	7.7	

*p-value of Chi-square test.

Discussion

Main finding of this study

The leading aim of FETP is to increase the number and quality of field epidemiologists at country level to increase global capacity for the timely detection, investigation of, and

response to public health emergencies. This study is the first to investigate the effectiveness of the FETP in response to COVID-19 pandemic; the largest global health crisis met since World War II.¹⁵

Selection of suitable candidates is crucial for program success. The study indicated that FETP-trained were older

Table 2 KAP scores for survey participants who attended FETP compared with those who did not attended FETP

Variable	Possible scale's score range	Attended FETP (n = 423)		Did not attend FETP (n = 914)		Bivariate analyses (t-test)	Multivariate analysis*
		Mean	SD	Mean	SD	P-value	P-value
Knowledge	0–45	33.86	4.1	33.53	3.9	0.154	0.451
Attitude	0–25	17.56	2.5	16.83	2.9	<0.001	<0.001
Practice	0–116	57.16	68.9	24.97	46.3	<0.001	<0.001

*GLM analysis adjusted for country of work, age, gender, level of employment, years of experience in public health field and years of experience at ministry of health.

Table 3 Knowledge attitude and practice scores for survey participants who attended FETP by level of FETP training (n = 423)

Final score	Basic (n = 79)		Intermediate (n = 155)		Advanced (n = 189)		Bivariate analyses (ANOVA) P-value	Multivariate analysis* P-value	
	Mean	SD	Mean	SD	Mean	SD			
Knowledge	45	33.16	5.6	33.64	3.5	34.34	3.9	<0.05	<0.05
Attitude	25	17.10	2.7	17.47	2.6	17.83	2.4	<0.001	<0.001
Practice	116	47.77	63.8	60.98	64.2	57.76	73.6	<0.001	<0.001

*GLM analysis adjusted for country of work, age, gender, level of employment, years of experience in public health field and years of experience at ministry of health.

than non FETP-trained even though most of them joined the program during the last 10 years. The study indicated that most of FETP-trained respondents were epidemiologists, whereas a large proportion of the respondents were healthcare providers (physicians and nurses). Selection of FETP candidates should target young ages, with involvement of more healthcare providers to fulfill the need for PH professionals in epidemic situation.

Most of participants had correct knowledge on COVID-19 symptoms, complications and preventive measures. Although there was no significant difference between FETP-trained and non-FETP-trained in the overall knowledge scores, yet FETP-trained were more knowledgeable regarding the preventive measures. This finding could be explained by the wide availability of the knowledge for everyone during this pandemic, and that FETP didactic part is largely dealing with the prevention and control of infectious diseases with global health importance.⁴

The overall attitude of participants toward epidemic investigation and control was satisfactory. Mean scores were significantly higher in FETP-trained for job and PH career satisfaction and willingness for involvement

in future epidemics than non-FETP-trained participants. Although FETP-trained were having more positive attitude, yet they were more worried of catching or transmitting the infection to their families than other participants. Given that field epidemiologists must demonstrate a rapid response to disease outbreaks, requiring decision-making with potentially serious situations and potential exposure to hazardous field sites, they need to be stable and show positive approach in emergency situations. A study conducted on FETP trainees in China found that more than half of them are having occupational stress. How to deal with occupational stress is an area that should be covered in FETP training to improve work performance and reduce job turnover.¹⁶

Study found that KAP are better for those attended the advanced or intermediate levels training compared with those who attended the basic level. However, there were no differences in knowledge or attitude and practice between the advanced level and intermediate level FETP-trained participants. This could highlight the advantage of the intermediate level training to increase the number of qualified field epidemiologists in shorter duration and with less costs.

