Global Health Development

EMPHNET
The Eastern Mediterranean Public Health Network

GHD | EMPHNET: working together for better health

Research Involvement and Engagement

Center of Excellence for Applied Epidemiology

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Introduction

Academic institutions advance science through research. Other non-academic institutions who are engaged in field activities face operational challenges and address their problems to optimize their operations and maximize program impact. Similarly, institutions funding public health programs, both governmental and non-governmental, need to show more accountability in the utilization of funds and the return on investment of such funds on the lives of the people.

The Eastern Mediterranean Public Health Network (EMPHNET) receives financial support from governmental, United Nations and other donor institutions to support countries of the Eastern Mediterranean Region (EMR) in public health workforce development, epidemiological studies of communicable and non-communicable diseases (NCDs), evaluation of program impact, development and monitoring of surveillance programs, rapid assessment of the health care and needs of internally displaced people (IDPs) and refugee populations, and assessment of sexual violence against women and children of IDPs, refugees and other vulnerable populations. Additionally, EMPHNET has research collaboration with academic and non-academic institutions in areas of communicable and non-communicable diseases.

Currently, countries in the EMR are going through different types of unrests that forces people to move either internally or across borders to seek safety. Such movements expose millions of people to starvation and diseases and may cause destruction of health services infrastructure. In addition, COVID-19 has posed new challenges at the global level, to which our region is no exception. The international community commits immense funds for humanitarian relief. However, and to be able to assist displaced populations, agencies need rapid health and nutritional assessment, delivery of health care services and continuous monitoring of the situation and relief program impact. Professional expatriates often face security risks; hence, they collaborate with EMPHNET to provide technical assistance to host countries and international humanitarian and public health agencies that provide relief services to the displaced and refugee populations.

Due to the increasing demand of a large number of agencies on EMPHNET, the increasing needs of technical capacities of public health programs supported and/or implemented by humanitarian and developmental organizations, non-governmental (NGOs) and governmental organizations, and the increasing research collaboration with academic and non-academic institutions, EMPHNET is continuously improving the quality of technical assistance offered to partners, program operations and impact of public health programs serving the populations in the region.

Research Conducted

EMPHNET currently supports several assessments, applied research and laboratory studies, and has completed many studies and research projects over the past nine years. This document provides brief description of the ongoing and successfully completed research projects. The projects are arranged in reverse chronological order, from newest/ most recent to the oldest:

Using Mobile Technology and Enhanced Counselling to Improve Family Planning Among Syrian Refugees and Host Communities in Lebanon and Jordan (2019-2022)

Family Planning is an important expression of the basic human rights to freely choose to become a parent and to determine the number or spacing of children. In Jordan and Lebanon, access to maternal health care and Family Planning services is particularly difficult in rural areas and among unregistered refugees who are not eligible to receive coverage for the services subsidized by the UNHCR. The unmet need for Family Planning in Lebanon and Jordan is a major barrier to the development and empowerment of vulnerable segments of the local population and Syrian refugees.

There is a need to develop novel and low-cost solutions to promote the utilization and improve the quality of existing Family Planning services. One of these solutions is the use of Digital technologies, which have the potential to reach out to women (and their spouses) seeking Family Planning services and to overcome the need for information about the availability and points of delivery of Family Planning services .

GHD|EMPHNET in collaboration with IDRC, and based on a partnership and interdisciplinary collaborative between institutions based in Lebanon (American University of Beirut) and Jordan (Jordan University of Science and Technology) is implementing the use of mobile technology and enhanced counselling to improve

family planning among Syrian refugees and host communities in Lebanon and Jordan.

Year one of this project was the formative phase, in which the listed activities were planned and implemented. Project activities started with the kick-off meeting/workshop, then establishing Project's Advisory Committees, conducting online project meetings, conducting field visits to 6 PHCs and meeting local stakeholders, con ducting 15 Focus Group Discussions (Formative research with clients), ending with conducting 17 Individual Interviews (Formative research with health professionals). The formative phase informed the co-design of the intervention for the remaining period of this research project.

Evaluating the Impact of Enhanced Laboratory-Based Surveillance of Animal and Human Brucellosis in Jordan (May 2019 - October 2020)

Brucellosis is a disease of high consequence causing significant morbidity in animals and humans ;qualifying Brucella spp. as a potential biothreat. Brucellosis is the most commonly reported zoonotic disease worldwide and is highly prevalent in the Middle East, including Jordan. This study aims to establish active surveillance and confirmatory testing in the human and animal sectors of Jordan. The general objectives of this study are to determine the true burden and major risk factors of brucellosis in humans and animals in three selected governorates. It also aims at providing a description of the geographic distribution of the circulating Brucella sub-types that can be derived from animal and human clinical samples using non-culture-based methods. In addition, the following research areas will be conducted: 1) Determine the main risk factors enhancing human and animal infections and mapping the most endemic areas in Jordan; 2) Evaluate the usefulness of current diagnostic assays for human and animal brucellosis. This may include rose Bengal test (RBT), serum agglutination test (SAT), Enzyme immunoassays (ELISA) IgG and IgM, PCR, microbial culture and fluorescence polarization assays (FPA); 3) Assess or evaluate the antibiotic resistance (AMR) profile and genotypes for the Brucella isolates recovered from blood clots of brucellosis cases collected throughout the project; 4) Evaluate the role of Rev-1 vaccine strain in causing infections to humans and/or abortion in animals; and 5) Molecular characterization of animal and human Brucella strains circulating in Jordan using whole genome sequencing (WGS) and MLVA.

More than thirteen one-day training workshops were rolled out targeting 151 clinicians, 47 laboratory technicians, and 24 veterinary and laboratory professionals from targeted sites in the three governorates covered in the project. In

addition, several technical training on data collection tool (Kobo), Rose Bengal Test (RBT), serum agglutination test (SAT), Enzyme-Linked Immunosorbent Assay (ELISA), fluorescence polarization assays (FPA), and real-time PCR have been conducted.

During May 2019 to October 2020, 556 human cases have been enrolled: 138 in East Amman, 288 in Mafraq, and 130 in Karak. 63% of these cases were males, while 37% were females. On the other hand, 199 farms were investigated: 63 in East Amman, 93 in Mafraq, and 43 in Karak. More than 2,219 (including blood and milk) biological samples were collected from animals, most of which were sheeps and goats.

The Epidemiology of Invasive Meningococcal Disease: multicenter, hospital-based surveillance of Meningococcal meningitis in Iraq (June 2018 - May 2020)

Neisseria meningitidis (meningococci) meningitis occurs in epidemic waves in the world and is pathogenic for humans. It has polysaccharide capsules, and it is usually colonizing the upper respiratory tract where it can spread to cause meningitis. Five to thirty percent of normal population may harbor meningococci in the nasopharynx and in epidemics, the carrier rate might go up to 70-80%. Thirteen serogroups of meningococci have been identified by immunologic specificity of capsular polysaccharides. The most important serogroups associated with disease in humans are A, B, C, Y and W-135). Meningococcal antigens are found in blood and cerebrospinal fluid of patients with active disease. Under this project, GHD aims to determine the mean annual incidence of cerebrospinal fluid (CSF) positive cases for Neisseria meningitides, and to identify the commonly circulating serogroups of N. meningitides in Iraqi population. Accordingly, 18 hospitals were selected as study sites (twelve hospitals in Baghdad governorate and six hospitals in three governorates (Karbala, Karkouk, Mysan)) according to geographical areas, known number of populations of the catchment area, and provide high standard health care.

GHD trained 24 physicians and laboratorians on meningitis case detection and definition; using the investigation form to collect the data, specimen collection and transportation. Also, Molecular (PCR) Detection and Subtyping of *N. meningitidis* from Clinical Specimens training was conducted and trained five laboratorians from CPHL/MOH.

A total of 2,314 patients with suspected meningitis were admitted to 18 designated hospitals in four Iraqi governorates during the study period 1st of June 2018 - 30th of

May 2020. Their age ranged between 3 days and 91 years, with a median of two years. Of all cases, 58.9% were males, where 41.1% of cases were females. The male to female ratio was 1:1.4. Overall, 370 cases (16.0%) had confirmed bacterial meningitis. Of those, 215 (58.1%) were caused by *N. meningitidis*, 154 (41.6%) were caused by *S. pneumonia*, and 1 (0.03%) case was caused by *Haemophilus influenzae* type b (Hib) as confirmed by RT-PCR. Almost two-thirds of patients with *N. Meningitidis* (63.2%) and *S. Pneumoniae* (61%) were males.

Enhancing brucellosis surveillance in Pakistan

Brucellosis is identified by the Government of Pakistan as a priority zoonotic disease. As livestock are the only source of human infection, reducing prevalence of brucellosis in livestock is usually accompanied by a reduction in human cases. Therefore, the identification of various *Brucella* species and their biovars and their reservoirs is important. Such information is critical for designing a control program for the choice of vaccine and selection of host species for targeting control efforts.

The overall objective of the study was to understand the epidemiology of brucellosis in peri urban dairy farms in ICT to fill the gaps in the existing knowledge and provide data support for any future control strategies.

