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ESTIMATION OF INFECTIOUS INTESTINAL DISEASE BURDEN AND DESCRIPTION OF THE INFECTIOUS DISEASE SURVEILLANCE SYSTEM IN RAS AL KHAIMAH, UNITED ARAB EMIRATES

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Under the Supervision of Dr. Mohamud Sheek-Hussein

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Declaration of Original Work

I, Fatema Hamdan Saif Al Alkeem Al Zaabi, the undersigned, a graduate student at the United Arab Emirates University (UAEU), and the author of this dissertation entitled "*Estimation of Infectious Intestinal Disease Burden and Description of the Infectious Disease Surveillance System in Ras Al Khaimah, United Arab Emirates*", hereby, solemnly declare that this dissertation is my own original research work that has been done and prepared by me under the supervision of Dr. Mohamud Sheek-Hussein, in the College of Medicine and Health Sciences at UAEU. This work has not previously been presented or published, or formed the basis for the award of any academic degree, diploma or a similar title at this or any other university. Any materials borrowed from other sources (whether published or unpublished) and relied upon or included in my dissertation have been properly cited and acknowledged in accordance with appropriate academic conventions. I further declare that there is no potential conflict of interest with respect to the research, data collection, authorship, presentation and/or publication of this dissertation.

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Abstract

Introduction: Infectious disease (ID) is an ongoing problem worldwide. In order to manage this problem, it is important to have an integrated and effective surveillance system that can be used to estimate the burden of ID. There is a scarcity of studies published on the prevalence of IDs in the United Arab Emirates (UAE), both in hospital settings and in the community. Infectious Intestinal Disease (IIDs) have been one of the commonest IDs that have been studied in the community around the world, there are no studies on prevalence of IIDs in Ras Al Khaimah (RAK). Furthermore, while the UAE is a member state of the World Health Organization (WHO) Eastern Mediterranean Region that is working toward a plan to fulfill the implementation of the International Health Regulations, and has in recent years started developing surveillance systems for several IDs, there are no publications describing or assessing these systems.

Aims: The aim of this study is to estimate the burden of IIDs in the community and to describe the surveillance system in the emirate of RAK.

Method: In the first part of this research, a population-based cross-sectional study design using a telephone-based questionnaire was used to estimate IIDs in a representative sample of the RAK population (N= 1254; 57.3% males; 25.2 % below 18 years) from all age groups. Participants completed the questionnaire collecting the sociodemographic characteristics and information about IIDs during the four-week period prior to the telephone interview.

The second part of this study was a descriptive scoping assessment of the core activities and supportive functions of the ID surveillance system in government health institutions in RAK based on the WHO guidelines.

Results: Overall prevalence of IIDs was 4.2% in the four weeks prior to the interview. Multivariate logistic regression analysis identified that being female (odds ratio (OR) 2.43, 95% confidence interval (CI) 1.16-5.07) and having a middle–range monthly household income (~ USD 4080-<6800: OR 5.42, 95%CI 1.15-25.48; ~ USD 6800<9530: OR 7.13, 95% CI 1.47-34.57) were positively associated with IID. Age≥ 6 years was negatively associated with IID (OR 0.95, 95% CI 0.90-0.99). Nearly half (49.1%) of participants with an IID sought medical care and 20.8% took

over-the-counter medication. ID surveillance systems in RAK exist at two levels: the higher level of Preventive Medicine Department (PMD) and the lower level of the hospitals. In the emirate of RAK, the basic structure, core functions and support functions of the ID surveillance systems exist at the two levels, however further development has been hampered by lack of standardization, limited training activities and absence of a formal quality improvement process.

Significant contributions: This study provides the first population-based prevalence estimates of IID in the UAE, which are similar to those reported in China (4%), but lower than those reported in Canada (10%), the Netherlands (7%), and the USA (6%). Furthermore, it is the first to describe the local ID surveillance system and identify areas for improvement.

Gap filled: It provides baseline data for IIDs in the community and documentation of the current surveillance system in RAK.

Keywords: Communicable diseases, disease notification, epidemiology, infectious diseases, infectious disease surveillance, infectious diseases surveillance system, infectious intestinal diseases, prevalence, Ras Al Khaimah, United Arab Emirates.

Title and Abstract (in Arabic)

تقدير عبء الأمراض المعوية المعدية ووصف نظام ترصد الأمراض المعدية في رأس الخيمة، دولة الإمارات العربية المتحدة

الملخص

المقدمة: تمثل الأمراض المعدية أو السارية مشكلة مزمنة في جميع دول العالم. ومن أجل السيطرة عليها، فمن الضروري مراقبة وقياس الأعباء التي تفرضها هذه الأمراض على المجتمع مع ضرورة إيجاد نظام فعال لمراقبتها. هناك ندرة في الدراسات التي تم نشرها حول مدى انتشار الأمراض المعدية في دولة الإمارات العربية المتحدة، سواء في المستشفيات أو في المجتمع. تعتبرالأمراض المعوية المعدية واحدة من أكثر الأمراض المعدية شيوعا والتي تم دراستها في مجتمع حول العالم، ولا يوجد دراسة عن مدى انتشارها في رأس الخيمة. ومع ذلك، وبما أن دولة الإمارات العربية المتحدة هي دولة عضو في منظمة الصحة العالمية لمنطقة شرق البحر الأبيض المتوسط فإنها تعمل جاهدة على وضع خطط لتنفيذ وتطبيق اللوائح الصحية الدولية. وقد بدأت الدولة في السنوات الأخيرة في تطوير أنظمة لمراقبة العديد من الأمراض المعدية السارية، لكن لا توجد دراسات موثقة منشورة لوصف أو تقييم هذه الأنظمة.

الأهداف: تهدف هذه الدراسة إلى تقدير عبء الأمراض المعوية المعدية (IIDs) لدى المجتمع ووصف نظام الترصد في إمارة رأس الخيمة (رأس الخيمة).

الطريقة: الجزء الأول من هذا البحث، عبارة عن دراسة مستعرضة اجرية لتقدير نسبة انتشار الأمراض المعوية المعدية (IIDs) وذلك باستخدام استبيان خاص لجمع المعلومات عن المشاركين عبر الهاتف لتقدير نسبة انتشار (IIDs) في عينة تمثل سكان رأس الخيمة (العدد = 1254؛ 57.3٪ ذكور؛ 25.2٪ أقل من 18 سنة) وذلك من جميع الفئات العمرية. وقد أكمل المشاركون الاستبيان الذي يجمع الخصائص الاجتماعية والديموغرافية ومعلومات حول الإصابة بالأمراض المعوية المعدية) لدى المشاركين، وذلك خلال فترة الأربع أسابيع الأخيرة السابقة للمقابلة الهاتفية.

وفي الجزء الثاني من هذه الدراسة، تم تقييم الأنشطة الرئيسية والوظائف الداعمة لنظام مراقبة الأمراض المعدية في المؤسسات الصحية الحكومية في رأس الخيمة بناء على معايير منظمة الصحة العالمية.

النتائج: وجدت الدراسة بشكل عام أن معدل انتشار الأمراض المعوية المعدية (IIDs) خلال الأربع أسابيع السابقة للمقابلة الهاتفية هو4.2%. وقد أوضح تحليل الانحدار اللوجستي متعدد المتغيرات أن الإناث (OR 2.43, 95%CI 1.16-5.07) و الأفراد من ذوي الدخل الشهري المتوسط USD ~)

4080-<6800: OR 5.42, 95%CI 1.15-25.48; ~ USD 6800<9530: OR 7.13, 95% CI 1.47-34.57)

مرتبطين إيجابيا بالإصابة بالأمراض المعوية المعدية. بينما وجد أن ذوي الأعمار6 أو أكبر مرتبطة سلبا بالإصابة بالأمراض المعوية المعدية (OR 0.95, 95% CI 0.90-0.99). 49% من المشاركين المصابين بالأمراض المعوية المعدية تلقوا الرعاية الصحية و 20.8% تلقوا الأدوية بدون وصفة طبية.

وأوضحت الدراسة وجود أنظمة لمراقبة الأمراض المعدية بإمارة رأس الخيمة وذلك على مستويين: المستوى الأعلى المتمثل في الطب الوقائي والمستوى الأدنى المتمثل في المستشفيات. وأوضحت الدراسة أيضا وجود بنية أساسية ووظائف دعم خاصة بأنظمة مراقبة الأمراض المعدية على كلا المستويين وأنها فعالة رغم أن هناك بعض الأمور التي تعيق تطوير النظام مثل عدم توحيد طريقة العمل بين المؤسسات المختلفة وعدم وجود تدريب الزامي يشمل جميع العاملين في هذا المجال. وعدم تطبيق برامج تحسين الجودة على نظام ترصد الامراض المعدية في رأس الخيمة.

المساهمات الهامة للدراسة: هذه أول دراسة لتقدير مدى انتشار الأمراض المعوية المعدية في مجتمع بدولة الإمارات العربية المتحدة، وتماثل دراسة الصين (4%) ولكن أقل من كندا (10%), هولندا (7%) والولايات المتحدة الأمريكية (6%). وهي أول دراسة من نوعها لوصف نظام مراقبة الأمراض المعدية برأس الخيمة بغرض تحديد المجالات المطلوبة لتحسين الخدمات.

سد الثغرات في المعرفة: كشفت الدراسة عن معلومات أساسية لمعدلات انتشار الأمراض المعدية في مجتمع رأس الخيمة، كما وثقت لنظام مراقبة الأمراض المعدية الحالي في إمارة رأس الخيمة.

مفاهيم البحث الرئيسية: الإبلاغ عن الأمراض، الأمراض المعدية، مراقبة الأمراض المعدية، نظام مراقبة الأمراض المعدية، الأمراض المعوية المعدية، علم الأوبئة، مدى الانتشار، رأس الخيمة، الإمارات العربية المتحدة.

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Dedication

To my country and family

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List of Abbreviations

CDC	Centers for Disease Control and Prevention
CAI	Community Acquired Infection
DALYs	Disability Adjusted Life Years
ELR	Electronic Laboratory Reporting
GP	General Practitioner
GCC	Gulf Cooperation Council
HIV	Human Immunodeficiency Virus
ICD	Infection Control Department
ID	Infectious Disease
IHR	International Health Regulation
IID	Infectious Intestinal Disease
JCI	Joint Commission International
KSA	Kingdom of Saudi Arabia
MENA	Middle East and North Africa
MoHAP	Ministry of Health and Prevention
NTSS	National Tuberculosis Surveillance System
PHC	Primary Healthcare
PCIC	Prevention and Control of Infection Committee
PMD	Preventive Medicine Department
QALYs	Quality Adjusted Life Years
RAK	Ras Al Khaimah
SARI	Severe Acute Respiratory Infection
SARS	Severe Acute Respiratory Syndrome

TB	Tuberculosis
UAE	United Arab Emirates
UK	United Kingdom
US	United States
UTI	Urinary Tract Infection
WHO	World Health Organization
YLD	Years Lived with Disability
YLL	Years of Life Lost

Chapter 1: Introduction and Literature Review

1.1 Introduction – infectious Diseases

Infectious Disease (ID) is defined as an illness which occurs because of the presence of one or more infectious agents or its toxic product [1]. These agents include: pathogenic bacteria, viruses, fungi, multicellular parasites, protozoa and prions. They are able to cause animals and plant diseases, which manifest in different ways. Infectious diseases are also called communicable diseases due to the ability of the infectious agents to transmit from one person to another or from one species to another. Routes of transmission include ingested food, liquids, body fluids, inhalation, vector borne spread and contaminated objects [2].