Table 4 Knowledge scores regarding COVID-19 for survey participants who attended FETP compared with those who did not attend FETP

Questions	Range of score	Pooled mean	SD	Attended FETP (n = 423)		Did not attend FETP (n = 914)		P-value*
				Mean	SD	Mean	SD	
Common symptoms of COVID-19	0–9	6.67	1.3	6.84	2.6	6.66	2.1	0.845
Complications of COVID-19	0–6	2.90	2.3	2.97	2.6	2.85	2.1	0.100
Possible modes of transmission COVID-19	0–7	5.18	2.6	5.10	3.1	5.22	2.4	0.135
Length of COVID-19 incubation period in days	0–1	0.86	0.6	0.86	0.7	0.85	0.6	0.820
Most effective preventive measures of COVID-19 at home	0–7	5.28	2.0	5.35	2.3	5.23	1.8	<0.05
Most effective preventive measures of COVID-19 at healthcare settings	0–7	6.13	0.8	6.11	1.9	6.15	1.6	0.461
Most effective preventive measures of COVID-19 at public places	0–6	4.93	1.3	4.98	1.6	4.90	1.2	<0.05
Laboratory test used to confirm COVID-19 acute infection	0–1	0.94	0.4	0.94	0.5	0.94	0.4	0.574
Type of specimen for COVID-19 confirmation	0–1	0.96	0.4	0.95	0.4	0.96	0.3	0.755
Total knowledge scores	0–45	33.83	7.9	33.94	9.4	33.75	7.1	0.450

• Higher knowledge score indicates better knowledge of COVID-19 symptoms, complications, length of incubation period, preventive measures at household, healthcare and in public places settings.

• Difference between score means was performed using *t*-test.

Table 5 Attitude scores regarding COVID-19 for survey participants who attended FETP compared with those who did not attend FETP

Attitude statements	Range of scores	Pooled mean	SD	Attended FETP (n = 423)		Did not attend FETP (n = 914)		P-value
				Mean	SD	Mean	SD	
Satisfied with my job career	0–5	4.33	1.8	4.44	1.9	4.26	1.3	<0.001
Going to choose the same career if having the chance to change career	0–5	4.01	1.9	4.21	2.0	3.87	1.8	<0.001
Feel worried from getting infected with COVID-19	0–5	2.61	2.1	2.55	2.4	2.66	1.9	0.101
Feel worried about transmitting COVID-19 to my family	0–5	1.70	1.7	1.68	1.8	1.71	1.6	0.564
Willing to be involved in upcoming epidemics control if occurred	0–5	4.53	1.3	4.64	1.2	4.45	1.2	<0.001
Total attitude scores	0–25	17.19	4.8	17.53	5.0	16.95	4.6	<0.001

• Highest attitude scores indicate Ministry of health and public health career satisfaction, less worry of getting or transmit COVID-19 to family and readiness for involvement in future epidemics.

• Difference between score means was performed using *t*-test.

Table 6 Reaction of survey participants who attended FETP and those who did not attend FETP if a colleague died with COVID-19 infection

Answer	N	%	Attended FETP		Did not attend FETP		P-value
			No	%	No	%	
Feel sad but keep on doing my job	1129	84.4	347	82.0	782	85.6	0.051
Ask for working from home	215	16.1	69	16.3	146	16.0	0.435
Ask for demonstration to prevent more deaths of HCWs	176	13.2	59	13.9	117	12.8	0.281
Contact psychologist for advice	92	6.9	33	7.8	59	6.5	0.788
Stop going to work without notification	73	5.5	30	7.1	43	4.7	0.040
Try to get sick leave	82	6.1	26	6.1	56	6.1	0.489
Not sure	53	4.0	17	4.0	36	3.9	0.466

• * Chi-square test

Table 7 Practice scores regarding COVID-19 epidemic for survey participants who attended FETP compared with those who did not attend FETP