A total of 220 herd from Tarlai and Sohan were investigated from June 2018- Jun 2019, The Epi Info software was used for data entry and analysis.

Pooled milk samples were collected from dairy farms. These samples were screened by milk ring test (MRT) and positives samples were confirmed for brucellosis by ELISA for pooled milk. On initial screening by MRT, 43 (19.55%) herds were positive for brucellosis. However, only 28 of these herds were confirmed to have brucellosis infection by ELISA, with an overall herd prevalence of 12.73%

DNA was extracted from positive milk samples (38 from 28 positive herds) using Qiagen DNAeasy kit. Realtime PCR was used for identification of *Brucella*. *B. abortus* has been identified in 07 samples so far.

Two outbreaks were reported in small ruminants (goats and sheep). Both herds were found negative for brucellosis. However, of the 04 outbreaks reported in large animals, 03 were confirmed to be brucellosis.

It is recommended that a one health approach should be followed to investigate the risk of brucellosis to farmers, workers and general public that can lead to appropriate mitigation strategy in livestock. As animals are the only source of brucellosis in humans, a control strategy using vaccination and local epidemiology of disease should be considered. As brucellosis is a chronic disease in most human cases, the socioeconomic impact of this infection among farming communities should be determined. This will also help in making a justified case for control of brucellosis in livestock.

Eid-al-Adha Survey of Animals in Kabul City for Hard Ticks as Suspected Cases of CCHF (August 2019)

Crimean-Congo hemorrhagic fever or (CCHF) is a zoonotic viral disease that has high case fatality rate (CFR) in humans. Ticks are the main reservoirs of CCHF virus, but animals including cattle, sheep, goat, camel, small mammals, and birds (especially ostrich) play a major role in the maintenance and spread of the viral agent to the ticks and humans.

CCHF is endemic in Afghanistan. On average, about 50 cases have occurred annually in Afghanistan and many outbreaks has been documented in the country. In recent years, especially after April 2017, CCHF cases in humans dramatically increased. Recent outbreaks of CCHF in Afghanistan, which were accompanied by high mortality, were probably the result of exposure to infected animal's blood and tissues especially during Eid-ul-Adha feast (WHO, 2018). Also, according to FAO and WHO, in the last two years (2017 – 2018), CCHF cases increased beyond expectations and there have been more than 267 confirmed cases of CCHF just form the beginning up to the end of August 2018 in 23 out of 34 provinces of Afghanistan.

EMPHNET, in close collaboration with the Faculty of Veterinary Sciences of Kabul University (FVS-KU), Kabul Municipality, and the Animal Health Directorate of the Ministry of Agriculture & Livestock (MAIL), successfully conducted a survey of randomly selected animals in Kabul City streets and markets before Eid-al-Adha (August 6 – 9, 2019). The survey was carried outby 150 students and staff members of the Faculty of Veterinary

Science of Kabul University. During this survey, around 4,000 animals were randomly selected and surveyed for the presence of ticks. In total, over 1,500 samples of ticks were collected for further morphological and lab investigations.

This survey is considered as an important step in the implementation of projects focusing on zoonotic diseases in Afghanistan as part of the one health approach.

Real-Time Surveillance for Infectious Diseases and Other Health Conditions During Iraq Al-Arba'een Mass Gathering (October 2018)

The World Health Organization (WHO) defines mass gathering as an event where the number of people attending is sufficient to strain the planning and response resources of the community, state or nation hosting the event. Each year, millions of visitors walk to Karbala in Iraq to observe Al-Arba'een. Arba'een is considered as one of the largest annual mass gatherings in the world. It falls on the 20th day of the month of Safar (a lunar month in the Islamic Calendar). Similar to other Islamic events, the occurrence of Arba'een varies from year to year by drifting approximately 11 days earlier each year. The date of the last Arba'een was October 30, 2018.

The number of visitors to Karbala during the Arba'een gathering reaches millions of people from Iraq and other countries. Although the walk of this huge population takes place over several days before the event and via different routes, such huge gathering is enough to overwhelm any health system in the world and the presence of massive crowd at all times around the day of Arba'een is an issue of concern to public health security. Mass gatherings of such sizes, which take place within a relatively limited space and time period, are usually associated with concerns over disease outbreaks and other health-related conditions such as food poisoning, health conditions due to seasonal changes (hot or cold weather, including heat exhaustion/heat strokes), wounds and accidental injuries, as well as concerns related to non-communicable

diseases such as exacerbation of ischemic heart disease symptoms and other chronic health conditions. In case of a disease outbreak, mass gathering can pose a serious challenge to global public health because of the potential for the spread of diseases both during and after the event as a result of crowd density and population movement. Thus, on one side, MGs can stretch health systems beyond their capacity. On the other hand, these events can also present opportunities for long lasting positive legacy in the form of strengthened public health systems, enhanced medical and hospital services, improved living environment, and increased public health awareness.

Building the capacity in the conduction of real-time surveillance of infectious diseases and other health conditions is one such opportunity where EMPHNET's technical capacity and background experience in previous MGs in Iraq and its overall technical expertise can be very effective to enable the country to gain a better understanding of the public health threats during the event, enhance preparedness/ rapid response capabilities, and enable evidence-based decision making to strengthen the public health system.

With its unique experience in the past Arba'een events, EMPHNET worked with the survey teams and provided round-the-clock (24/7) support during the MG event that took place from October 8th to November 3rd, 2018. EMPHNET closely worked with Iraq Ministry of Health (MOH), the Field Epidemiology Training Program (FETP) and other institutions in Iraq to build the capacity of and provide technical support to 300 data collectors in 152 health facilities en-route to Karbala across eleven (11) governorates (a significant expansion of the surveillance activity from 60 data collectors in 20 health facilities across 2 governorates in the year 2016). EMPHNET provided technical support in conducting

real-time surveillance of infectious diseases and health conditions during the mentioned MG event. An enhanced and effective real-time surveillance system (powered by mobile technology and linked to a server where real-time data from all 11 governorates were aggregated) enabled MOH to trigger early response and appropriate measures to address health security issues and reduce the chances of any mishaps during the event. On the other hand, activities during the pilot project were specifically designed to strengthen the capacities in real-time data collection and the effective utilization of the influx of data. These measures will ensure informed follow-up on outbreak investigations and present opportunities for long lasting positive legacy in the form of strengthened public health system and, hence, a reduction in the global threats. By the end of the MG event, an overwhelming number of infectious, chronic, and injury cases (more than 338,000) were recorded in 152 health facilities in the mentioned 11 governorates. Majority of these cases were Iraqi and Irani nationals followed by other nationalities (Bahrain, Kuwait, Pakistan, Lebanon, India, Oman, Saudi Arabia, Syria, Afghanistan, and other countries). Since literature on Arba'een MG in Iraq is scarce as opposed to other religious and non-religious mass gatherings around the world, findings from this pilot project will contribute to the literature body and will be essential to inform decision making by the Ministry of Health and other partners involved in the event for the years to come.

The Effect of Increased Self-Efficacy and Knowledge on Improved Sexual and Reproductive Health Service Use among Adolescent Girls and Young Women Refugees - The SEEK Trial (2018 - 2021)

Conducted simultaneously in Jordan, Lebanon, and Turkey and led and funded by WHO Geneva, this multi-country community-based randomized trial will be the first in the Middle East to examine the impact of psychosocial SRH infused intervention to improve the use of SRH services during humanitarian crisis. Evidence gained through this research effort will enhance the gained life skill approaches to enrich the Minimum Initial Service Package (MISP) for SRH in humanitarian crisis settings among adolescent girls and young women. It will also result in a smooth translation and cultural adaptation of the intervention package among the targeted populations.

The SEEK Trial project aims at the effect of increased self-efficacy and knowledge (using an innovative psychosocial package) on improved sexual and reproductive health service use among adolescent girls and young women refugees. This comes in parallel to other efforts to reduce maternal/child morbidity

and mortality, decrease the level of sexually transmitted infections, prevent and manage the consequences of sexual violence. The successful implementation of a comprehensive SRH services integrated into the primary health care will expressively improve equitable access of upgraded health services and better-quality of life, not only to Syrian refugees but also to all residents of Jordan.

The SEEK Trial stresses on the importance of integrating the MISP into primary health care. MISP is a set of SRH intervention priorities that need to be implemented at the onset of emergency. It necessitates access to comprehensive and inclusive, high- quality SRH care for all persons, irrespective of age, gender, ethnicity and sexual orientation. The MISP is a sphere standard and is integrated in the global health cluster guidance. It offers universal minimum standard of life saving SRH interventions. The use of selected SRH services from the MISP, particularly family planning, will serve as the primary outcome of this research. This project aims to improve and adapt a low-intensity multi-component psychosocial intervention, infused with SRH knowledge, with an emphasis on self-efficacy empowerment regarding the use of particular SRH services defined within the MISP.