IDs are an ongoing public health problem. IDs in humans have been classified by the World Health Organization (WHO) as the second leading cause of death, accounting for approximately 15 million deaths worldwide annually and in the 21st century these diseases still pose a serious problem to the public health [3].

In view of the fact the IDs have been of global concern, there has been extensive research in this field. This research has taken on different focuses such as clinical, microbiological and epidemiological aspects. The focus from a clinical perspective is the organ system that is affected by the infection or by the clinical manifestation of the disease, such as diarrheal diseases, respiratory diseases, cardiovascular infection, central nervous system infection, and sepsis [4]. Commonly the aim of such research is to optimize treatment regimens.

On the other hand, the concern with microbiologists is related to the causative organism characteristics and where applicable culture identification, sensitivity and resistance patterns, and antimicrobial agents [4].

Epidemiological research on IDs is concerned with how the disease spreads, how long the incubation period is, and how the disease is transmitted [4], to propose acceptable, appropriate, and practical public health interventions to prevent and control diseases in the community [5].

1.1.1 Burden of IDs

Burden of disease is a function of incidence and severity of a disease in a target population, [6] and can be measured by a number of indicators such as prevalence, incidence, financial cost, morbidity, and mortality. These indicators have been used to quantify burden of disease by calculating Disability Adjusted Life Years (DALYs) and Quality Adjusted Life Years (QALYs), all of which provide information about health status of an individual [7].

The effect of all possible adverse events on health can be measured by the DALYs [8], which is considered to be one of the measurements of the disease burden and it can be obtained by the summation of Years of Life Lost (YLL) which is defined as the number of years of life lost due to mortality of a specific disease in a specific population and Years Lived with Disability (YLD) which is defined as the number of years lived with a disability [9].

The DALYs best approach to measure the disease burden is by using the units of time, which can be calculated using the prevalence or incidence measures. Both prevalence and incidence have been used to calculate nonfatal health outcomes [7]

and considered as predominant measures of the disease occurrence [6]. The time lived with a disability can be measured either by taking the point prevalence measures of disability, adjusting for the seasonal variation if available and then expressing them as an annual prevalence, or by measuring the incidence of disabilities and the average period of each disability [7].

Another way to measure the disease burden is by QALYs, which is a general evaluation of health in terms of quality and quantity of life lived. A value can be placed on the time lived in non-fatal health states. To quantify the social preferences for different health states, the health state weights are used, and they are referred to as QALY weights, disability weights or health state preferences. Such weights are measured on a scale of 0-1, where zero corresponds to death while one indicates perfect health [7].

It should be noted that the scores measuring QALY are inverted compared with DALY; that is, in DALY a score of "1" indicates death and "0" indicates perfect health, because DALY is measuring the loss of health. On the other hand, a QALY score of "1" represents perfect health and a score of "0" means death, because QALY is measuring equivalent healthy years lived [7].

There are a number of difficulties in estimating the burden of IDs. Firstly, a long term chronic disease, which may be caused by symptomatic or asymptomatic infections might not be recognized as originally caused by an infection, so it may not be calculated when estimating the burden of the IDs. Secondly, IDs occur on very different time scales. For example, the acute illness and sequelae for influenza infection occur within a short period of time (weeks), but for Human Immunodeficiency Virus (HIV) infection it may take a decade. These variations in

time period require adding disease burden for the diseases that occur over long periods of time. In some situations, a short-lived infection (such as Ebola virus or hemorrhagic fever) causes more fatalities than a more wide-spread long-term condition such as hepatitis C [8].

1.1.2 Increase in antimicrobial resistance

Antimicrobial resistance occurs when microbes become resistant to the antimicrobial drugs that are used to treat the infections they cause [10]. Pathogenic bacteria that are resistant to the common antimicrobial treatments and the emergence of multidrug resistance bacteria are a huge challenge worldwide, that is associated with a high mortality and morbidity [11].

One of the main factors causing antimicrobial resistance is the inappropriate use of drugs. This includes unnecessary use of drugs (for example use of antibiotics for treating illness caused by viruses like the common cold) and inappropriate choice of drugs (such as use of a broad-spectrum antibiotic when an alternative narrow spectrum antibiotic would be equally effective). In humans, the global consumption of the antibiotics has increased by 36% between the year 2000 and 2010 [10]. Antibiotic resistance incurs extra health costs, because of increased drug use, persistent infection and complications [10].

It is difficult to estimate the global burden of antimicrobial resistance, because the data is not collected consistently and systematically, although some factors like misuse of antibiotics and having less developed health systems increases the antimicrobial resistance burden in many countries around the world. For example

in India, *E.coli* bacteria resistance to certain types of antibiotics (third generation cephalosporin) increased from 70% to 83% between the years 2008 and 2013 [10].

The accuracy of assessing the burden of diseases depends on the quality of the data collected. There are two major ways of collecting data that can be used to assess the burden of disease: surveillance and self-reported surveys.

1.2 Introduction – public health surveillance

Surveillance, commonly known as public health surveillance, is defined according to the World Health Organization (WHO) as: "the systematic ongoing collection, collation and analysis of data for public health purposes and the timely dissemination of public health information for assessment and public health response"[12].

Public health surveillance covers a wide range of health-related issues such as obesity, cardiovascular disease, diabetes, injuries, adverse drug events, IDs and many others [13]. From here onwards in this document, surveillance will be discussed specifically in the context of infectious diseases. The term ‘infectious diseases surveillance’ is used to describe a range of methodologies, concepts and actions related to identification and management of IDs [14-17]. Surveillance systems vary widely between countries, and sometimes within different regions in the same country, and at different time points, depending on their scope and purpose. At the national level, most countries have a system for dealing with infectious diseases, although this varies greatly in terms of structure and function. At the global level, Centers for Disease Control and prevention (CDC) and WHO are two main authorities that coordinate a wide range of activities related to infectious diseases.

1.2.1 CDC

The CDC is a United States (US) federal agency formed in July 1946. The CDC works at the local state and national level to prevent disease outbreaks, control environmental health threats, maintain national health statistics, control infectious and chronic diseases (e.g. cancer) and improve the health of US people [18].

The CDC provides public health and healthcare facilities, with the leadership and technical expertise needed to conduct the basic function of the public health services. It has the office of IDs which aims to protect the population of US from IDs. This protection comes by responding to the unusual health events and outbreaks (including bioterrorism) rapidly. CDC focuses also on improving health state and reducing the burden of diseases to reduce the health-related costs [19].

1.2.2 WHO

WHO is an international organization of the United Nations, which came into force on 7 April 1948. This date is celebrated every year as WHO Day. The WHO improves people's well-being by producing health guidelines, and by helping countries in addressing their public health problems [20]. The WHO memberships consist of 194 countries, that have agreed to follow WHO guidelines to combat the health concerned events in that country [21].

Worldwide surveillance of infectious diseases has shown that the top disease killers differ from one area to another. For example, in 2016, human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS) was the top disease in African region [22], while tuberculosis (TB) was the top killer in India [23], and malaria top in sub-Saharan Africa countries [24].

However, looking at the deadliest IDs across the world, the WHO reported that lower respiratory tract infections caused 3.0 million deaths worldwide in 2016 [25]. Another important disease group is infectious intestinal Disease (IID), which even in high income countries like the United Kingdom (UK) is associated with a high disease burden [26]. In 2016 IIDs caused 1.4 million deaths worldwide [25], as well as huge financial costs that were reported even from developed countries such as US [27].

On May 23, 2005, the WHO adapted International Health Regulations (IHR), which are an international legally binding instrument, which contains a decision instrument that helps in identifying the health-related events that each country must report to WHO, when that country agrees to be bound by the regulations and to control the international spread of diseases [28]. The purpose of the IHR 2005 is to prevent, control, protect, and to facilitate the responses to the international spread of disease. It also makes disease surveillance central in order to guide public health action against threats from cross border disease. IHR 2005 was developed to address many limitations of the original IHR 1969, such as the narrow scope of application which is only limited to three IDs, lack of international coordinated mechanism to control cross border disease threats and focusing only on the emergencies caused by ID agents.

The framework set by IHR involves several steps which should be carried out at country level and then followed by reporting to the WHO (Figure 1.1 is modified from the source) [28].

The IHR 2005 requires formal notification to the WHO by state parties, broad scope of application and focusing on both the ID and non-ID disease events [28].

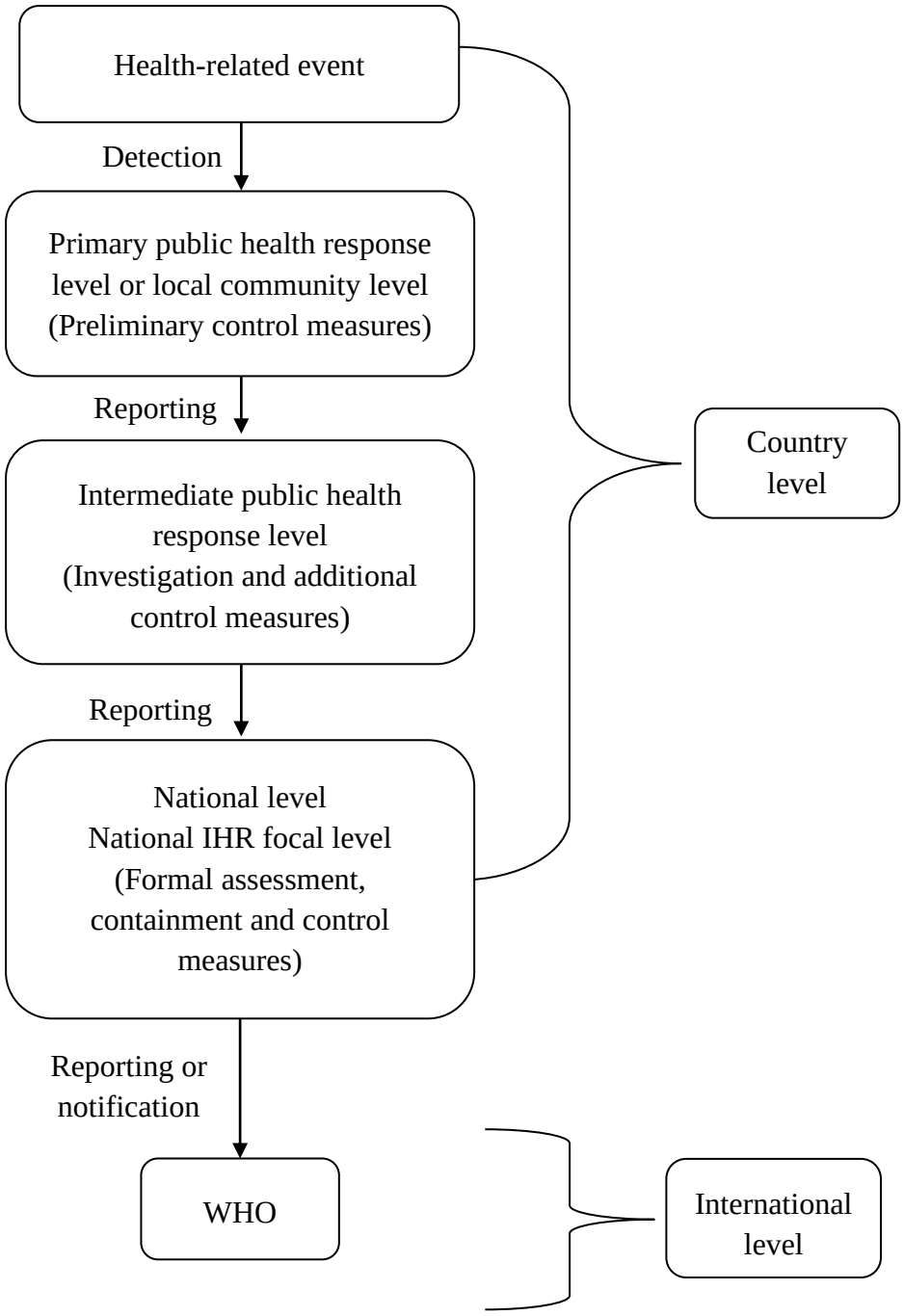

Figure 1.1: ID surveillance structures and processes specified in IHR (2005)

1.2.3 Components of surveillance system

While surveillance systems vary greatly across different geographic regions, certain minimal components need to be in place for the system to be effective [29].