Areas of practice	Range of scores	Pooled mean	SD	Attended FETP (n = 423)			Did not attend FETP (n = 914)			P-value
				Mean	SD	Level of participation	Mean	SD	Level of participation	
Surveillance and risk assessment	0–22	10.59	12.5	12.31	14.7	56.0%	9.38	11.0	42.6%	< 0.001
Risk communication	0–28	13.14	15.6	14.96	18.7	53.4%	11.86	13.6	42.4%	< 0.001
Command and coordination	0–10	4.47	6.8	5.48	8.0	54.8%	3.76	5.9	37.6%	< 0.001
Public health laboratories	0–18	4.23	9.7	5.38	11.9	29.9%	3.41	8.1	18.9%	< 0.001
IPC	0–14	6.10	9.0	7.00	10.6	50.0%	5.50	8.1	39.3%	< 0.001
Rapid response to the epidemic	0–10	5.24	6.3	5.84	7.1	58.4%	4.81	5.7	48.1%	< 0.001
Points of entry	0–14	5.05	8.5	6.23	10.1	44.5%	4.24	7.4	30.3%	< 0.001
Total practice scores	0–116	48.83	55.8	57.16	68.9	49.3%	42.97	46.3	37.0%	< 0.001

• Public health areas assessed are: public health surveillance, risk assessment, risk communication, command and coordination at different levels, COVID-19 laboratory confirmation, COVID-19 transmission prevention and control at healthcare and community settings, rapid response to COVID-19 epidemic at the country level and prevention of transmission of COVID-19 at points of entry.

• For each activity, a participant scores one point if participated once, and 2 points if participated more than once.

• Difference between score means was performed using *t*-test.

Although survey participants were worried of getting COVID-19 or transmit the infection to their families, yet almost all of them mentioned that they are committed to their work in the event of loss of a colleague with COVID-19. There was no difference in job commitment between FETP-trained and non-FETP-trained. Work commitment found to be related to job satisfaction in PHWs in many studies.¹⁷

FETP is a competency-based training program and managing public health surveillance is one of the main competencies required in the FETP graduate.¹⁸ The study showed that FETP-trained had more actively participated than others in surveillance during the COVID-19 pandemic. Activities performed in this area included developing and distribution of case definitions and reporting form, training of healthcare

providers and surveillance officers, surveillance data analysis for monitoring situation and risk assessment, in addition to media scanning and signal verification.

Risk communication is vital in the event of an epidemic. In a study conducted for evaluation of risk communication of emerging and re-emerging infections in the EMR, it was found that all participating countries have a national risk communication plan, well-known national spokesperson and two-way real-time communication with media. However, the study identified two weak areas including the interdisciplinary coordination and communication within the health sector in each country and with other actors, and the defective timely responses to the events.¹⁹ Risk communication was an area with high level of participation by FETP-trained participants in this study. In depth, assessment of risk communication during the COVID-19 epidemic is recommended to find out any progress due to FETP-trained participation.

Rapid response teams (RRTs) are a mechanism that proved effective in response to previous epidemics including COVID-19. It ensures fast and effective response by reducing the time from disease detection to response and limiting disease transmission, hence reducing mortality and morbidity.²⁰ This study proved that rapid response to epidemic was the area with the highest participation level by all participants, especially FETP-trained PHWs. EMPHNET has led a series of RRT training workshops, with more than 650 PHWs from 12 countries trained during 2016–2017 to improve FETP graduates' knowledge and skills in response to epidemics.²¹

Study participants indicated lower levels of participation in the IPC area at healthcare setting. Sound infection control practice at healthcare facilities is paramount to ensure healthcare providers protection and help prevent the spread of the virus.²² Although FETP-trained had significantly participated in the area of IPC more than others, yet more participation is required in this utmost important area of epidemic control.

The role of public health laboratories in epidemics is well documented. Studies indicated that effective epidemic control require public health approach where laboratory should help providing the data. One of the main functions of the public health lab in responding to epidemics of emerging pathogens is to provide efficient diagnostic test that assist in case detection for contact tracing and outbreak control measures. In addition, a lab network within a country should work closely for sharing protocols, samples, controls and validation materials to enhance capacity for efficient testing.²³

Realizing that merging and re-emerging diseases are major public health threats, there was a need to integrate laboratorians in FETP. Starting 2004, around 20 countries had modified the FETP curricula to include a laboratory component. It is offering laboratory competencies in management,

policy, quality systems and laboratory diagnostic methods. Epidemiologists trained alongside with laboratorians are gaining mutual understanding of each other's disciplines and strengthen surveillance and epidemic response.²⁴ This study identified the area of public health laboratory with the lowest level of participation by all study subjects and FETP-trained. Pakistan is the only country in the EMR who included the lab component to FETP. It is recommended that other EMR countries to include the lab to improve graduates knowledge and practice in the area of public health laboratory.