Currently the research team focuses on the first two formative phases of the larger community-based randomized trial aimed to test the feasibility and effectiveness of

the herein proposed intervention package: Phase 1) the development of the proposed package, guided by local priorities and perspectives; and Phase 2) local translation and cultural adaptation of the package for use in the context of Jordan, Lebanon and Turkey. The research methodology is informed by the UK Medical Research Council framework for the development of complex interventions, which recognizes iterations of a) Intervention Development; b) Feasibility and Piloting; c) Evaluation; and d) Implementation, and assist in predicting as well as identifying problems pertaining to acceptability, compliance, delivery of the intervention, recruitment and retention before the large definitive scale trail is conducted.

The psychosocial-SRH infused intervention package is believed to have a positive impact on individuals' emotional regulation, SRH education, psycho-education, communication skills acquisition, problem management, self-efficacy and decision making. It is rationalized that this intervention package will improve the use of SRH services. In other words, it will enhance the outcomes of SRH services amongst Syrian women refugees. This includes preventing unplanned pregnancies, averting sexually transmitted infections, and declining the level of complications from abortion, pregnancy and childbirth.

Establishing a *harmonized* Reproductive Health Registry (*h*RHR) in Jordan to Improve Maternal and Child Health (2017-2021)

This is an implementation research project, where EMPHNET collaborates with the Ministry of Health (MoH) in Jordan to improve the health of women of reproductive age by introducing a

sustainable intervention that will influence the access and use of reproductive health data to support program planning, policy development and decision making at all levels of the health system. Creating *harmonized* Reproductive Health Registry (*h*RHR) for women, will allow personalized care information throughout pregnancy and childbirth to be easily accessed during antenatal visits, labor, delivery, and postnatal visits, thereby improving care provision. The *h*RHR will be implemented in Al Mafraq Governorate initially and then it is intended by MOH to be rolled out to include all governorates of Jordan.

The *h*RHR is a three-year project, funded by the International Development Research Centre- Canada (IDRC). The project involves three phases: Preparatory phase, Implementation phase and Documentation phase. The preparatory phase was accomplished by establishing different committees including the Technical Steering Committee and SRH and ICT Subcommittees. A situation analysis was conducted during the first year of the project. The overall aim of the situation assessment was to understand the current situation of data registration system, SRH data flow in all health centres providing MCH services, and to explore factors associated with low and non-registry issues. Results of the preparatory phase identified several components regarding SRH health information system that needs to be addressed by decision makers and stakeholders.

The second year includes the implementation phase, which will be through developing a web-based application by the Electronic Health Solutions Company (EHS-Hakeem) to allow all sectors to be part of the harmonization process and ensure one patient record across all sectors. The Project team will conduct training workshops for residents of the Jordan Field Epidemiology Training Program (FETP) and focal points from Central MOH as well as Mafraq Health Directorate, hospitals and MCHs with the aim to establish a core technical team that can maintain and administer the new system.

Finally, an evaluation will be conducted to assess the impact of the implemented electronic *h*RHR system. A comparison of the situation before and after the implementation, to analyze the success-fulness of the introduced electronic hRHR, will be conducted at each quarter of data entry during the Documentation phase (third year) of the project.

Family and Community Medicine Team (FCMT) Implementation in Jordan (2019)

The Family and Community Medicine Team (FCMT) is an innovative approach

that aims to improve access to quality Primary Health Care (PHC) services and reduce out-of-pocket expenditure on health for the vulnerable populations including refugees. FCMT is new health care model that focuses on outreach, prevention, and health education and promotion. It is a partnership between physicians at the PHC, family practitioner, and community health service providers such as Community Health Committee staff, Community-Based Organizations, and Community Health Volunteers who visit households, screen for chronic diseases, provide health education and health promotion materials and refer patients to the PHC, when needed, for further care.

The aim of this project is to map and identify gaps in the existing information and education and communication materials to better respond to burden of NCDS and the needs and expectations of patients in vulnerable and marginalized populations. To reach this aim, EMPHNET has conducted a full desk review of available information and education and communication materials including brochures, pamphlets, posters, and others at the MoH and its health facilities at different levels; village primary, and comprehensive health centers (CHC).

EMPHNET has supported UNICEF- Jordan and provided technical expertise to implement the FCMT. The project started on 15th of January 2019. Specifically, EMPHNET mapped and identified gaps in the existing information and education and communication materials to better respond to the needs and expectations of patients in vulnerable and marginalized populations, mapped and identified gaps in the existing guidelines and protocols on PHC, and developed recommendations for updating and re-designing existing old materials and guidelines. Moreover, EMPHENT developed training packages for all stakeholders and workers in FCMT primary health and trained 30 trainers, 100 health professionals, and 200 community workers in Irbid and Mafraq governorates. EMPHNET team had collected the necessary pre and post data to evaluate the impact of the developed training materials on the trainees' knowledge and attitudes.

Strengthening Brucellosis Surveillance, Diagnostics, and Control in Iraq

The project addresses the high incidence of brucellosis in Iraq and will strengthen the surveillance system in Iraq. In 2014, molecular detection techniques were introduced at Iraq Central Public Health Laboratory (CPHL) to determine the Brucella species causing human disease burden. Under this project, GHD collaborates with the Ministry of Health (MOH) and the Ministry of Agriculture (MOA) to strengthen surveillance and

laboratory capacity of brucellosis in four new districts in Iraq. Brucella melitensis and Brucella suis were developed experimentally as biological weapons by state-sponsored programs. It is essential that health and veterinary authorities are skilled in detecting, preventing and responding to Brucella outbreaks and the threat of bacteria being weaponized.

GHD trained 45 technicians on brucellosis technical knowledge and skills, 26 clinicians on Brucellosis case definition, diagnosis and control, 16 veterinary and laboratory professionals, 8 technicians on Brucella diagnosis and detection using ELISA Technique, 8 on Epi Info system on Brucellosis, and 17 of high-risk workers on public awareness on preventing the spread of Brucellosis. In addition to the capacity building activities, GHD developed a follow up mechanism with Iraqi focal point to ensure proper implementation of the circulated Standard Operating Procedures (SOPs) and materials.

The data collection and samples testing started on April 2019. Fifteen human samples were collected and tested positive by Rose Bengal. Of these, fourteen were negative by PCR and one sample was positive (B. abortus).

Improving Diagnosis and Safe Handling of Anthrax in Jordan

Currently, suspected cases of human Anthrax in Jordan are rarely sent for laboratory testing as the diagnostic capacity is not existent.Suspected cases of animal Anthrax are only tested by non-rapid and non-characterizing culture test. Through this project, EMPHNET aims at strengthening the diagnostic capabilities for Anthrax that could be a threat to humans and animals or used as bioweapons while also increasing biosecurity and biosafety

awareness for Jordanian laboratory staff. Under this project, a laboratory assessment was performed, specialized and general laboratory supplies were provided, biosafety/biosecurity training was conducted, and the disease diagnostics tools for Anthrax were upgraded.

The Epidemiology of Invasive Meningococcal Disease: multi-center, hospital-based surveillance of Meningococcal meningitis in Iraq

Neisseria meningitidis (meningococci) meningitis occurs in epidemic waves in the world and is pathogenic for humans. It has polysaccharide capsules and it is usually colonizing the upper respiratory tract where it can spread to cause meningitis. Five to thirty percent of normal population may harbor meningococci in the nasopharynx and in epidemics, the carrier rate might go up to 70-80%. Thirteen serogroups of meningococci have been identified by immunologic specificity of capsular polysaccharides. The most important serogroups associated with disease in humans are A, B, C, Y and W-135). Meningococcal antigens are found in blood and cerebrospinal fluid of patients with active disease. Under this project, GHD aims to determine the mean annual incidence of cerebrospinal fluid (CSF) positive cases for Neisseria meningitides, and to identify the commonly circulating serogroups of N. meningitides in Iraqi population. Accordingly, 18 hospitals were selected as study sites (twelve hospitals in Baghdad governorate and six hospitals in three governorates (Karbala, Karkouk, Mysan)) according to geographical areas, known number of populations of the catchment area, and provision of high standard health care.

GHD trained 24 physicians and laboratorians on meningitis case detection and definition; using the investigation form to collect the data, specimen collection and transportation. Also, Molecular (PCR) Detection and Subtyping of N. meningitidis from Clinical Specimens training was

conducted whereby five laboratorians from CPHL/MOH received training.

A total of 1242 specimens were collected from admitted patient to all selected hospital from selected governorates for one-year period from June 2018 – May 2019. Out of which, 59.9% of patients were males and 40.1 % were females. As well, 1188/1244 (95.5%) samples either from CSF or blood serum were tested in the public health center.