Necessary components include existence of a structure for the surveillance system, core functions, support functions and mechanism for assessment [28].

1.2.3.1 Structure of the surveillance system

Any surveillance system needs to have a clear structure. The structure of the surveillance systems in any country should be supported by regulations and legislations of that country, and should involve the implementers (public health practitioners, physicians, private healthcare providers, and healthcare facilities) and other stakeholders (region/district public health department) and how they relate to each other through different partnerships and networks [30].

The surveillance system can be simple or it can be complex. A simple surveillance system may use few resources or whatever resources available as long it performs the basic actions required to make it function. For example, in Tamil Nadu (India) a paper-based reporting method is used in a tertiary care hospital for notifying the IDs [31]. While a complex surveillance system may use web, computer-based methods to notify their IDs of interest, such as in the US [32].

1.2.3.2 Core Function of surveillance system

The core functions of the surveillance systems can be broadly classified to functions related to individual cases and to functions related to collated data.

The core functions associated with the individual cases include the early detection (identifying outbreaks and cases), registration (recording the identified cases), and confirmation of the case (capacity for confirming). Core functions related to the collated data include data analysis, interpretation and then public health

response including reports to stakeholders. The surveillance systems are useful only if followed by proper response and control [30].

1.2.3.3 Support functions of the surveillance system

To facilitate the implementation of the surveillance core functions, the following support functions should be included:

1) Policies and guidelines are essential supporting elements for the surveillance system and they are important for monitoring and evaluating the surveillance system to make sure that the systems are working according to what was planned for. An example is the guidelines used for the investigation of the outbreaks, which should define the priority diseases for the surveillance system. The policies and guidelines also include the updated case definitions, which is vital for the IDs case definition.

2) Training, which should happen at different levels, and should be tailored to fulfill the set objectives. For example, at the clinical settings, the health professional that is in direct contact with patients should have hands on training on prevention of transmission of IDs. Laboratories personnel should be trained on different testing methods. In addition to the previously mentioned training, the IDs control team should be trained for reporting.

3) Financial resources and communication facilities (offices, paper, computer, phone, fax, laboratories, equipment, vehicles) [30].

1.2.4 Assessment of the surveillance system

The surveillance system of each country needs to be evaluated to ensure it is operating efficiently and fulfilling its purpose. Assessment criteria may differ depending on the context of the surveillance system and its aim.

CDC developed guidelines involving two steps that are important to evaluate the quality of public health surveillance systems: The first step is describing the elements, purpose and the operation of the surveillance system. The second step is evaluation of the surveillance systems performance depending on the key attributes (Table 1.1 modified from the source) [28]. The key attributes are: timeliness, positive predictive value (PPV), representativeness, completeness, sensitivity, usefulness, flexibility, simplicity, and acceptability [33].

Table 1.1: Attributes to evaluate public health surveillance systems

Attribute	Attribute details
Usefulness	Is the system providing data that can be used to prevent and control adverse health related events?
Sensitivity	Is it able to detect the outbreaks and what is the proportion of the true events detected by the system?
Timeliness	Are data collected and dispatched without delay?
Simplicity	Is the system easy to implement by the staff?
Flexibility	Could the system easily adapt to cope with the changes?
Acceptability	Are the persons and organizations willing to participate?
Data quality	Are the recorded data valid and complete?
Positive predictive value	What is the proportion of the true events?
Representativeness	Is the data described the events over time and their distribution (by person and place)?

In reality, publications on assessment of surveillance systems have generally not evaluated all of these components at once. In some studies, the assessment has dealt with basic issues such as structure [33, 34]. With others, one or more quality criteria have been evaluated, such as timeliness of reporting and completeness of records [32].

1.2.5 Type of surveillance

Depending on the ways in which the data is collected, the surveillance of the diseases can be passive or active [35].

1.2.5.1 Passive surveillance

Passive surveillance is compilation of information from data which is routinely collected, exclusively from healthcare institutions. The specific diseases/cases covered in this type of surveillance differs according to the facility; for example, the diseases routinely collected in a health facility providing antenatal care may be infections such as symptomatic or asymptomatic Urinary Tract Infection (UTI), whereas in a surgical ward, post-operative wound infection might be more of a concern. Once the data have been collected, it must be pooled and analyzed to identify possible outbreak. It is used also to detect vaccine preventable diseases and sometimes to report other diseases of interest [36].

Notification

Notification is the reporting of certain IDs to specific authorities (national and/or international) [5]. The aim of notification reporting systems is to observe disease trends, support epidemiological investigation, prevent disability and death due to the spread of the diseases and assess disease prevention programs [34].

The notifiable disease reports serve as a source of data for the ID surveillance, which consist of the mandatory reporting of a list of diseases by phone, mail or fax, and demographics including data on birth, marital status, and data on death [3].

The fluctuations in the prevalence and incidence of the pathogens over time define the list of the diseases which is reported at the state or at the national level [3].

Notification of the IDs serves as an early warning about outbreaks and new occurrences. It also provides information about disease frequency. The early detection of disease outbreaks helps in the immediate control of its spread [31].

At present, the list of notifiable disease varies from one country to another and each country should set their notifiable diseases list according to significant diseases in that country. There are three diseases (yellow fever, cholera and plague) that have been declared by WHO to be on every list, which means that any cases of these diseases should be reported [37, 38]. All healthcare facilities should have a mechanism for sending regular reports to the concerned authorities [36].

In many countries, IDs notification is an official duty of the medical practitioner or physician and also of the healthcare institutions [31]. However, in many developed countries like New Zealand, Ireland, Sweden and in some less developed countries like Sri Lanka, reporting the diseases notification is not only required from the clinicians, but also from laboratories [39].

Healthcare providers should have clear case definitions and the laboratories should be able to perform the required laboratory diagnoses [40]. There are several advantages associated with passive surveillance. Importantly, is not too demanding

on resources, because much of the work is integrated into the ongoing clinical work using existing resources [35]. It also covers large areas (provinces / countries) and is less expensive than other surveillance types (e.g. active surveillance). However, it can be hard to ensure the timeliness and completeness of the data, because it relies on a large network of healthcare providers who are concurrently occupied with fulfilling their basic duties [36].

1.2.5.2 Active surveillance

Active surveillance is non-routine collection of data about a specific disease over a defined period of time, such as during an outbreak or after the exposure to the disease in the community [5].

For example: it is useful in the procedure of case ascertainment during the investigation of an outbreak, since it brings data from sporadic cases that could help us getting information about how disease transmitted [40].

The advantage of active surveillance is that it is provides a more complete reporting of the health events (e.g. disease outbreak). However, since it is non-routine data collection, there may be a higher demand for resources and their related costs [35].

Although many surveillance systems currently exist around the world, some of which are well-developed, ID surveillance remains challenging [3]. Events such as the Ebola outbreak in West Africa [41], the H1N1 influenza pandemic [42], severe acute respiratory syndrome (SARS) outbreaks and Zika outbreak have demonstrated that IDs can't be predicted [38].

There are numerous ways in which active surveillance can be carried out, such as conducting population based surveys [43], and self-reported illness surveys [44].

1.2.5.3 Sentinel surveillance

Sentinel surveillance systems are a specialized type of surveillance that only exist in certain centers. These sites are usually chosen because they are most likely to be representative of the health concern in question [35]. The physicians notify the public health authorities about cases with certain specific symptoms (e.g., influenza like illness). Additionally, data from hospital admission and discharge records, and data from absenteeism that are obtained from schools and work absenteeism declarations can also be used in the detection of outbreaks.

Some of the data which is produced from the laboratories is valuable in identifying IDs. The laboratories generate results that are necessary to confirm cases of diseases or syndromes in population. The data generated from laboratories can also be used in the epidemiological events investigation [3].

1.2.6 Source of data for ID surveillance

There are several sources from which data relevant to infectious disease surveillance can be collected. Direct sources include patient health information that is stored in paper or electronic medical records from hospitals, clinics, and laboratories [3]. Additional information can be obtained from indirect sources that can identify individual or spreading infection. For example, environmental data on air and water pollution can potentially identify microbes in either of these sources.

Sometimes data from telephone triage hotlines about people requiring quick healthcare assistance due to an acute contamination problem can be the first flag indicating a potential spread of infection.

Another source of data is from the drug prescribing patterns as well as sales of (prescribed as well as over the counter) medications. However, drug utilization data should be analyzed together with information about the patient's health status (either from medical records or self-reported symptoms). An example of self-medication is when purchasing from a drugstore without prescription. Additionally, data can be obtained from the medical records when physicians ask questions to collect information about the patient's health status such as asking about their symptoms [3].

1.2.7 ID surveillance strategies

The surveillance of IDs can be broadly divided into traditional (disease-specific) surveillance, syndromic surveillance and event based surveillance [3].

1.2.7.1 Traditional (disease-specific) surveillance

This type of surveillance is based on the routine reporting of the notifiable diseases. The building blocks of the traditional surveillance is any data coming from routine reports such as laboratories (positive results), sentinel surveillance, and reports which are sent from general practitioners.

The National Tuberculosis Surveillance System (NTSS) in United States of America (USA) is an example for this type of surveillance. For example, when a positive case for *Mycobacterium tuberculosis* is identified, a report to the NTSS will be sent by the state health department, and this data will be published on CDC

website. The advantage of this type of surveillance is that it can be used for a wide range of pathogens, but before starting the surveillance, the targets such as diseases, pathogens, populations and syndromes must be identified clearly [3].

1.2.7.2 Syndromic surveillance

Syndromic surveillance is defined according to the CDC as: an investigational approach in which the health department staff use automated data acquisition, monitor diseases indicators continually or at least daily to discover the diseases outbreaks earlier [45]. In this type of surveillance, once the clinical features (symptoms) of the suspected disease have been identified, appropriate action is taken (such as isolation) even before the diagnosis (laboratories results) is confirmed [46].