South Korean experience in COVID-19 epidemic control has identified effective coordination as a key for success. The pandemic does not only demonstrate the importance of effective national, regional and local command systems within a country but also showed the need for such a structure in other countries, as well as coordination among the countries to be effective during similar pandemics.²⁵ This study revealed that command and coordination is one of the areas with low participation by the PHWs and FETP-trained especially during pandemics.

Study also indicated that the overall participation level in the cross-border measures was limited. Although some studies suggest that such restrictions can delay disease spread, yet the impacts of cross-border measures are not well understood.²⁶

What is already known on this topic

To the best of our knowledge, no studies were conducted to systematically evaluate the performance of PHWs during the current COVID-19 pandemic.

What this study adds

This is the first multi-countries study to the role of PHWs in the Eastern Mediterranean countries through assessment of their KAP in response to the pandemic. In addition, to evaluation of the effectiveness of the FETP in enhancing PH capacity through comparing performance of the PHWs who attended FETP to those who did not, to identify strengths and gaps in the training and share lessons learned from the current pandemic with other countries.

Limitations of this study

Different participating countries have different public health capacities and duration of FETP implementation. In addition, different countries were in different pandemic phases. To overcome these limitations, results were weighted by country and number of years of FETP implementation for each of the participating countries. Self-reporting could also be an issue, to compensate for this confidentiality was ensured.

Conclusions

The study concluded that the FETP has achieved one of its main goals in providing field PHWs with the necessary skills for timely detection, investigation of, and response to public health emergencies.

Study proved that FETP-trained PHWs are having better attitude and more effectively participated in the control of COVID-19 pandemic. To maximize the benefit from the program, selection criteria should include healthcare providers, young ages and emotionally stable candidates. Expanding the intermediate level of training to increase the number of qualified field epidemiologists in shorter time and with less resources. Maintain the Rapid Response in Emergencies training, and introduce the laboratory component in more countries of the EMR. Infection control and antimicrobial resistance at healthcare settings and coordination in emergencies are areas where training should include more.

Supplement Funding

This paper was published as part of a supplement financially supported by Global Health Development (GHD).

Conflict of interest

There are no conflicts of interest to report.

Acknowledgements

The authors would like to acknowledge the Global Health Development (GHD) for supporting the research.