Evaluating the Impact of Enhanced Laboratory-Based Surveillance of Animal and Human Brucellosis in Jordan

Brucellosis is considered a disease of high consequence causing significant animal and human morbidity qualifying Brucella spp. as a potential bio-threat. Brucellosis is the most commonly reported zoonotic disease worldwide and is highly prevalent in the Middle East, including Jordan. This study aims to establish active surveillance and confirmatory testing in the human and animal sectors of Jordan. The general objectives of this study are to determine the true burden and major risk factors of brucellosis in humans and animals in three selected governorates and to describe the geographic distribution of the circulating Brucella sub-types that can be derived from animal and human clinical samples using non-culture-based methods. In addition, the following research areas will be conducted: 1) Determine the main risk factors enhancing human and animal infections and mapping the most endemic areas in Jordan; 2) Evaluate the usefulness of current diagnostic assays for human and animal brucellosis. This may include Rose Bengal test (RBT), serum agglutination test (SAT), Enzyme immunoassays (ELISA)

IgG and IgM, PCR, microbial culture and fluorescence polarization assays (FPA); 3) Assess or evaluate the antibiotic resistance (AMR) profile and genotypes for the Brucella isolates recovered from blood clots of brucellosis cases collected throughout the project; 4) Evaluate the role of Rev-1 vaccine strain in causing infections to humans and/or abortion in animals; and 5) Molecular characterization of animal and human Brucella strains circulating in Jordan using whole genome sequencing (WGS) and MLVA.

Evaluation of Polio Village Volunteers (PVV) Training (April 2019)

Yemen, declared by World Health Organization as polio-free in 2009, remains at high risk of reinfection with poliovirus. The recent conflict that led to decreasing access to social and healthcare services, including vaccination for children, has further weakened the Acute Flaccid Paralysis (AFP) surveillance system. Furthermore, Yemen is threatened by the possible importation of poliovirus from the remaining endemic countries and the spread of circulating vaccine-derived poliovirus from neighboring countries in the Horn of Africa.

EMPHNET supports Yemen Ministry of Public Health and Population to strengthen the AFP surveillance capacities through training 350 Polio Village Volunteers (PVVs) and 51 District Surveillance Officers (DSOs) from 51 high risk districts. As part of this capacity building efforts, an evaluation was conducted to find out whether the training has achieved its objectives and to capture the lessons learned to improve the outcome of future trainings.

This evaluation employed the worldwide standard for evaluating the effectiveness of training (Kirkpatrick Four Level Model) that measures reaction, learning, behavior and

results or impact. Out of the targeted 51 districts, 17 districts (33%) were randomly selected where 108 trained PVVs and 17 DSOs were included together with the Governorate Surveillance Coordinators (GSCs) from the randomly selected seven governorates and the National AFP Surveillance team members. A mix of qualitative and quantitative data collection techniques was used to exploit triangulation and identify the convergence and divergence.

In general, the finding showed that the overall objectives of the PVVs training were met and the training has shown a positive impact on AFP surveillance. Furthermore, the trainees' behavior was found to be positively changed and the trainees are utilizing their skills in their work effectively and efficiently. Most significantly, the evaluation showed that training has contributed to improved surveillance for AFP cases in Yemen.

Retention Survey and Utilization of Long-Lasting Insecticide Nets (LLINs) in Ibb, Taiz and Lahj Governorates [December 2018 to January 2019]

Considered one of the most emergency-affected countries in the world, Yemen's conflict has exacerbated the already fragile situation and threatened the health and survival of more than 20 million people out of the 28 million total population of the country. The damage to health facilities and breakdown of basic infrastructure has increased the vulnerability to communicable diseases in general and Malaria in particular. Malaria is endemic in Yemen and because of the current situation, the registered cases of malaria and other mosquito-transmitted diereses, as dengue fever, were increased in the past five years.

In order to respond to this threat, Long-Lasting Insecticides Nets (LLINs) were distributed in priority Governorates in Yemen as a preventive measure for controlling malaria and other mosquitoes transmitted diseases.

During 2017, Yemen's Malaria National Control Program (MNCP), supported by the International Organization for Migration (IOM), managed to secure 400,200 LLINs to cover neediest populations in 13 districts in three Governorates of Yemen; Taiz, Ibb and Lahj. The 399,700 LLINs were successfully distributed to 809,079 HHs in the selected districts of the three Governorates mainly targeting under-five children, pregnant women and elderlies. The distribution included internally displaced persons (IDPs), hard-to-reach populations and communities at risk.

Accordingly, GHD/EMPHNET conducted a survey aiming at assessing the level of retention of bed LLINs in high-risk areas in

Yemen. For such purpose, five districts namely; Almadareba in Lahj Governorate, Gabal Habashi and Almaafer in Taiz Governorate and Almakhader and Alssabra in Ibb Governorate were selected to conduct the assigned assessment. A sample of 210 HHs were targeted in 30 random villages (clusters) in each district (30 by 7 technique). A detailed questionnaire was developed, tested and approved as the assessment tool. The statistical data analysis was performed by SPSS 24 and the main important indicators were determined in line with the survey's objectives.

The overall goal of the retention survey was to provide evidence for strengthening the MNCP thus improving district level capacity in Malaria control and managing related local public health threats during emergencies. Specific objectives included identifying gaps in LLINs distribution at household level; measuring the proportion of populations at risk with at least one LLIN that has been optimally used; assessing the retention and distribution of LLINs as effective and efficient practices to control Malaria; identifying the gaps in utilization of the distributed bed nets; and recommend actions for improving bed net retention. This survey was not intended to measure durability elements of LLINs including survivorship, fabric integrity and insecticidal activity (bio-efficacy).

Two training workshops were held in Sana'a and Aden to acquire the needed skills for data collectors to fill out the questionnaire properly. As well, a capacity building program was held to provide participants with important knowledge about Malaria and other diseases transmitted by mosquitoes and role of LLINs in its prevention. Additionally, participants were equipped with knowledge about sample size and its distribution on different villages.

The statistical analysis of the collected data gave in-depth insights about the HHs characteristics, LLINs distribution including utilization and reserve and health issues training. These insights can be used as a guideline for future more effective interventions.

On another note, it is highly recommended to build on this survey results to plan for a field research regarding the durability of the LLINs. This proposed research would enable more decision-making tools in regard to survivorship, attrition, physical integrity and bio-efficacy of the distributed nets towards more effective utilization in the future.

Reaching Full Immunization Goal through Applying Appreciative Inquiry Model in Selected Districts in Iraq (2018-2019)

Appreciative Inquiry (AI) for immunization is a community engagement strategy pioneered in Nepal and proved to be effective in increasing vaccination coverage. It aims at mobilizing local communities and building ownerships towards improving health indicators of priority programs. The approach is designed to motivate and empower local communities to be actively engaged in taking lead and ownership to achieve challenging goals. Consequently, communities become catalysts and empowered for arising dedication towards the selected health programs.

Considering that GHD's vision is directed towards better health for people in the Eastern Mediterranean Region, this initiative was undertaken to contribute to improving health among Iraqi infants of the targeted areas through ensuring their completion of all routine vaccines based on the governmentally approved routine vaccination schedule.

The ideology and approach of AI was piloted by GHD/EMPHNET in two districts in Iraq to improve immunization coverage and successfully reached the 100% coverage targets in the selected areas.
In order to confirm the accuracy of the reached goal, a field verification survey took place in the targeted areas of the two targeted districts before declaring the selected areas as AI success story. A random sample of 10% of the targeted children in the selected areas was taken representing 240 children equally distributed between Al Hurr and Al Mahaweel Districts all under the age of 15 months. Female infants represented 48.75% of the surveyed children.

A team of health workers were trained to perform the field work including data collection accompanied by volunteers from the communities who were trained as well. To ensure independence of staff and avoid any possible conflict of interest, selected health workers for Al Mahawwel intervention areas worked in Al Hurr intervention areas and vice versa.

House to house visits were conducted and 60 households were visited during the field survey. Systematic random sampling method was used selecting the fifth house

in the targeted areas subject to availability of a child under the age of one. All collected forms were sent by data collectors to the central Expanded Program on Immunization (EPI) in Baghdad.

In conclusion, the AI succeeded in reaching all targeted children and most importantly the engagement of local communities.

Ensured enrolment of whole system and stakeholders in full immunization initiative in the district was a great achievement with clear understanding and know how developed about full immunization program and defaulters tracking.

Real-Time Surveillance for Infectious Diseases and Other Health Conditions During Iraq Al-Arba'een Mass Gathering (November 2016)

The World Health Organization (WHO) defines mass gathering as an event where the number of people attending is sufficient to strain the planning and response resources of the community, state or nation hosting the event. Each year, millions of Shia visitors walk to Karbala in Iraq to observe Al-Arba'een. Arba'een is considered as one of the largest annual mass gatherings in the world. Similar to other Islamic events, the occurrence of Arba'een varies from year to year by drifting approximately 11 days earlier each year. The date of the Arba'een in the year 2016 was November 21.