These surveillance systems are being developed at local, regional, and national levels [46]. Factors such as the outbreak size, the affected population dispersion and the ability of healthcare providers to identify and report unusual cases influence the ability of syndromic surveillance to identify outbreaks earlier than conventional surveillance methods [47]. Syndromic surveillance systems are rapid to implement and can help the public health leaders in making decisions in implementing and evaluating programs for the prevention and control of IDs, but the lack of human resources may affect the collection and sharing of the data. The Electronic Surveillance System for the Early Notification of Community Based Epidemics (ESSENCE I) is an example of syndromic surveillance in US. The implementation of the ESSENCE started as a partnership between the Johns Hopkins University Applied Physics Laboratory and the US Department of Defense. The initial program (ESSENCE I) involved screening of the US army personnel [3].

1.2.7.3 Event based surveillance

The data in the event based surveillance is not based on the routine collection of data, but rather relies on the immediate reporting of events. Originally the information can come from inaccurate sources or unreliable sources such as rumors, reports, and even internet sources. This type of surveillance spots health related events (infectious) worldwide. Program for Monitoring Emerging Diseases (ProMed) [3], HealthMap, EpiSPIDER and BioCaster are examples of event based surveillance and they are important to detect the true outbreaks globally [48]. Event based surveillance is rapid in detecting and reporting the potential health hazards and it can be used in countries with no public health surveillance system, such as in some low-income countries. The events detected by this type of surveillance need to be confirmed by reliable methods such as accurate clinical diagnosis and confirmatory laboratory testing (where applicable) [3].

1.2.8 Types of surveillance programs/regional activities

Infection Control Committee

Infection Control Committee is group of professionals or personnel in a healthcare facility whose aim is to monitor and supervise the infection control activities within the healthcare facility.

The committee should be multidisciplinary, and include physicians as well as representatives from: administration, clinical microbiology, training services, pharmacy, housekeeping and maintenance. This committee must be able to meet quickly in emergency situations (such as an outbreak) and whenever required.

Some of their tasks are, reviewing the epidemiological surveillance data, ensuring that the staff is getting appropriate training in safety and controlling infections and investigating of epidemics [49].

Regional programs

To reduce the risk of the infections in the healthcare facilities, the health authority is responsible of establishing a regional program which must develop the guidelines for healthcare surveillance, practice and prevention, and must be updated continually to ensure it is fulfilling its goals. In order to have effective regional programs, it is essential to have adequate staffing and appropriate training, appropriate equipment (chemical reagents, kits), and proper isolation facilities [49].

Self-reported surveys

There are different methods to assess the burden of infectious diseases. One method is routine collection of data from healthcare facilities, and this is generally known as passive surveillance (Figure 1.2 is modified from the source) [44].

The other way to collect data that is not available or not collected routinely from the healthcare facilities is by using surveys, in which the data is collected directly from the population of interest (self-reported). Such data is valuable to estimate the burden of disease in people that are not likely to visit the healthcare facilities for their illness [6].

An example for such illness is Infectious Intestinal Disease (IIDs), which is described as diarrhea or vomiting caused by microorganisms and it is one of the most common IDs in the world [50]. The high annual costs due to the burden of this illness are making IIDs an important public health issue [44]. Some data on IIDs can be

obtained from outbreak surveillance, activities of the routine public health surveillance and laboratory based communicable disease reporting [6].

Self-reporting IID is useful in several situations. People in remote communities are unlikely to visit health facilities because travelling may be cumbersome. People with chronic diseases may have difficulties in visiting the health facilities, because of the nature of their disease, so it will not be captured in the routine health monitoring surveillance system. Since many cases of IIDs are tolerable and self-limiting, they often are not identified unless captured in a self-reported survey [6].

Usually such self-reported disease surveys contain a questionnaire which may collect information about the symptoms that are reported by the respondents. In addition, the participant may be required to undergo laboratory, physical or radiological examination. For example, in studying the self-reported IIDs, a stool sample may be collected [6].

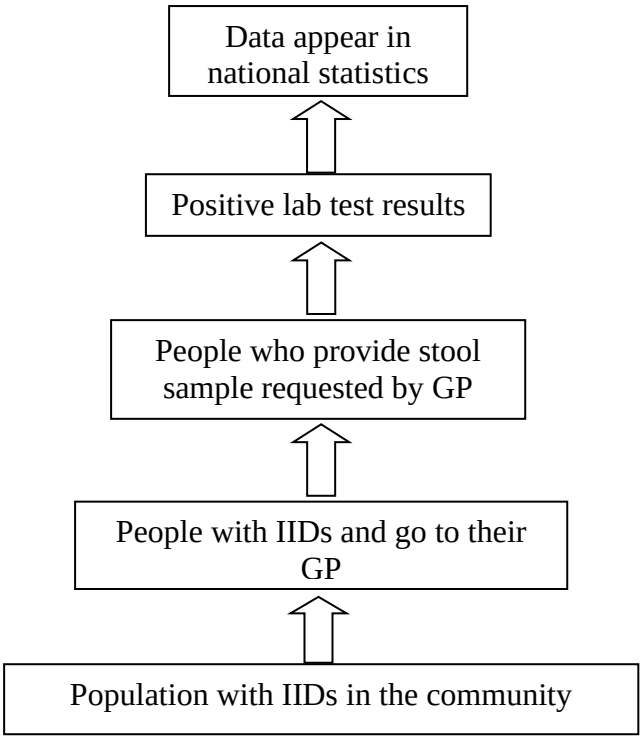

Figure 1.2: Surveillance of IIDs, showing the data flow at each level

Standard based case definition needs to be used for studies on IIDs [51]. Although IID has been the topic of many studies [52-55], the different symptom based case definitions and the different terms for the same illness that have been used in these studies make it hard to draw comparison between such studies, despite the fact that in these studies the same illness is being evaluated (Table 1.2 is modified from the source).

Table 1.2: Symptom based case definitions for gastroenteritis to population data from United States, Ireland, Canada, Norway, and RAK

Definition name/ Ref	Illness	Definition	Prevalence/ Incidence	Remarks
FoodNet (United States) [52]	Diarrhoeal illness	≥ 3 D in 24 h lasting > 1 day, or resulting in activity restriction	Prevalence=6% Incidence=0.75 episodes per person per year	The definition is more specific after interview confirmed cases
Irish (Ireland) [53]	Acute gastroenteritis	≥ 3 D: or bloody D: or V with one of D, cramps/abdominal pain, fever in 24 h	Incidence= 0.60 episodes per person per year	The definition is more specific
NSAGI (Canada) [54]	Acute gastrointestinal illness	D or V	Prevalence=10% Incidence=1.3 episodes per person per year	The definition is very general
Norwegian (Norway) [55]	Gastroenteritis	≥ 3 D in 24 h: or at least 3 of the following: V, nausea, abdominal cramps, fever	Incidence=1.2 episodes per person per year	The definition is general and only excluded chronic cases
RAK	Infectious Intestinal Diseases	≥ 3 D in 24 h: or V in 24 h	Prevalence=4.23%	

FoodNet, United States Foodborne Diseases Active Surveillance Network; NSAGI, National Studies on Acute Gastrointestinal Illness; D, diarrhea (loose stool); V, vomiting, in all studies the time period for observation was 4 weeks prior to interview

To estimate the true level of morbidity, prevalence and the incidence of the IIDs in the community, many studies have been conducted using different methodologies like retrospective and prospective study designs [51, 56]. These studies using retrospective cross sectional studies and prospective cohort studies methodologies have collected information about self-reported IID data from their target population such as information about the demographics, possible causes of this

illness, symptoms and their severity, healthcare use and secondary symptoms [51, 56].

The retrospective cross-sectional studies are based on contacting the participant, usually by the phone, to ask about their symptoms in the recent past. By contrast, cohort prospective studies recruit the participants and asking them to record their symptoms in a form of a diary over a period of several weeks or months [44].

An important advantage of prospective cohort studies is that the pathogens causing the IIDs can be determined by requesting stool samples from the participants who report illness, thereby confirming the diagnosis through laboratory testing [44]. However, such study designs suffer from information bias in which the outcome assessment can be affected by knowledge of exposure, take longer time and are more expensive. Additionally, there is the risk of selection bias due to loss of follow up, which may lead to under estimation the true burden of the disease [6].

Using the retrospective cross-sectional method has many advantages over the prospective cohort method. For example, it is less expensive and can be performed over a relatively short period of time, which enables use of a large sample size, thereby reducing type II error. Also, since it is not relying on those who attend the healthcare facilities, this method is able to capture cases that do not make their way to a doctor [56].

However, the retrospective cross-sectional method has some disadvantages such as not including microbiological information on the cases of illness [44] and suffers from a number of biases. For example, recall bias (telescoping) occurs when

the participants have a tendency to displace events in time and includes the inaccuracy in recalling the symptoms onset date, severity and duration [44, 51].

Recall bias will give an over estimate of the IID frequency [6, 56]. An example is in an IID study, the incidence of IID was 0.55 episodes per person-year when using the retrospective cross-sectional method, while it is 0.19 episodes per person-year using prospective cohort method even after using the same case definition in both methods [26].

1.3 Literature review – ID surveillance system

Search of the published articles on the surveillance system showed that the majority of the literature that was published involved different aspects of surveillance systems, either providing a description or an assessment or an intervention expected to improve the system.

1.3.1 ID surveillance systems – worldwide

The surveillance systems around the world are very different with regards to how developed and efficient they are [37]. Since the distribution and the magnitude of the IDs vary by region, each country needs to develop its own strategies and surveillance system for their particular situation [57].

1.3.2 ID surveillance system – developed countries

ID surveillance is usually based on notifiable disease reporting systems and these diseases are required to be reported to government health authorities by law [31]. Most developed countries have a well-established system which is functional. Publications in the literature about this topic give some information about issues of concern in these surveillance systems. For example, developed countries tend to

focus on how efficient their surveillance systems are (quality) and their main challenges in the areas related to timeliness [32] and completeness [58] (Table 1.3).

Table 1.3: Main issues addressed in studies published of ID surveillance system in developed countries

Country	Year of publication	Hospital or System	Single or national level	Main issues	Ref
Australia	2017	System	National	Quality issues (completeness &timeliness)	[59]
Canada	2016	Pneumococcal surveillance system	National	Quality issues: [1-Effectiveness (usefulness, data quality) 2-Feasibility (simplicity, acceptability, timeliness)]	[60]
Canada (Ontario)	2018	ID surveillance system	Ontario (provincial)	Core elements, Quality issues	[61]
Germany	2017	ID surveillance system	National	Quality issues	[64]
Italy	2015	Acute viral hepatitis surveillance system	National	Quality issues	[63]
Korea	2009	Notifiable diseases surveillance system	National	Quality issues	[57]
Netherlands	2011	System	National	Quality issues	[66]
Norway	2016	SSI surveillance system	National	Core elements and quality issues	[62]
United Kingdom	2012	ID surveillance system	National	Quality issues	[65]
United States	2002	Notifiable surveillance system	National	Quality issues	[58]
United States	2004	ID Surveillance system	National	Quality issues	[32]

Many European countries assess national surveillance systems that cover a large region. For example, US evaluated the quality issues of their national ID surveillance system such as completeness [58] and timeliness [32]. Australia also focused on completeness and timeliness (quality issues) when evaluating their national ID surveillance system [59]. In Korea and Canada, the national ID surveillance systems were evaluated focusing on quality issues such as effectiveness

(usefulness, data quality) and feasibility (simplicity, acceptability, timeliness) [57, 60].