References

- World Health Organization. Transformative scale up of health professional education. *An effort to increase the numbers of health professionals and to strengthen their impact on population health*. March 2011. WHO/HSS/HRH/HEP2011.01. https://apps.who.int/iris/bitstream/handle/10665/70573/WHO_HSS_HRH_HEP2011.01_eng.pdf?sessionid=CC2AEBA08C39CB7F20D657657D6A95B7?sequence=1.
- Bhaumik S, Moola S, Tyagi J *et al*. Community health workers for pandemic response: a rapid evidence synthesis. *BMJ Glob Health* 2020;**5**:e002769.
- Schuchat A. Public Health Response to the Initiation and Spread of Pandemic COVID-19 in the United States, February 24–April 21, 2020. *MMWR Morb Mortal Wkly Rep* 2020;**69**(18):551–6.
- Jones DS, Dicker RC, Fontaine RE *et al*. Building global epidemiology and response capacity with Field Epidemiology Training Programs. *Emerg Infect Dis* 2017;**23**(13):S158–65.
- André AM, Lopez A, Perkins S *et al*. Frontline Field Epidemiology Training Programs as a strategy to improve disease surveillance and response. *Emerg Infect Dis* 2017;**23**(13):S166–73.
- Al Nsour M, Khader Y, Bashier H, Alsoukhn M. Evaluation of Field Epidemiology Training Programs in the Eastern Mediterranean Region: a multi-country study. *BMC Med Educ* Preprint.
- López A, Cáceres VM. Central America Field Epidemiology Training Program (CA FETP): a pathway to sustainable public health capacity development. *Hum Resour Health* 2008, **6**:27. https://www.researchgate.net/publication/23668228_Central_America_Field_Epidemiology_Training_Program_CA_FETP_A_pathway_to_sustainable_public_health_capacity_development 1.
- Egypt Ministry of Health and population. *About FETP*. <https://egftp.org/about-fetp>.
- Al Nsour M, Bashier H, Al Serouri A *et al*. The Role of the Global Health Development/Eastern Mediterranean Public Health Network and the Eastern Mediterranean Field Epidemiology Training Programs in Preparedness for COVID-19. *JMIR Public Health Surveill* 2020;**6**(1):e18503.
- Benjamin GC. Ensuring health equity during the COVID-19 pandemic: the role of public health infrastructure. *Rev Panam Salud Publica* 2020;**44**:e70.
- Al Nsour M, Iblan I, Tarawneh MR. Jordan Field Epidemiology Training Program: critical role in national and regional capacity building. *JMIR Med Educ* 2018;**4**(1):e12.
- Alwan A, Shideed O, Siddiqi S. Essential public health functions: the experience of the Eastern Mediterranean Region. *East Mediterr Health J* 2016;**22**(9):694–700.
- Abdel Wahed WY, Hefzy EM, Ahmed MI, Hamed NS. Assessment of knowledge, attitudes, and perception of health care workers regarding COVID-19, a cross-sectional study from Egypt. *J Community Health* 2020;**45**(6):1242–51.
- World Health Organization. *National capacities review tool for a novel coronavirus*. <https://www.who.int/publications/i/item/national-capacities-review-tool-for-a-novelcoronavirus>.
- Barr J, Podolsky SH. A national medical response to crisis — The Legacy of World War II. *N Engl J Med* 2020;**383**:613–5.
- Ryu S, Kim YW, Kim S *et al*. Occupational Stress among Field Epidemiologists in Field Epidemiology Training Programs from the Public Health Sector. *Int J Environ Res Public Health* 2019;**16**(18):3427.
- Lu K-Y, Chang L-C, Wu H-L. Relationships between professional commitment, job satisfaction, and work stress in public health nurses in Taiwan. *J Prof Nurs Mar-Apr* 2007;**23**(2):110–6.
- Traicoff DA, Walke HT, Jones DS *et al*. Replicating success: developing a standard FETP curriculum. *Public Health Rep* 2008;**123**(Suppl 1):28–34.
- Araj R, Alqasrawi S, Samy S, *et al*. Preventing emerging and re-emerging infections in the Eastern Mediterranean Region: gaps, challenges, and priorities. *JMIR Public Health Surveill* 2019; **5**(4):e14348.
- Greiner AL, Jones DS, Stehling-Ariza T *et al*. Challenges in public health rapid response team management. *Health Security* 2020S-8-S-13. doi: 10.1089/hs.2019.0060.
- Araj R, Odatallah A, Mofleh J *et al*. Rapid response teams' initiative: critical role and impact on National and Eastern Mediterranean

- Regional emergency management capacity building. *JMIR Public Health Surveill* 2019;**5**(4):e14349. Published 2019 Oct 16. doi: [10.2196/14349](https://doi.org/10.2196/14349).
- 22 World Health Organization (WHO). *Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19) 2020* <https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid-19-final-report.pdf> (1 March 2020, date last accessed).
- 23 Pabbaraju K, Wong AA, Douesnard M *et al*. A public health laboratory response to the pandemic. *J Clin Microbiol* 2020;**58**:e01110–20.
- 24 Gatei W, Galgalo T, Abade A *et al*. Field Epidemiology and Laboratory Training Program, where is the L-Track? *Front Public Health* 2018;**6**:264.
- 25 Kim Y, Oh SS, Wang C. *From uncoordinated patchworks to a coordinated system: MERS-CoV to COVID-19 in Korea*. Vol. **50**, Issue **6–7**, 2020.
- 26 Errett N, Sauer L, Rutkow L. An integrative review of the limited evidence of international travel bans as an emerging infectious disease disaster control measure. *J Emerg Manage* 2020;**18**:7–14.