The number of visitors to Karbala during the Arba'een gathering of December 2, 2015 reportedly exceeded 22 million individuals from Iraq and other countries. Although the walk of this huge population takes place over several days before the event and via different routes, such huge gathering is enough to overwhelm any health system in the world and the presence of massive crowd at all times around the day of Arba'een is an issue of

concern to public health security. Mass gatherings of such sizes, which take place within a relatively limited space and time period, are usually associated with concerns over disease outbreaks and other health-related conditions such as food poisoning, health conditions due to seasonal changes (hot or cold weather, including heat exhaustion/ heat strokes), wounds and accidental injuries, as well as concerns related to non-communicable diseases such as exacerbation of ischemic heart disease symptoms and other chronic health conditions. In case of a disease outbreak, mass gathering can pose a serious challenge to global public health because of the potential for the spread of diseases both during and after the event as a result of crowd density and population movement. Thus, on one side, MGs can stretch health systems beyond their capacity while, on the other hand, these events can also present opportunities for long lasting positive legacy in the form of strengthened public health systems, enhanced medical and hospital services, improved living environment, and increased public health awareness.

Building the capacity in the conduction of real-time surveillance of infectious diseases and other health conditions is one such opportunity where EMPHNET's technical capacity and background experience in previous MGs in Iraq and its overall technical expertise can be very effective to enable the country to gain a better understanding of the public health threats during the event, enhance preparedness/ rapid response capabilities, and enable evidence-based decision making to strengthen the public health system.

With its unique experience in the past Arba'een events, EMPHNET worked with and provided round-the-clock (24/7) support during the MG event that took place from November 12 to 21, 2016. EMPHNET closely worked with Iraq Ministry of Health (MOH), the Field Epidemiology Training Program (FETP) and other institutions in Iraq to build the capacity of and provide technical support to selected number of health outlets en-route to Karbala in two governorates of Iraq (Karbala and Najaf) in conducting real-time surveillance of infectious diseases and health conditions during the MG event. An enhanced and effective real-time surveillance system (powered by mobile technology and linked to a server where real-time data from both governorates were aggregated) enabled MOH to trigger early response and appropriate measures to address health security issues and reduce the chances of any mishaps during the event. On the other hand, activities done during the pilot project were specifically designed to strengthen the capacities in real-time data collection and the utilization of the influx of data in an effective way. These measures will ensure informed follow-up on outbreak investigations and

present opportunities for long lasting positive legacy in the form of strengthened public health system and, hence, a reduction in the global threats. By the end of the MG event, an overwhelming number of infectious, chronic, and injury cases (more than 41,000) were records in 20 health facilities in the mentioned two governorates. Majority of these cases were Iraqi and Irani nationals followed by other nationalities (Bahrain, Kuwait, Oman, Lebanon, Saudi Arabia, Pakistan, Afghanistan, India, and other countries). Since literature on Arba'een MG in Iraq is scarce as opposed to other religious and non-religious mass gatherings around the world, findings from this pilot project also contributed to the literature body and will remain essential to inform decision making by the Ministry of Health and other partners involved in the event for the years to come.

Community Engagement to Increase Vaccine Demand in Afghanistan, 2016 – 2020

In Afghanistan, despite progress in routine immunization and availability of services, national penta3 coverage is 59.7% and 75% of disease outbreaks are measles outbreaks (EPI Coverage Survey, 2013 and Disease Early Warning System, 2014). Lack of awareness regarding the benefits of vaccines and negative perceptions regarding vaccine safety remain key challenges to increasing vaccine acceptance throughout Afghanistan. The 2013 National EPI Coverage survey found that the top five reasons for not vaccinating children are related to vaccine acceptance and confidence, including "lack of awareness of the need" "no faith in immunization", and "fear of side effects". Afghanistan has the highest rates of missed children due to refusals and low community perceptions about polio and the vaccine. These findings indicate that activities that address vaccine concerns and complacency are critical in Afghanistan to increase vaccine acceptance, ensure

sustained public trust in the immunization program, and allow for coverage levels necessary to reach control or elimination goals. Currently, the Expanded Program on Immunizations (EPI) in Afghanistan is focused on the issues of vaccine supply and little is done for demand generation. Efforts to educate and engage parents, households, and communities overall regarding the benefits of vaccines are needed.

Current strategies used to raise awareness include printed materials, i.e. brochures, pamphlets, banners, billboards and messages communicated through media outlet i.e. TV channels, radio stations and health education through health facilities. These messages are often ineffective because approximately 75% of the Afghanistan population live in rural areas, the majority do not have access to TVs and radios, are illiterate and can't read printed messages, and refuse printed materials with pictures particularly those designed with female photos. There is a need to use innovative and culturally appropriate interventions that generate demand for routine immunization. Because at least 60% of the Afghanistan population has access to mobile phones (according to Ministry of Communication and IT), this could be an effective communication strategy for raising awareness around routine immunizations and polio SIAs.

To address the above-mentioned issues, EMPHNET in close coordination and collaboration with the Ministry of Public Health in Afghanistan implemented a case-control study in a cluster randomized design and evaluated the effect of holistic community-based interventions aimed at increasing acceptance and demand for immunizations in Afghanistan. The goal of this project was to capture information on knowledge, attitude and practices (KAP) and demand related to Virus-preventable diseases (VPDs) at randomly selected communities in 5 southern and eastern provinces of Afghanistan and provide information that is specific to the evaluation of this intervention in Afghanistan and contribute to the knowledge within this context.

Jordan's Maternal Mortality Surveillance Response (JMMSR) System (2016 – 2021):

Under this project, EMPHNET with the support of Abt Associates Inc. USAID/Jordan Health Service Delivery Activity, provides technical assistance in planning and implementing of the JMMSR System. The primary goal of this project is to eliminate preventable maternal mortality by obtaining and using information on each maternal death to guide public health actions and monitor their impact.

The JMMSR system consists of the following five steps: 1) Notification of all Women of Reproductive Age (WRA)

suspected death cases; 2) Identification of all suspected cases that happened during pregnancy, childbirth, and puerperium; 3) Maternal death review conducted for the investigation of causes and contributing factors at both health facility and household levels; 4) Analysis of the causes and contributing factors surrounding each maternal death case; and, 5) Response and dissemination of results.

The project expands on ongoing efforts to provide information that can be used to develop programs and interventions for reducing maternal morbidity and mortality and improving access to and quality of care that women receive during pregnancy, delivery, and the puerperium. It also aims to provide information that will lead to specific recommendations and actions and improve the evaluation of their effectiveness.

EMPHNET is working to collect accurate data on all maternal deaths; analyze and interpret the collected data; use the data to make evidence-based recommendations for action to decrease maternal mortality; disseminate findings and recommendations to civil society, health personnel, and decision-makers and policy-makers to increase awareness about the magnitude, social effects, and preventability of maternal mortality; ensure actions take place by monitoring the implementation of recommendations; inform programmers on the effectiveness of interventions and their impact on maternal mortality; allocate resources more effectively and efficiently by identifying specific needs; enhance accountability for maternal health; improve maternal mortality statistics and move towards complete civil registration/ vital statistics records; and to guide and prioritize research related to maternal mortality.

Neonatal Death and Stillbirth Audits Among Syrians from Zaatari and Azraq Refugee Camps, Jordan, April 2016 – Present

In line with UNHCR's global Strategy for Public Health (2014 – 2018) and with the support of the Gates Foundation, UNHCR started a special project to improve neonatal care focusing on low-cost interventions in Jordan, Kenya and South Sudan. UNHCR Jordan approached EMPHNET to assist in conducting the neonatal mortality audits in the two refugee camps. Thus, in close coordination with UNHCR, EMPHNET has been regularly conducting neonatal death audits among Syrian refugees to systematically capture information on the number and causes of all neonatal deaths and the potential avoidable factors linked to deaths. These audits were conducted in a no-blame, interdisciplinary environment to improve the care provided to all mothers and babies. The Main objective behind this research is to investigate possible causes of death/ and factors affecting the coverage and quality of babies' care with an aim to improve neonatal care in refugee camps and to prioritize action to save lives of babies.

Since July 2018, stillbirth audits among refugees of the two camps were also included in the mentioned surveillance system. Thus, the overall aims of the project are: to understand the number of stillbirths and neonatal by obtaining information over the time; and, to collect information from review of each stillbirth and neonatal death individually, investigating causes and contributing factors and using the information to guide health system and provide action to prevent similar deaths in the future .

Strengthening Management Systems for scaling up Integrated School Health (ISH) in government schools and Makani informal education centers in Syrian refugee camps in Jordan 2016/17.

The Integrated School Health (ISH) project, implemented by EMPHNET and supported by UNICEF, aims to strengthen the delivery of school health services in Syrian refugee camps to simultaneously improve the health and educational outcomes of Syrian refugee children and youth. The ISH project delivers capacity building, coordination, information management, performance-based pay and monitoring and evaluation to organize key stakeholders towards the establishment of a comprehensive, inclusive and integrated school health program. This project included a research component which closely looked at vaccinations, physical, vision, hearing and dental examinations among more than 8,000 school-going

Syrian children and youth in around 30 schools in three camps.