It is important to evaluate not only the quality issues of a surveillance system, but also the core elements. A recent Canadian publication in 2018 evaluated the existing ID surveillance system, focusing on both the core elements and the quality issues of their system [61]. Similarly, in Norway in 2016, a published article evaluated the core elements and the quality of their national ID surveillance system and found that the completeness of their surveillance system is improving over a time, and also found that the computer based surveillance systems gives good accuracy when analyzing the data [62].

Italy [63], Germany [64], UK [65], and the Netherlands [66] published articles on evaluation of their national ID surveillance systems, focusing on the quality issues. Italy, Germany and Netherlands evaluated the timeliness of their surveillance system, while UK assessed the completeness of their reports.

1.3.3 ID surveillance system – developing countries

By contrast, publications on ID surveillance systems from developing countries are different from those from developed countries in terms of the issues they deal with.

In general, the focus is on issues related to the basic structure of the surveillance systems, such as the core elements and the support functions. For example, in an Iranian study evaluating the support functions of their surveillance system; it was found that combining the computerized surveillance systems with the

use of the internet is useful to ensure that updated surveillance information is always available at any time [29].

Tanzania identified gaps related to core functions in their surveillance system; standardized case definitions were unavailable for the majority of IDs they were reporting (only 3 of 21 IDs were with standardized case definitions) and require improvement in the reporting, analysis and feedback [33]. Pakistan found that most practitioners were noncompliant towards reporting the notifiable diseases, because of the lack of time (difficult reporting system) and poor knowledge about the importance of reporting such diseases [67].

In India, the non-reporting and the incomplete reporting of notifiable diseases were because of the lack of information or unawareness about the reporting system [21, 68]. In Sri Lanka, improvement of the system through computerization and enhancement of laboratories were seen as steps to improve the surveillance system [69]. Improvement of the surveillance system in Brazil was proposed to be through training of health professionals [70].

China found when evaluating their national surveillance system that the early warning (early detection) is an essential element for their ID surveillance system to be more efficient [38].

Some developing countries have been working on improving their surveillance system. In Pakistan a publication evaluating the core elements of their national ID surveillance system [67], was followed by a second publication several years (2016) later focusing on quality issues of a national ID surveillance system [71].

Similarly, Ghana evaluated the core elements and support functions of their national ID surveillance system first in 2015 [72], then focused on evaluating the quality issues of their national ID surveillance system in 2016 and found that their surveillance system improved in completeness and timeliness [73].

Several other African countries have recently started evaluating the quality issues of their national ID surveillance system. For example, Nigeria (Enugu) in 2018, published an article focusing on the quality issues (timeliness and completeness) when evaluating their national ID surveillance system and found that their surveillance system needs to be improve focusing on completeness and timeliness issues [74]. Also Madagascar (southern coast of Africa) published an article in 2017 evaluating the quality of their ID surveillance system and found that their surveillance system is performing very well especially in terms of its simplicity and acceptability [75].

In Afghanistan, an article published in 2013, focused on evaluating the quality issues of their ID surveillance system. Their surveillance system was poor in terms of timeliness and acceptability [76] (Table 1.4).

Table 1.4: Main issues addressed in studies published of ID surveillance system in the developing countries

Country	Year of publication	Hospital or System	Single or national level	Main issues	Ref
Afghanistan	2013	TB surveillance system	National	Quality issues	[76]
Brazil	2012	ID surveillance system	National	Core elements	[70]
China	2017	ID surveillance system	National	Core elements, support functions	[38]
Enugu (Nigeria)	2018	System	Regional	Quality issues (timeliness and completeness of data reporting)	[74]
India (Mumbai)	2012	System	National (city)	Core and support functions	[68]
India	2017	ID surveillance system	National	Core and support functions	[21]
Iran	2010	ID surveillance system	National	Core and support functions	[29]
Madagascar (low income)[Southern coast of Africa]	2017	Influenza sentinel surveillance system	National	Quality issues	[75]
Northern Ghana	2015	ID surveillance system	National	Core and support functions, quality issues	[72]
Northern Ghana	2016	ID surveillance system	National	Quality issues	[73]
Pakistan	2014	ID surveillance system	National	Core elements	[67]
Pakistan	2016	Acute respiratory surveillance system	Gilgit-baltistan (single)	Quality issues	[71]
Sri Lanka	2011	ID surveillance system	National	Core elements, support functions	[12]
Sri Lanka	2013	Notifiable disease surveillance system	National (Jaffan city)	Advantage and disadvantage of the surveillance/ support functions	[69]
Tanzania	2002	ID surveillance system	National	Core and support functions	[33]

1.3.4 ID surveillance system – Middle East and North Africa (MENA)

Publications in the literature about the ID surveillance system in the MENA region are limited (Table 1.5). In Iraq (Mosul), the ID surveillance system was evaluated focusing on issues related to core elements and support functions, which was at the regional level. Their surveillance system was in general poor in issues related to the core functions [77].

Qatar published an article in 2014 that was conducted during 2012-2013 which evaluated the ID surveillance system focusing on quality issues in a very small newly build hospital (75 beds), the core elements and the support functions was not evaluated which are the building blocks of any surveillance system and must be evaluated first [78].

Kingdom of Saudi Arabia (KSA) published an article in 2000 evaluating their ID surveillance systems focusing on quality issues in several hospitals from (Jeddah) in the year 1999.Their surveillance system found to be good in reporting the cases [79].

Kingdom of Saudi Arabia (KSA)

Hajj issue in our region

The IDs are important issue especially in a situation of mass gathering, because it may result in outbreaks. The WHO defined mass gatherings as "events attended by a sufficient number of people to strain the planning and response resources of a community, state or nation"[80]. Every year, the KSA hosts the Hajj, which is the largest religious mass gathering in the world [81], in which 2-3 million

pilgrims [82] coming from over 180 countries around the world are present in an area of 356,000 square kilometers [83].

In the crowded Hajj conditions, the infections of the respiratory tract, such as TB, spread rapidly through sneezing and coughing. Food poisoning by toxins produced by some microorganisms like *Staphylococcus aureus* or gastroenteritis due to viruses and *Salmonella spp* also is a common during the Hajj [81].

For any mass gathering, there are three core areas that are important: the risk assessment for the things that may happen, surveillance to predict when a disease appears, and the action in the cases of the disease outbreak [80].

The KSA always prepares for the Hajj season by: regular updating of the health regulations and updates the Hajj travel advice through international public health agencies such as WHO and CDC as well as Hajj travel agencies.

Additionally, 25000 health workers are deployed during the Hajj season. Healthcare services for acute conditions are offered free to Hajj pilgrims. There are additional preventive measures such as: mandatory vaccination prior to travelling for Hajj and prohibition of bringing agricultural products or fresh food into KSA) [81].

Table 1.5: Main issues addressed in studies published of ID surveillance system in the MENA region

Country	Year of publication	Hospital or System	Single or national level	Main issues	Ref
Iraq	2008	System	Mosul	Core elements and function	[77]
Qatar	2014	One hospital – new	Single	Quality issues	[78]
Saudi Arabia	2000	Hospitals – several	Jeddah	Quality issues	[79]

United Arab Emirates (UAE)

ID is a particularly important public health issue in the UAE due to the tourist influx from all over the world and also due to a high migration of expatriates [84]. Nevertheless, the rates of infectious disease are low due to the regular screenings of expatriate residents, immunization program, strict legislation regarding certain diseases and the high standard of living [85].

The UAE is a relatively small country, spanning an approximate area of 83,000 square kilometers. It was established in December 1971 and comprises seven Emirates: Abu Dhabi (capital of the UAE), Dubai, Sharjah, Umm Al Quwain, Fujairah, Ajman and Ras Al Khaimah (Figure 1.3) [86].

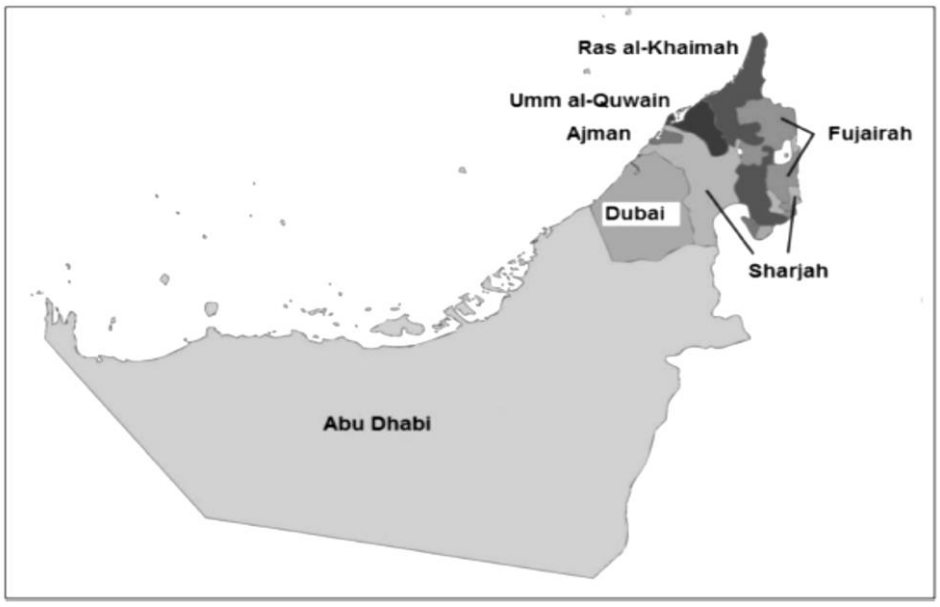

Figure 1.3: Map of United Arab Emirates showing the seven Emirates

According to the 2015 censes, the total UAE population was 9,154,000 [87]. RAK is one of the seven emirates and the fourth largest emirates that's cover 2,478 square kilometers of the total land area of the UAE with a population of 231,000 [88].

An effective surveillance system is one of the important keys to control spread of IDs, and inadequate surveillance and response capacity in a single country can endanger national populations and the public health security of the entire world [89].

1.4 Literature Review – IIDs

1.4.1 IIDs – Worldwide

Few studies have attempted to measure the burden caused by all types of infection in a single study, but many studies that have measured the burden of specific infectious diseases such as IIDs [50].

IID is one of the commonest IDs, and it is the most frequently studied in the community studies, because it gives information about intestinal illness which is not detected by passive surveillance.

In developing countries, the mortality due to IID is high, especially in countries with limited health facilities. By contrast, the mortality due to such illness is low in developed countries, but the morbidity and the economic impact are substantial [54]. Much of the burden due to IID is overlooked by passive surveillance systems, because many of these cases do not present to the healthcare system, and remain at home until the self-limiting condition resolves on its own or is managed with home remedies or self-medication [50] and most of the people don't try to obtain medical attention, so it is hard to determine the incidence of this disease using routinely collected data [26]. In order to fill this gap, researchers have used community based surveys to obtain information about IID [90].