Estimating Population Immunity to Poliovirus in Jordan's High-Risk Areas, 2016

This serosurvey is part of a collaborative project with CDC that aims to inform the polio outbreak preparedness plan and routine immunizations program in Jordan. The primary objective of the serosurvey is to estimate population immunity to poliovirus from sera obtained from children under five years of age in high risk areas in Jordan to inform the Ministry's Expanded Program on Immunizations policy and implementation. Questionnaires will be administered to collect information on demographic factors, place of birth of the child, vaccination status of the child for all vaccine preventable diseases, place where vaccinations were received (e.g. outpatient clinic, private clinic, home), source of information on vaccinations, and reasons for non-vaccination. Additionally, approximately 2-ml of blood will be collected by venipuncture from each subject.

The expected outputs are 1) National and governorate level estimates of immunity levels to poliovirus types 1, 2 and 3 among children less than five years of age residing in the high risk areas of Jordan; 2) estimates of immunity levels among Syrians compared to Jordanians in high risk areas; 3) estimates of the contribution of demographic factors to immunity levels; and 4) estimates of the burden of disease of chronic hepatitis B and immunity levels to diphtheria, tetanus, measles, and rubella viruses. The results will be used by Jordan MOH to guide program planning and implementation.

Burden of Influenza Virus Infection among Hospitalized Infants and the Potential of Prevention through Influenza Vaccination, 2015/17

This prospective cohort study is supported by Abt Associates which aims to provide important information that is lacking on the burden of severe disease associated with influenza virus infection among infants younger than one year in low- and middle-income countries, including the clinical presentation and course of illness in infants, influenza-associated hospitalization, its related outcomes, and the potential value of influenza vaccine effectiveness and antiviral treatment. This assessment will examine hospitalizations due to both respiratory and non-respiratory acute medical illnesses using both molecular and serologic diagnostic assays. The expected output is to estimate the burden of severe influenza that is potentially vaccine-preventable through indirect protection of infants aged 0-5 months old and through direct vaccination of infants aged 6-11 months old. Secondary objectives include: 1) describing the local use of and potential preventive value of interventions in settings where influenza vaccines and/or antiviral agents are available; 2) addressing the primary objectives as they apply to other respiratory pathogens specially, respiratory syncytial virus (RSV) infection among hospitalized infants; and 3) examining the clinical diagnosis and management of influenza and RSV infections in hospital settings.

The study will enroll around 300-500 hospitalized infants per year over two years. Respiratory specimens will be collected for all enrolled hospitalized infants in order to test for influenza virus infection and potentially other viruses using molecular diagnostics. Acute sera and convalescent sera will be examined using serologic assays to examine changes in influenza antibodies associated with influenza virus infection and biomarkers of disease severity. Information on hospital treatment and interventions will be abstracted daily from medical records. Additionally, around 100-200 non-ill infants

will be enrolled during weeks when local influenza virus circulation is confirmed. Respiratory specimens will be collected for molecular diagnostic testing in order to examine possible shedding of influenza virus, RSV, or other viruses among infants that are not acutely ill. Descriptive and medical information will be collected from a parent interview.

Vaccination Coverage Survey in Baghdad Resafa, Iraq.2016

Baghdad Resafa is the eastern side of Baghdad, with around 4.6 million inhabitants and a lot of slums areas. The two cases of poliomyelitis reported in 2014 were from this area. Meanwhile, it is the most affected area by Mumps outbreak in 2016. The purpose of this study was to estimate immunization coverage for all antigens among children aged 12-23 months, in Baghdad Resafa Directorate of Health, 2016, and characterize it by districts; and, to identify the causes of "never" or "delayed vaccination". The survey methodology involved 600 children selected randomly using the proportionate cluster (120 clusters) survey. Twenty teams (each of two) participated in the data collection using the standard WHO questionnaire. Data were compiled using tablets and timely reviewed and analyzed. The study defined a "fully immunized child" as a child who received one dose of BCG, three doses of oral polio vaccine and Pentavalent vaccines and one dose of measles vaccine. The study found that around 41% of children had completed the vaccine schedule within the date. Fully vaccinated children were 75%. Only 2.2% were never vaccinated. Card retention rate was 94%. Immunization coverage for pentavalent 1 (access) was 93%, pentavalent 2 was 77%, and measles was76%. Forty-two percent of all children surveyed received valid doses of Rota vaccine. Dropout rate was 17%, while it was around 25%in rural districts. Parents' neglect ion, mother busy, vaccine not available were the main causes of "never vaccinated" and incomplete vaccination by different antigen. The study concluded that fully immunized children are still below national target besides the high dropout particularly in rural districts. The access is good in all districts while utilization is low in districts with slums. Public communication strategies and raising capacity of health workers were recommended to address reasons of un-vaccination.

The Epidemiology of Middle East respiratory syndrome corona-virus study in Jordan, 2016

In coordination with EMPHNET and the Jordan Ministry of Health, CDC staff have been invited to assist in defining the epidemiology and transmission of MERS-CoV among surviving 2015 cases and their contacts. The aim of this study is to identify

any genetic changes in the genomic sequences of the virus obtained from patient samples and direct further sero-epidemiologic investigation on the transmissibility and pathogenicity of new MERS-CoV strains.

Strengthening Brucellosis Surveillance, Diagnosis and Control in Jordan, 2016

In this project, EMPHNET aims to improve the surveillance system and the diagnostic capacity in human and veterinary laboratories in Jordan. This collaborative project will work in the areas of detecting both human and animal brucellosis detection. Hence, EMPHNET will conduct clinician refresher training on diagnosis and testing for brucellosis, establish serology confirmatory test (ELISA test), establish PCR as a reference laboratory testing in the Central Public Health Laboratory (CPHL) in Amman, establish human specimen collection, management and transport system, work on human data management and reporting, and describe the epidemiology of human brucellosis in Jordan.

Additionally, EMPHNET will conduct refresher veterinarian training on diagnosis and testing for brucellosis in sheep and goats, establish serology confirmatory test (ELISA test), establish PCR as a reference laboratory testing in the Central Veterinarian Laboratory (CVL) in Amman, establish animal specimen collection, management and transport system, work on animal data management and reporting, and describe the epidemiology of sheep and goat brucellosis in Jordan. Further, the

project will aim at integrating animal and human data in order to target vaccination campaigns and assessing cost-effectiveness of vaccination of animals.

Strengthening Brucellosis Surveillance, Diagnosis and Control in Iraq, 2016 (Research proposal submitted).

There are over 6000 cases of human brucellosis reported by the Government of Iraq per year. The Iraq Ministry of Health has requested CDC assistance with implementing a rational brucellosis diagnostic testing strategy, improving the surveillance of human brucellosis, investigating risk factors and modes of transmission, and creating an evidence base to inform brucellosis control action plans. Currently, the majority of human brucellosis cases are diagnosed with a simple agglutination test without confirmation utilizing any additional diagnostics. The recommended treatment course of brucellosis is six weeks with at least two antibiotics, so accurately identifying confirmed cases is critical for treatment of the individual and for targeted public health interventions.

In the brucellosis Iraq project EMPHNET collaborates with the Iraq Ministry of Health to work with two districts in Iraq where disease surveillance has shown a high incidence of brucellosis. Within these districts, the project will add additional confirmatory ELISA testing for persons with a positive initial agglutination test; supplement the current surveillance systems with updated surveillance forms and investigative tools to document and investigate cases; support epidemiologists in the investigation of outbreaks of brucellosis; establish molecular methods in the Central Public Health laboratory to

further characterize Brucella by species; and foster partnerships with the Ministry of Agriculture through meetings and data sharing to target control interventions, primarily vaccination of animals. The Iraq Ministry of Health (MOH) will provide active leadership of the project and the outcome will inform the MOH on how to expand this surveillance and testing strategy to the rest of the country. Consequently, this approach can be used as a model for other countries in the region.

Sero-Epidemiologic Investigation of MERS-CoV in Survivors, Contacts for Jordan's 2015 Cases:

In collaboration with the Centers for Disease Control and Prevention (CDC) and the Jordanian Ministry of Health, EMPHNET conducted a sero-epidemiologic investigation for survivors and contacts of the Middle East Respiratory Syndrome Coronavirus (MERS-CoV). The investigation was done for the cases identified in 2015, and was performed in hospitals in Amman and Zarqa between April 2 and 7, 2016.

The first known cases of MERS-CoV in Jordan occurred in Zarqa between March and April of 2012. New cases and clusters of the MERS-CoV infections continue to occur within the Arabian Peninsula and have been exported to other countries around the world. Little is known regarding the duration of antibody responses following MERS-CoV exposure and infection. Moreover, for the first time, a large-scale deletion in the MERS coronavirus has been identified. Notably, all MERS cases in Jordan of 2015 were

identified as having this deletion. It is for this reason that the sero-epidemiologic investigation was conducted.

Preventing Emerging and Re-emerging Infections Mini-grant Projects, 2015

EMPHNET offered mini grants for competitive proposals with the purpose of implementing projects related to regional priority challenges to address country gaps related to infectious diseases. Hence, joint animal and human health teams from Eastern Mediterranean countries partnered to develop proposals with the ultimate goal of improving management best practices and sustainable disease control methodologies for evolving pathogens. From these proposals, EMPHNET funded four projects related to enhancing biosafety and biosecurity by developing reference materials and conducting training of trainers for MOH personnel in Egypt; developing biorisk management guidelines for Jordan; developing rapid response teams' guidelines in Jordan; and establishing an integrative zoonotic epidemiological surveillance system to address human health risks in Morocco by employing West Nile Fever and Rift Valley Fever as a model.

Middle East respiratory syndrome corona-virus Follow-up Study in Jordan, 2015

In April 2012, the Jordan Ministry of Health investigated an outbreak of lower respiratory illnesses at a hospital in Jordan; two fatal cases were retrospectively confirmed by real-time reverse transcription polymerase chain reaction (rRT-PCR) to be the first detected cases of Middle East respiratory syndrome (MERS-CoV). Epidemiologic and clinical characteristics of selected potential cases were assessed through serum blood specimens, medical record reviews, and interviews with surviving outbreak members, household contacts, and healthcare personnel. Cases of MERS-CoV infection were identified using three CDC serologic tests for detection of anti–MERS-CoV antibodies.

In 2015, EMPHNET in collaboration with MOH and CDC measured longitudinal antibody responses to Middle East Respiratory Syndrome coronavirus (MERS-CoV) from the 2012 outbreak. The aim of this study was to better understand the persistence of these antibodies over time.

Outbreak Investigation of Hepatitis B and C Among Syrian Hemodialysis Patients from Zaatari and Azraq Refugee Camps in Jordan, 2015

In March 2015, representatives of Jordan Ministry of Health (MOH) and Office of High

Commissioner for Refugees (UNHCR) reported to MOH a temporal cluster of cases of hepatitis B (HBV) and hepatitis C (HCV) that occurred on around 24 March 2015. The incidence of these cases among Syrian hemodialysis patients in Zaatari and Azraq refugee camps suggested the possibility of an outbreak of hepatitis due to contaminated hemodialysis machines. Objectives of the investigation were to characterize the extent of the outbreak, determine the most likely source(s) of the outbreak or method of transmission, and make recommendations to assist MOH in taking appropriate action to control the outbreak and protect hemodialysis patients.

Knowledge, Attitudes and Practices towards Family Planning and Reproductive Health in Selected Districts in Jordan, 2015

The Jordan Communication, Advocacy, and Policy (J-CAP) Project is a 5-year USAID-funded activity that aims at increasing demand for and use of modern family planning (FP) methods; increasing capacity of government, civil society, and other partners for social behavioral change, policy, and advocacy; and improving the enabling environment for FP programs. Whereas the J-CAP project will conduct major communication campaigns at National level, it will also employ a phased approach to conducting community-based field level programming with key target groups in selected geographic sites.

To be able to achieve set targets and assess the impact of various community-based interventions, JCAP is planning to carry out pretest and posttest surveys in designated intervention and control sites following a quasi-experimental design. Population-based Survey will focus on measuring knowledge attitudes and practices of currently married women of reproductive age. Hence, EMPHNET conducted a study and provided results of the pretest phase (bassline) survey that covered 16 districts in the three regions of Jordan (central, north and south). In addition to Jordanian women, Syrian women from the central and north regions were included in the study. Eight of the 16 districts served as intervention sites and the other eight as controls. Fielding of the study including data entry was carried out by the Center for Research Studies at Jordan University. EMPHNET performed data cleaning, analysis and report writing for the subject baseline survey.

The main objectives of the survey were 1) To provide reliable estimates of knowledge, attitude and practice parameters related to family planning and reproductive health for married women of reproductive age (15-49 living in JCAP implementation and non-implementation (control) sites in Jordan. The information generated by the baseline can be used by program managers to

improve programming decisions 2) To analyze the comparability of demographic and other key characteristics of the married women of reproductive age respondents in intervention and control sites to document their equivalencies at baseline; 3) To provide a methodologically and statistically sound basis and valid findings as the foundation for measuring changes in key knowledge, attitude and practice variables across time. Findings from this baseline study will be employed in a planned end line impact assessment study of the JCAP Activity, measuring 'discrepancy in the differences' at start and completion.

Mass Gathering Project in Iraq, 2014

Mass Gathering is an annual religious occasion where eight million individuals from Iraq and other countries visit Karbala. The event draws large crowds within a relatively limited space and time period. Naturally, public health concerns arise within such conditions, whereby such concerns include: the occurrence of injuries, communicable diseases, non-communicable diseases, exhaustion and heat related illnesses, alongside other public health related issues, such circumstances impose challenges to public health systems.

EMPHNET in collaboration with the Iraq Ministry of Health has implemented a project that aimed 1) To identify and implement strategies that can strengthen efforts geared towards decreasing morbidity and deaths during mass gatherings 2) To strengthen Iraq's MOH public health system by enhancing the research skills of Iraqi's MOH graduates, residents and FETP residents 3) To strengthen surveillance at the mass gathering event in order to identify strengths and weaknesses, assess gaps,

and make necessary evidence based recommendations 4) To tackle main health problems during the gathering and provide recommendations for decision-makers.

As part of this project, EMPHNET supported eight operational research projects on 1) Knowledge, attitude, and practice of food handlers on food safety and personal hygiene, during Arbaeenia mass gathering 2) Assessment of mobile clinics during Arbaeenia mass gathering at Baghdad-Alkarkh 3) Satisfaction with health services provided at mobile clinics during Arbaeenia mass gathering at Baghdad 4) Temporary health care services for mass gatherings at Karbala 5) Disease burden on health facilities in governorates South of Karbala during the Arbaeenia mass gathering 6) Injuries reported from selected health facilities during Arbaeenia mass gathering at Babel Governorate 7) Communicable disease syndromic surveillance among attendees of mobile clinics during mass gathering of Imam Al Husain's Arbaeenia at Wassit Governorate 8) Non-communicable disease emergencies during Arbaeenia mass gathering at Karbala, Najaf and Babel hospitals.

Acute Respiratory Infections among Returning Hajj Pilgrims in Jordan, 2014

Hajj is one of the largest annual mass gatherings in the world, with millions of pilgrims from over hundred countries traveling each year to Mecca, Kingdom of Saudi Arabia (KSA). The emergence of Middle East Respiratory Syndrome coronavirus (MERS-CoV) in 2012 prompted additional travel guidance and surveillance recommendations for Hajj, given that the majority of cases have occurred in KSA, including those in the same region and time period as the 2014 Hajj, which began on 2 October 2014. Post-Hajj surveillance for MERS-CoV was a priority for Jordan, which has reported cases of MERS-CoV and shares its southern border with KSA. In October 2014, Jordan established targeted surveillance of acute respiratory illnesses in Hajj pilgrims returning to Jordan. Subsequently, EMPHNET with Jordan MOH and other partners characterized this surveillance initiative, which included testing for MERS-CoV and other pathogens known to cause acute respiratory illnesses.

Service Availability and Readiness in the North of Jordan, 2014

This survey utilized a short adapted version of the WHO service availability and readiness assessment (SARA) tool. The target facilities are MOH operated comprehensive healthcare centers (CHCs) and hospitals in the four northern

governorates of Ajloun, Irbid, Jarash, Mafraq, in addition to Zarqa governorate in the central region. General service readiness was measured in five main domains of basic amenities, basic equipment, standard infection prevention, diagnostic capacity and essential medicines. Service-specific availability and readiness was measured for only maternal and child health services (antenatal care, vaccination and childcare), non-communicable chronic diseases (diabetes, cardio-vascular and chronic pulmonary diseases), mental health and services for patients with special needs. Service-specific availability and readiness refer to the ability of health facilities to offer a specific service, and the capacity to provide that service measured through consideration of tracer items that include trained staff, guidelines, equipment, diagnostic capacity, and medicines.

Obesity and Related Factors among Jordanian Women of Reproductive Age Based on Three DHS Surveys (2002, 2009 and 2012), 2014

The main objective of this study is to analyze the trends of obesity among Jordanian women of reproductive age over a 10-year period from 2002 to 2012 based on three Demographic Health Surveys carried out during this period. Furthermore, the study aims at analyzing the possible predicting factors associated with obesity among Jordanian women.

Both individual and household member data sets for each survey were used to get data for ever-married and unmarried women respectively. The Body Mass Index (BMI) of each woman was calculated as her weight in kilograms divided by the square of her height in meters. Binary obesity variable identifying obese women with BMI of 30 kg/m2 and above was used throughout for descriptive, bivariate and multivariate analyses. Two sets of analysis were performed, one for all women and the other for ever- married women only. Each set of analysis covers the three individual DHS surveys. For multivariate analysis, in addition to three models of standard logistic regression for individual surveys a fourth model using multi-level fixed effect model was used for the pooled data. Independent variables included: age, education, place of residence, wealth quintiles and marital status. For the ever-married sample, additional variables related to parity, use of contraceptive method, smoking and working status were used.