The epidemiology of IID has showed big differences between countries as shown below. Incidence/prevalence have varied cross countries in deferent parts of the world. It is important to be aware of different methodologies to be used.

1.4.2 IIDs – Developed countries

Data on infectious intestinal diseases can give us important information on the burden of disease, which may be otherwise missed by traditional surveillance systems. However, when examining such data, it is important to be aware of the methodology behind it.

For example, studies that use a general definition that also encompasses respiratory infectious diseases are likely to report a higher prevalence than those reporting on intestinal diseases only such as: in Italy the IIDs incidence is 1.08 episodes per person-year without excluding those with respiratory symptoms and it is 0.76 episodes per person-year when excluding the respiratory symptoms [90].

Several studies around the world have looked at incidence or prevalence through telephone based surveys, these studies generally do not focus on specific agent (bacteria, viruses and parasites), but rather depending on participants reporting their symptoms to be considered a positive case. For example: a study conducted in the UK estimated the incidence of symptomatic IIDs in 2016 without confirmatory laboratory testing to identify the causative agent [26]. Two US studies were conducted to investigate all types of causative agents that may cause IIDs [43, 52].

Ireland and Canada both published articles in 2004, studying all types of causative agents causing IIDs in their target population [53, 54]. Other studies from

Malta [56, 91, 92] and Australia [93] also did the same by studying all the causative agents causing the IIDs in their target population.

The incidence/ prevalence of the IIDs may increase, decrease, or it may remain almost constant over a certain time interval in the same country. For example, in the Netherlands, the incidence of IIDs increased from 0.283 episodes per person-year (prospective cohort) in the 2001 [94] to reach 0.964 episodes per person-year (retrospective) in 2012 [50].

By contrast, in Malta, the prevalence of the IIDs decreased from 5% (during 2003) in 2006 [56] to 3.18% (during 2004-2005) in 2007 [92]. In the US, the incidence and the prevalence remained almost constant over a time. The incidence in 2002 (during 1996-1997) was 0.75 episodes per person-year (prevalence 6%) [52] and in 2004 (during 1998-1999) it was 0.72 episodes per person-year (prevalence 6%) [43].

Comparing the incidence of IIDs over the same time period has highlighted differences within the same continent. For example, data from the Netherlands and Italy in 2012, estimated similar incidences (0.964 and 1.08, episodes per person per-year respectively) [50, 90]. In both of these studies the authors suggest that it is important to note that telescoping may have inflated the incidence reported. Another example is Canada and US which are considered to be in the same continent, while showing differences in the prevalence and incidence even during a relatively similar duration of time. The incidence in Canada 2004 (during 2001-2002) was 1.3 episodes per person-year and the prevalence was 10% [54], while in the US the incidence in 2004 (during 1998-1999) was 0.72 episodes per person-year and the prevalence was 6% [43]

Studies of IIDs provide important information, but using different case definitions, different study designs, and including respiratory tract infection cases have made the comparisons between studies done in different countries difficult (Table 1.6).

Table 1.6: Epidemiological studies on IIDs from different developed countries

Country/ Year of pub	Disease	Study design	Target	Size	Outcome Prevalence/Incidence*	Associated factors	Ref
Australia (2005)	Diarrhea	-Cross sectional telephone survey	All ages	N=6087	-Prevalence=6.4%	-Age -Gender	[93]
Canada (2004)	Acute gastrointestinal illness	-Retrospective cross sectional telephone survey (self-reported)	All ages	N=3500	-Prevalence=10% -Incidence rate=1.3 episodes per person year	-Medications (antibiotics) -Season -Age -Gender	[54]
Ireland (2004)	Acute gastroenteritis	-Population based telephone survey (2000-2001)	All ages	N= 9,903	-Prevalence= 4.5% -Incidence= 0.6 episodes per person per year	-Presence of a child in a household	[53]
Italy (2012)	Acute gastrointestinal illness	-Retrospective telephone survey (self-reported)	All ages	N=3490	-Prevalence=8.9%	-Occupational status -Season -Citizenship -Gender -Age	[90]
Malta (2006)	IIDs	-(Pilot study) Age stratified retrospective cross sectional telephone survey	All ages	N=2652	-Prevalence=5%	-Demographic data -Symptoms -Burden of illness	[56]
Malta (2007)	IIDs	-Age stratified retrospective cross sectional telephone survey	All ages	N=3504	-Prevalence=3.18%	-Working/school days lost -IID cost (direct/indirect)	[92]

Table 1.6: Epidemiological studies on IIDs from different developed countries (Continued)

Country/ Year of pub	Disease	Study design	Target	Size	Outcome Prevalence/Incidence*	Associated factors	Ref
Malta (2010)	IIDs	-Age stratified retrospective cross sectional telephone survey	All ages	N=3504	-Prevalence=3.18% Data on specific pathogens which are not shown in this table -Incidence=0.421 episodes per person per year	-Pathogens causing the illness	[91]
Netherlands (2001)	Gastroenteritis	-Prospective population based cohort study	All ages	N=4860	-Incidence= 283 per 1000 person-years	-Age -Gender -Degree of urbanization -Region -Level of education	[94]
Netherlands (2012)	IIDs	-Retrospective cross sectional study (self-reported)	All ages	N=1975	-Prevalence=7.4%	-Season -Age, -Gender	[50]
United Kingdom (2016)	IIDs	-Retrospective telephone survey (self-reported)	All age	N=14,813	-Incidence=0.533 episodes per person - year	-Age -Gender	[26]
United States (2002)	Acute Diarrheal illness	-Population based telephone survey	All ages	N=8624	-Prevalence=11% -Incidence=1.4 episodes per person per year	-Age, -Gender -Residence -Education - Income, -Race	[52]
United States (2004)	Acute Diarrheal Illness	-Population based telephone survey	All ages	N=12,075	-Prevalence=6% -Incidence=0.72 episodes per person per year	-Education level -Area -Ethnicity -Age, -Gender -Season	[43]

*Some studies reported prevalence only and some studies reported incidence only and some reported both; the values presented in the table were as reported by the authors in the original paper.1.4.3 IIDs – Developing countries

Some developing countries have reported different incidence/prevalence of the IIDs within the same geographic and even within the same country**.** For example, in Iran different prevalence of the intestinal parasitic infections were reported in three different cities, Gorgan, Boyer Ahmad, and Tehran, with the prevalence of 28.8%, 37.5%, and 32.7% respectively [95, 96, 97]. Although it must be acknowledge that other factors may contribute to these differences.

When comparing published research from developed and developing countries, it is clear that the main focus of the developing countries is on intestinal parasitic infections (Table 1.7). Furthermore, studies in some developing countries have included all types of causative agents causing the IIDs such as Malaysia [98] and China [99], while many other developing countries studies focused on studying intestinal parasitic infections such as West Africa (Burkina Faso) which found a high intestinal parasitic infection (86.2%) of parasites in a school children age from 8-14 years [100]. Iran reported a low prevalence of parasites (3.7%) causing IIDs in food clerks (4612 samples) in Tabriz city, although it must be noted that the study sample was very specific sample of adults [101]. In Pakistan (Karachi) prevalence of parasites in children aged 1-5 years was 52.8% [102]. In Ethiopia 34.2% of children from grade 1-8 had parasites causing IIDs [103].

Table 1.7: Epidemiological studies on IIDs or parasitic infections in developing countries

Country/ (Year of pub)	Disease	Study Design	Target	Sample size	Outcome Prevalence/Incidence*	Associated factors	Ref
China (2013)	IIDs	-Retrospective cross sectional From July/2010- July/2011	All ages	N=39686	-Prevalence=4.2%	-Gender -Age -Ethnic group -Education -Days off -Causes of their illness. -Seeking healthcare	[99]
Malaysia (2011)	IIDs	-Nationwide cross sectional survey From Apr/2006- mid Aug/2006	All ages	N=56710	- Four week incidence=5%	-Age, Ethnicity, Gender -Education, Locality -Household Income	[98]
West Africa, Burkina Faso (2016)	Intestinal parasitic infections	-Cross sectional survey In Feb/2015	Age 8-14 years	N=385	-Prevalence=86.2% (parasites)	-Gender -Ethnicity -Hand hygiene -Exposure to fresh water -Quality of drinking water	[100]
Ethiopia (2013)	Intestinal parasitic infections	-Cross sectional survey From Apr/2012- Jun/2012	Grade1- grade8	N=304	-Prevalence=34.2% (parasites)	-Age -Gender -Hand hygiene -Education -Family monthly income	[103]
Pakistan, Karachi (2008)	Intestinal parasitic infections	-Cross sectional From Feb-June/ 2006	Children aged 1-5 In town in Karachi	N= 350	-Prevalence= 52.8% (Parasites)	-Gender, -Age -Mother education status -Monthly family income -Pathogens	[102]
Iran (2012)	Intestinal parasitic infection	-Cross sectional survey Between Oct/ 2010- March/ 2011	Primary school of Gorgan City Age 8 to 12 years old	N= 800	-Prevalence= 28.8% (Parasites)	-Hand hygiene -Household Income -Education level -Family size -Animal contact	[95]
Iran (2016)	Intestinal parasitic infections	-Cross sectional population based survey. From Jun-Dec/ 2014	All ages (Boyer ahmad distract)	N=1025	-Prevalence= 37.5% (Parasites)	-Pathogens -Contact with animals -Education status	[96]
Iran (2016)	Intestinal parasitic infections	-Descriptive study In 2014	Food clerks in Tabriz City	N= 4612	-Prevalence= 3.73% (Parasites)	-Pathogens	[101]
Iran, Tehran (2017)	Intestinal parasites	-Cross sectional From Jun-Dec/ 2014	All ages residents of Roudehen area	N= 561	-Prevalence=32.7% (Parasites)	-Gender, -Age -Occupation, Education -Water source -Animal contact	[97]

*Some studies reported prevalence only and some studies reported incidence only and some reported both; the values presented in the table were as reported by the authors in the original paper.1.4.4 IIDs – Gulf Cooperation Council (GCC)

Six countries closely related geographically and culturally, make up the GCC. These are Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and UAE [85]. Studies of IIDs are very limited in the Gulf region (Table 1.8), and it is notable that the majority of them focused on parasitic infections.

The prevalence of the intestinal parasitic infections has been shown to vary in different cities of KSA. A community based study conducted in (Riyadh) in 1999 reported that 32.2% infected with the intestinal parasites infections [104]. The only study of IID was reported in (Jeddah), where the one-month incidence of diarrhea was 14.9 % (during 2004-2005) [105]. Intestinal parasitic infections were reported in 44.2% from the study population in (Madinah) during 2012 [106].

In Bahrain, the first and only published community based study was conducted from 1984-1986 and found that 739 persons (34.8%) had intestinal parasitic infections from a total number of 2123 participants [107].

In Qatar, over a three-year period from 2005-2008 it was found that 10.2% of the study population (N=9208) were found positive when tested for intestinal parasitic infections [108].

Table 1.8: Epidemiological studies on IIDs from different MENA region

Country/Year of pub	Disease	Study design	Target	Size	Outcome Prevalence/Incidence*	Associated factors	Ref
Bahrain (1995)	Intestinal parasites infections	First community based study From 1984-1986	All ages	N=2123	-Prevalence=34.8%		[107]
Dubai (2015)	Infectious Diseases	From 1995-2013			-Data about 21 ID were included, of which 5 diseases were intestinal diseases		[84]
KSA, Riyadh (2001)	Intestinal parasites infections	Household survey	All ages (Riyadh)	N=6012	Prevalence=32.2%	-Area -Gender -Age -Education -Nationality -Environmental factors	[104]
KSA (2009)	Diarrhea diseases	Cross sectional survey (self-reported) -From Oct/2004-Feb/2005	Boys public School in Jeddah 7-12 years	N=1064	-Prevalence= 14.9%	-Children under 5. -Sewage spillage near household. -Eating out after school -Not drying hands after washing -Using reusable cloths to dry dishes. -Eats in traditional restaurants	[105]
KSA Madinah (2015)	Intestinal parasites infections	Prospective cross sectional	Workers in Madinah (Asia, Africa)	N= 120	Prevalence=44.2%	-Gender -Nationality -Age	[106]
Qatar (2010)	Intestinal parasitic infections	Hospital records From 2005-2008	Subjects of all age groups from28 nationalities and resident in Qatar	N= 9208	- Parasites increase in prevalence (almost doubling) over the period 2005-2008 - prevalence= 10.2%	-Region (nationality) -Age -Gender	[108]
Sharjah (2010)	Intestinal parasitic infections (Protozoa)	(laboratories investigation) -From Jan/2008-Dec/2009	Patients of all age (native & expatriate) attending MoHAP hospitals in Sharjah	N=10514	-Prevalence=7.7% intestinal parasitic infections	-Nationality	[109]

*Some studies reported prevalence only and some studies reported incidence only and some reported both; the values presented in the table were as reported by the authors in the original paper. In the United Arab Emirates (Sharjah), the prevalence of the intestinal parasitic infections was 7.7% (15.7% native and 3.2% expatriate) from the study population of all ages attending Ministry of Health hospitals in the emirate of Sharjah (N=10514); the rate of infection in males was 58% and 42% in females (from Jan 2008-Dec 2009) [109].

The only study published from the UAE on IIDs, is a study conducted in UAE (Dubai) that represented retrospective hospital data about 21 different IDs including some selected intestinal diseases. This study found that in more recent years (2014-2016), the forecasted Crude Incidence Rate (CIR) of Amoebic Dysentery, Bacillary Dysentery and Food Poisoning was much higher than the calculated CIR in previous years [1997-2013] (Table 1.9) [84].

Table 1.9: Change in the mean of CIR associated with one year increase in time every 4 years starting by 1997 and ending by 2013, and forecasted changes from 2014-2016

	Change in time				Forecasted values		
	1997-1998	2002-2003	2007-2008	2012-2013	2014	2015	2016
Diseases							
Amoebic Dysentery	-0.33	0.47	1.27	2.07	17.12	19.51	22.06
Bacillary Dysentery	-2.35	-1.25	-0.15	0.95	3.29	4.68	6.29
Food poisoning	-1.47	0.53	2.53	4.53	41.53	46.86	52.59
Salmonellosis	-4.1	-1.9	0.3	2.5	-	-	-
Typhoid	-4.75	-2.35	0.05	2.45	-	-	-

1.5 Statement of problem

The UAE has worked on developing its health services which have now become comparable to international standards. The UAE also works closely with the WHO on several areas that aim to improve the public health situation, with IDs being one of the top priorities. The UAE is a member state with the WHO Eastern

Mediterranean that is working towards a plan to fulfill the implementation of the IHR [110].

There is very limited published data about both active IIDs and passive IIDs surveillance systems in the UAE. Considering that community based surveillance of IIDs is an example of active surveillance, there is a lack of studies in the UAE, therefore there is a need for further studies to better understand intestinal disease in UAE. Most data available is hospital based data, which does not reflect the true burden of IIDs in the community.

Regarding health system based surveillance, there are no publications describing the core capacities and structure of surveillance systems in the UAE. Neither has there been any published evaluation of the associated support functions nor quality issues related to the surveillance system such as timeliness of reporting and completeness of records.

In UAE, this is the first attempt to examine IIDs in the RAK community to understand the burden of IIDs in this emirate. And it is also the first attempt to describe some components of ID surveillance system in RAK using the core criteria setup from the IHR.

1.6 Research question

What is the IIDs burden in RAK community and what are the main characteristics of the local ID surveillance system?

1.7 Aims

The aim of the study is to estimate the burden of infectious intestinal disease in the community and to describe the surveillance system in the emirate of RAK.

1.8 Objectives

1. To measure the self-reported prevalence of infectious intestinal disease in a representative population-based sample using a standardized interviewer assisted questionnaire.
2. To describe the burden of intestinal infections and explore some of the associated factors.
3. To describe the structure, core functions and support functions of the infectious disease surveillance system in RAK.

1.9 Expected benefits

This study estimates the burden of intestinal infection amongst the population of RAK. With it being the first community study on infectious diseases in Ras Al Khaimah, this study will identify the practical challenges in doing this type of study in the local setting. Furthermore, the findings will help identify the magnitude of the problem and associated factors. This work can help in development of the infrastructure and public health staff, so that it is possible to identify those who are at risk of intestinal infections in RAK population. Furthermore, since this is the first published description of the surveillance system in RAK, it can be used as part of future quality improvement projects.

Chapter 2: Methods

2.1 Introduction

In this chapter, the methods used to estimate self-reported infections in RAK and the methods used to describe the existing surveillance system in RAK are presented.

2.2 Part 1: Community survey to estimate self-reported IIDs

This section has been written in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [111].

2.2.1 Study design, population and setting

A population-based telephone survey (cross-sectional design) was conducted from 07 January 2017 to 31 September 2017 in the Emirate of RAK. The target population was all residents of RAK and those who were no longer living in RAK were excluded. The UAE Federal Competitiveness and Statistics Authority provided the sampling frame, which was a list of all residential addresses and telephone numbers in RAK.

2.2.2 Estimation of sample size

From previous studies, it was estimated that four weekly prevalence of IID was 6% [43]. This estimate was used in the following equation:

Sample size n = [DEFF*Np(1-p)]/ [(d2/Z21-α/2*(N-1)+p*(1-p)] [112].

Where, N = Population size (RAK population 231000)

p = prevalence (0.06) 6%

d = Precision (0.015) = (0.045 – 0.075)/2 = 0.015 from CI (4.5% - 7.5%).

DEFF = Design effect (1): usually 1 except for stratified or cluster sampling.

$Z1-\alpha/2 = 1.96n = [1*231000*0.06(1-0.06)]/$

$[(0.015^2/1.96^2)*(231000-1)+0.06*(1-0.06)] = 13028.4/13.586 = 959$

Then a sample of 959 will give an estimate of the population proportion of 4.5%-7.5% with 95% confidence. It should be noted that this sample would consist exclusively of adults, and therefore the only way to include children in the study was for them to be reached through the adult participants (see below).

The UAE Federal Competitiveness and Statistics Authority provided the sampling frame, which is the only authority with information on the UAE population in all Emirates. This authority compiles data on the population, through its database that covers all geographic areas in each emirate according to households in each area. Each residential address is covered; however only a single mobile number is noted for each address. Furthermore, the majority of the numbers were registered under a male name, regardless of which member of that household or other person associated is using it.

In order to recruit a representative sample of females and children in our sample we aimed to recruit one male, one female, and one child from each household. For example, if a male respondent answered the telephone call then his spouse (or other adult female if spouse not available) and a child was recruited into the study. The next birthday method was used to select one child (<18 years) from each household. Considering the unique family and social hierarchical characteristics

of our population, we expected this recruitment method to at least provide a representative study sample that comprised adult males, adult females and children.

Based on a previously published study in the UAE, it was assumed that the response rate in the current study would be 65% [113]. A more conservative response rate of approximately 50% was assumed. As per the policies of the UAE Federal Competitiveness and Statistics Authority provided a list of 1728 residences with a mobile number for the head of the household, stratified by geographical location and nationality.

All telephone numbers were provided by the Federal Competitiveness and Statistics Authority, Abu Dhabi branch, based on their database of numbers which were according to 108 geographical areas into which the emirate of RAK was divided. Their sampling method ensured that representation was from all areas of RAK, since their database included information about where the person is living.

Additionally, information about living area was collected to account for people changing accommodation. Anyone no longer living in RAK was excluded. Those who were in RAK, even if their accommodation was changed from one area to another were included. To ensure that all areas of RAK were covered, the final location of all study participants were once again mapped against the geographical areas in municipality, to ensure no area was neglected.

2.2.3 Recruitment method

Each of the mobile numbers in the list of 1728 contacts given by the authority was called. Numbers for which there was no response on the first call had repeat calls to a maximum of 4 times in total.

Along with the list of 1728 potential participants, the names, mobile numbers and residential area were provided.

2.2.4 Data collection procedures

The initial plan for the study was to divide the list of 1728 numbers by 12, with the aim of having an equal number of potential participants to be contacted every month. As such, there were around 145 numbers to be contacted per month, from which it was anticipated to get a response from around 100 participants. The response rate improved after the second month and as a result the study period was reduced to 9 months (January to September).

2.2.5 Research team and training workshop

The research team consisted of three research personnel experienced in performing questionnaire based studies.

There was an initial meeting held on 07 January 2017, to go through the protocol with the research team and explain to them their responsibilities. Specific instruction was given on how to collect the information needed to fill the questionnaire from the participants, how to respond to the possible questions from participants and how to address any concerns that the participants may have. A chart was produced to guide the research personnel on how to recruit females and children (Figure 2.1).

In the questionnaire, there were no options for the interviewers to elaborate on the questions as the majority was closed ended multiple choice questions. Researchers had to ensure that forms were complete, and in case there was missing

data or other issue related to the form, it was immediately raised to the principal investigator to resolve.

Prior to initiating the study, the researchers were trained on the study procedures including how to go through the questionnaire with the participants without influencing the responses and how to document the responses on the form. Definitions that were relevant to the research were covered in detail (see definition section below).