Jordan Valley Assessment of Syrian Refugees, 2014

A rapid assessment with a purposive sample was conducted. The sample consisted of well-known 24 locations (sites) of Syrian refugees living in temporary

shelters (tents), distributed over 13 areas located in three districts of the Central and Northern JV. The UN Office for the Coordination of Humanitarian Affairs (OCHA)'s standard tool/ World Health Organization for Initial Rapid Assessment (IRA) was used to conduct this study. The tool was adapted for Jordan; many questions were added to the questionnaire in coordination with UNHCR, after which it was translated into Arabic and validated. The data collected were related to health and its related needs, namely water, sanitation, hygiene, shelter, food, essential non-food items, education and access to governmental services. Data were collected through the use of key informant's interviews (both community and official), group discussions, observations and facility visits.

School Health Assessment Survey, 2014

This survey was intended to assess effectiveness of certain interventions, mainly the Health School National Accreditation and Think First Programs as judged by practices of students at these public schools. A total of 2103 respondents participated in the study. In addition to drawing a sample of schools implementing these programs, another set of schools was selected to serve as a comparison group. Variables were collected to cover meal intake, food consumption, oral and hand hygiene, availability of drinking water, bullying, smoking, practices during playing, physical assault and violence and physical injuries. EMPHNET involvement was limited to data analysis and report writing.

Post-Polio Vaccination Campaign Evaluation, 2014

The objective of this study was to evaluate quality of the campaign conducted between 2-6 March 2014, through estimation of OPV vaccination coverage in Zaatari camp. Hence, a random cluster survey was conducted. Management of the camp divided the camp into twelve districts. Population of each district in the camp were obtained from UNHCR. Ultimately, thirty clusters were randomly selected from twelve districts of the camp. The number of clusters in each district was proportionate to the size of population of each district. From each cluster, thirty families who had at least one child under five years of age were interviewed using a questionnaire, shared by Jordan Office of World Health Organization.

Mental Health Assessment of Syrian Refugees, 2013

Between June to July 2013, the Eastern Mediterranean Public Health Network, in collaboration with the Ministry of Health in Jordan, the World Health Organization and the International Medical Corps, conducted a mental health assessment survey for Syrian refugees in Jordan. This survey aimed to present findings of a survey undertaken to assess the mental health and psychosocial (MHPSS) problems, services, and needs of displaced Syrians in Jordan. The assessment was based on quantitative and qualitative tools adapted from the WHO-UNHCR Toolkit for Assessing MHPSS Needs and Resources in Humanitarian Settings. The study was conducted in Amman, Irbid, Mafraq and Ramtha. EMPHNET was responsible for the design, data collection, data entry, data analysis, and report writing of the study. Findings were based on data collected from 1811 families, providing information on 7964 individuals. Information on family members was reported by the heads of households who were interviewed in this study.

Stillbirth during infection with Middle East respiratory syndrome corona-virus (MERS-CoV), 2013

In May 2013, EMPHNET joined epidemiologists from the Centers for Disease Control and Prevention (CDC) and the Jordan Ministry of Health to conduct a retrospective investigation of an April 2012 outbreak of respiratory illness, using newly developed serologic tests for detection of MERS-CoV antibodies. In this investigation study, serum specimens were collected and epidemiologic data were obtained from potentially exposed groups, including outbreak survivors and household contacts, through medical chart reviews and interviews.

Interviews focused on a range of topics, including the history of illness, detailed contact history (with surviving outbreak group members, the household members of outbreak group members, visiting travelers, and animals, travel history, and occupation. As a result of this investigation study; novel serologic tests allowed for the detection of otherwise unrecognized cases of MERS-CoV infection among contacts in a Jordanian hospital-associated respiratory illness outbreak in April 2012, resulting in a total of 9 test-positive cases.

Non-Communicable Diseases Risk Factors Survey in Ajloun and Jarash Governorates, 2011

The study aimed at establishing baseline prevalence estimates of major NCDs and their behavioral risk factors in Ajloun and Jarash governorates, with particular emphasis on hypertension, diabetes, and obesity. The prevalence of major modifiable NCD risk factors (tobacco use, physical inactivity, and unhealthy diet) was also estimated in these two governorates. The study findings aimed at encouraging use of data in planning and implementing a scalable NCD project, and in promoting the use of data among public health planners and policy makers.

A sample size of 1800 households was randomly selected using a three-stage stratified cluster sampling design. Three strata were used, two for Ajloun and one for Jarash. Data for the study was collected using an instrument which was developed based on the WHO NCD stepwise instrument BRFSS instrument and tailored to address study needs and objectives. Data was collected during the first two weeks of October 2011. Ten teams of trained data collectors participated in data collection through face-to-face interviews and assessment of physical measurements. Data analysis was done using complex sample analysis.

Supplement on Mass Gatherings, 2011

EMPHNET and the Centers for Disease Control and Prevention (CDC) developed and conducted 2 workshops on Public Health Surveillance during Mass

Gatherings for field epidemiology training programs and ministry of health focal points from 10 countries. In addition, each team country was awarded a mini grant in order to implement field project in its country. Mass Gathering Supplement of Eastern Mediterranean Health Journal (EMHJ) was published as a result of this collaborative project. This supplement describes major mass gatherings in the MENA region, and the public health implications of these events, and provides recommendations for public health officials of the host country. The main potential public health concerns associated with mass gatherings include infectious diseases (e.g. respiratory disease, gastro-intestinal tract disease, foodborne disease), injuries, traffic accidents, heat-related illnesses, insect stings, non-communicable diseases and terrorism.

Projecting the prevalence of major non-communicable diseases / risk factors for the Jordanian youth population for the years, 2011

In 2012, The Higher Population Council (HPC) collaborated with EMPHNET in estimating projections for the prevalence of major NCDs and their related risk factors for the Jordanian youth population (18-34) for the years 2007-2050. The technical support provided by EMPHNET was enhanced by involving the Technical Team of the National Population Projection Committee. This study was planned with the intention of promoting the use of information and data among health service planners and policymakers in Jordan. The study aimed at generating and providing projections for the prevalence of major non-communicable diseases (NCDs) and risk factors among Jordanian youth aged 18-34 years using data from the 2007 Stepwise surveillance survey and applying it to the nationally adopted population projections data developed by the Higher Population.

Assessment of Health Competent School Initiative, 2010

EMPHNET in collaboration with The Jordan Health Communication Partnership, a program under the auspices of the Johns Hopkins Bloomberg School of Public Health's Center for Communication Programs, conducted the survey assessing the effectiveness of the Health Competent School Initiative. The survey was a school-based, cross-sectional survey targeting youth aged 13 to 15 years. The sampling frame for this survey at national level consisted of all Health Competent Schools including 8th through 10th grades. This study employed a one-stage clustered design whereby the population is partitioned into strata (defined by region: North, Middle, South) and primary sampling units (PSUs) - e.g., schools - are sampled independently within each stratum using systematic equal probability sampling.

Other Activities and Partners

In addition, EMPHNET participates, in partnership with WHO, NGOs and others, in refugee needs assessment, design of intervention services and evaluation of its impact, capacity building for the host country for the refugees and IDPs, as shown in the examples below:

Partners: Jordan Ministry of Health, FETPs of Iraq and Yemen

☐A training on Applied Epidemiology Methods and Epi Info 7 was conducted in July 2016 for participants from Iraq and Yemen FETPs. The training was applied in nature with focus on research projects of the participants.

Partners: Jordan Ministry of Health

☐Rotavirus and infection control training provided for health workers in Zaatari Camp, 2015

Partners: Jordan Ministry of Health, UNHCR

☐Health Facility Assessment of Hospitals and Community Health Centers in the Northern Governorates of Jordan, December 2014

Partners: World Health Organization

☐Post-Polio Campaign Evaluation in Zaatari and Azraq refugee camps, August 2014

Partners: World Health Organization, Jordan Ministry of Health

☐Assessment of Mental Health Psychosocial Support Needs of Displaced Syrians in Jordan, October 2013

Partners: World Health Organization, International Medical Corps, Jordan Ministry of Health

☐Needs Assessment of Syrian Refugees in the Jordan Valley, January 2014

Partners: UNHCR

☐Public Health in Emergencies Training, October 2013-January 2014

The Eastern Mediterranean Public Health Network - EMPHNET

The Eastern Mediterranean Public Health Network is a regional network that focuses on strengthening Public Health Systems in the Eastern Mediterranean Region (EMR). EMPHNET works in partnership with Ministries of Health (MOH), non-government organizations, international agencies, private sector, and other public health institutions in the region and globally to promote public health and applied epidemiology.

GHD and EMPHNET: *Working together for better health*

Global Health Development (GHD) is a regional initiative created to support countries in the Eastern Mediterranean Region (EMR) and to strengthen their health systems to respond to public health challenges and threats. GHD was initiated to advance the work of the Eastern Mediterranean Public Health Network (EMPHNET) by building coordinating mechanisms with Ministries of Health, International Organizations and other institutions to improve population health outcomes. As an implementing arm to EMPHNET, GHD aligns its strategies with national policies and directions. Serving as a collaborative platform, GHD/EMPHNET is dedicated to serve the region by supporting national efforts to promote public health policies, strategic planning, sustainable financing, resource mobilization, public health programs, and other related services.

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