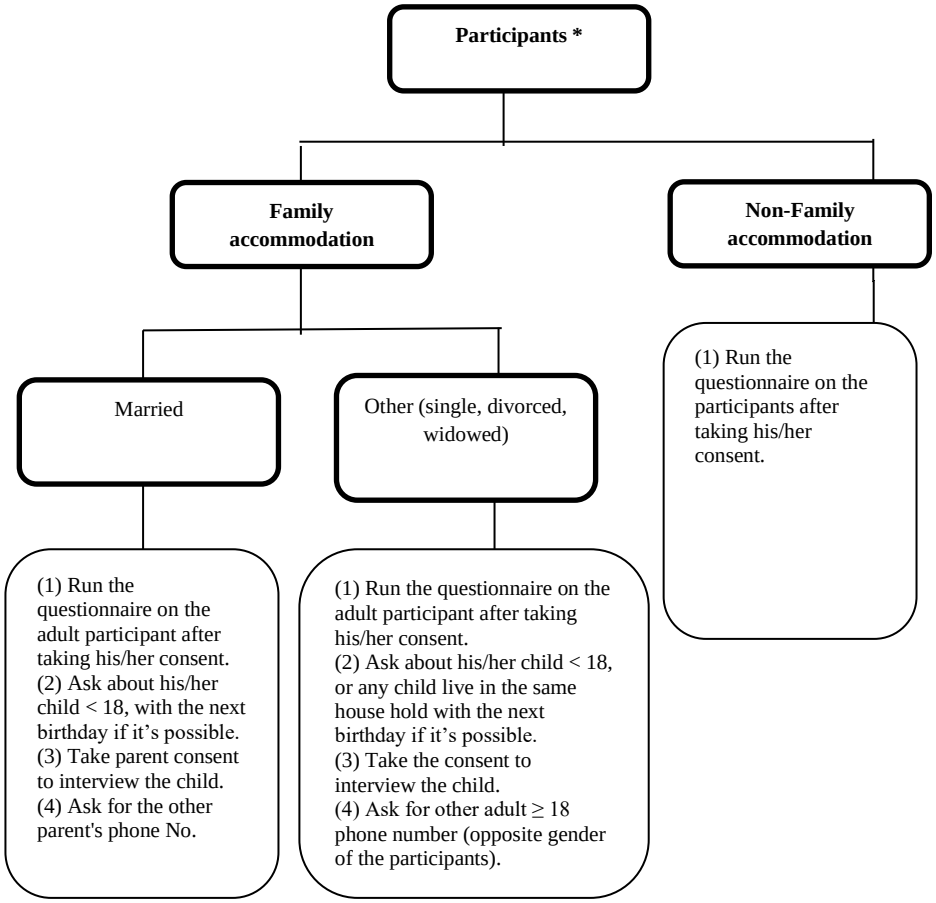

Figure 2.1: Chart to outlining the recruitment strategy

The plan was that for each household 3 questionnaires would be completed: two adults and one child

(1) Male (≥ 18), (2) Female, (3) Child

*Participants from the initial list given by the Statistics Authority of Competitiveness

For each family household, the aim was to recruit both parents and one child. For single parents, the aim was to enroll the parent of the child, another adult in the household and a child.

Non-Family household included individuals living alone as well as laborers living in communal accommodation. For the latter group, only the first contacted participant was included. This was because all individuals living in these premises are male and recruitment of more than one participant would introduce a gender imbalance in the study sample.

Research personnel used mobile phones with research study numbers that were provided to conduct all study related calls. Monitoring of progress was done through monthly meetings in which all members of the research team got together. The purpose of these meetings was: 1) to submit the hard copies of the completed questionnaire from the previous month 2) to discuss any difficulties encountered in the previous month 3) to assign each member with a new set of participants numbers for the next month as well as the blank forms that were to be completed for the next month.

The principal investigator was available to meet with one or more members of the research team to discuss and resolve any urgent study related issues that emerged.

2.2.6 Questionnaire development and administration

The final versions of the questionnaire that were used in three languages in this study (Arabic, English and Urdu) are provided (Appendix 1, 2, 3 respectively). All versions were pre-tested before finalization.

The questionnaire was developed by modifying questions from an existing questionnaire that has been used in a similar study in Holland [50]. The authors of that study approved the use and adaptation of their questionnaire for this study.

The questionnaire was initially developed in English and translated to Arabic by a professional translator. The Arabic version was sent to a second professional translator who reviewed it and back translated from Arabic to English. The English version of the questionnaire also was translated into Urdu by two independent translators whose mother tongue is Urdu and the two translations were checked side by side and reconciled by a third person.

For each participant, information regarding socio-demographic characteristics such as age, education, employment status, monthly income, and type of accommodation was collected. Furthermore, information about the occurrence and severity of IID symptoms such as diarrhoea and vomiting in the 4-week period prior to the interview was collected.

Three trained research personnel explained the questionnaire to the participants before the interviews and gave them the opportunity to ask questions. Parents were asked to complete the questionnaire on behalf of their children. Once consent was obtained and documented, the research personnel went through the questionnaire with the participants and wrote the responses they provided on the form.

Definitions

The Definition of the IIDs that was used was that of the International Collaboration on Enteric Disease 'Burden of Illness' studies, which defined IID as a

condition where a person has three or more loose stools or any vomiting in 24 hours, that was not because of the consumption of alcohol, pregnancy, or drugs and excluding those with cancer of the bowel, irritable bowel syndrome, ulcerative colitis, Crohn's disease, celiac disease or other chronic illnesses with symptoms of diarrhea or vomiting in the 4 weeks prior to the day of the interview [50]. This case definition was chosen because of its acceptability, simplicity and the symptoms mid-range severity, all of which are important especially when considering the research in developing countries [51].

Diarrhea was defined as stool with abnormal liquidity or loose stool [54]. Symptoms of IIDs may include nausea, abdominal pain, vomiting, abdominal cramps, fever, diarrhea and other systemic symptoms [114].

In the current study a potential participant was considered to be a non-responder if four independent contact attempts were made with no response in each time.

Pilot study

The questionnaire was tested face-to-face before finalization on fifty participants working in a governmental hospital in RAK to ensure that the questions in the questionnaire are cultural and context appropriate. The majority of the participants were Emirati adults, because the Emirati population generally has less exposure to telephone based surveys and it was necessary to ensure that the questionnaire that is being used will be culturally acceptable.

The participants took between 8 to 13 minutes to complete the questionnaire. All participants agreed that the questions were clear and easy to understand, although

almost two thirds thought that some of the questions were a little too long, such as: The types of food they consume (more vegetables or more meats or both) and medications they currently take. Based on the findings from the face to face testing and taking into consideration the method of the questionnaire administration (as a phone questionnaire) that needs to be straightforward and simple, some of the questions were shortened and some others were deleted. For the purpose of comparison, basic questions were added on the end of the questionnaire to detect the occurrence of other infectious disease such as respiratory tract infection, eye ear nose mouth infections, skin infections and urinary tract infections.

The final questionnaire comprised 60 questions, the majority of which were closed ended multiple choice and some questions were open ended like questions on age, name of the country they traveled to in the last two weeks before their illness and name of the animals they were in contact with. Participants were given the choice to share their comments in the end of the questionnaire.

Finally, the revised questionnaire was pretested by phone on a sample of 7 individuals, to check for the average time needed to complete the questionnaire over the phone (which was 3-5 minutes) and to ensure that the participants go through all the questions during the field calls.

2.3 Part 2: IDs surveillance system in RAK

For this part of the study, a descriptive retrospective design was used. The study sample consisted of all active infectious diseases units in RAK:

1) Lowest level which is at the level of hospitals. In RAK there are three government hospitals, but only two hospitals were included (Saqr and Ibrahim Bin

Obaidullah), because, at the time of the current research, a third government hospital was closed for renovation.

2) Higher district level. The information from this level was obtained from the preventive medicine department (PMD), which is responsible for overseeing ID reporting from the hospitals.

The survey tool that was used was based on the WHO guidelines to monitoring and evaluating communicable disease surveillance systems [30]. The survey tool was designed so as to obtain information about core functions (case detection, registration, case confirmation, reporting, data analysis, outbreak preparedness and response) and supportive functions (communication, training, supervision, resources) of the current surveillance system.

All information was collected through face to face interviews by the principal investigator with various personnel working at different levels within the concerned department during the first half of 2018. In addition to the interviews, samples of notification forms, zero reporting forms, surveillance forms, case investigation forms, education materials used, and the guidelines used were examined.

In UAE, the top most authority in the healthcare system is the MoHAP, through which a variety of health services are provided across the different Emirates. The MoHAP headquarters are located in Dubai, while each emirate has its medical district that serves as the local health authority for that emirate, and reports back to the MoHAP. Each emirate has hospitals, primary health centers and PMD, all under the jurisdiction of the local medical district and ultimately the main MoHAP.

From RAK, the PMD and two government hospital were included: Saqr hospital (Hospital 1) and Ibrahim Bin Obaidullah hospital (Hospital 2).

Only questions that were deemed to be relevant to the specific site were asked. In gathering information to describe the surveillance system the main areas from the WHO guidelines: Structure, core functions and support functions were followed.

Within each area several questions were asked to either hospitals alone or PMD alone or both see (Table 2.1).

Since the study sample in this part of the research was small, data from each site was presented separately, since it was considered that it would be misleading to expresses the results as percentages.

Table 2.1: Questions from the semi structured questionnaire about the ID surveillance system

	Preventive Medicine Department (PMD)	Hospitals
Structure of the IDs surveillance system		
1) Can you share with me your surveillance structure?	✓	✓
2) Can you share with me the guidelines that you are using in your work?	✓	✓
3) What kind of surveillance and for which type of diseases?	✓	✓
4) What is the urgent notification? Do you have your own notification list?	✓	✓
5) Do you have regular meetings with other hospitals Infection Control Committee (ICC) members? How often?	✓	✓
6) Do you have regular meetings with PMD members? How often?	*	✓
7) Do you collaborate with other sectors such as municipality?	✓	✓
Core function of the IDs surveillance system		
1) What case definitions do you use? Are they updated?	✓	✓
2) How the data that you receive is handled/ processed?	✓	✓
3) Is laboratory testing done locally or in collaboration with reference laboratories?	✓	✓
4) Who reports to you? In what format and frequency is it done?	✓	✓
5) Do you have prevalence data that helps you identify trends in ids and/ or areas to improve the surveillance system?	✓	✓
6) What kind of feedback do you get and what feedback you give?	✓	✓
7) What are the most recent outbreaks or emergencies and the procedures that were in place to deal with them?	✓	✓
Support function of the IDs surveillance system		
1) Do you update the guidelines? How often the guideline updated?	✓	✓
2) Describe the training activities related to the surveillance system?	✓	✓
3) How many persons are working on each surveillance?	✓	✓
4) What training do the healthcare professionals get on notifications?	✓	✓
5) Do you visit any of the healthcare facilities? For what?	✓	*
6) Describe the means of communication used with the stakeholders?	✓	✓
7) Describe quality control measures implemented?	✓	✓
8) After evaluation, if there is a gap what is the action?	✓	✓
9) What other activities you have?	✓	✓
Miscellaneous		
1) Do you feel that the healthcare professionals need to train to be able to fill the notification? Are they trained?	✓	✓
2) How the samples transfer from your facility to others? Is the protocol from you or from the hospital or from MoHAP?	✓	✓
3) Do you have any published statistics? How is the annual data published?	✓	✓
4) Do you have any publications about the surveillance system? About evaluating any of its components (structure, core elements and support functions)?	✓	✓
5) How do you see the development of your department?	✓	✓
6) If you were to place a development program for your department, what priority issues you will focus on?	✓	✓

2.4 Ethical approval

2.4.1 Ethical considerations

The principal investigator ensured that this study is conducted in accordance with the principles of the Declaration of Helsinki. The protocol, participant information sheet and questionnaire were revised and approved by the Social Sciences Ethics committee of the United Arab Emirates University with the reference number: ERS_2015_3207. The survey questions were tested to ensure ethical and cultural sensitivity. All research personnel went through the consent process with the participants and ensured their willingness to participate and documented it in writing before proceeding with the interview.

For the informed consent process, written versions of the information sheet and informed consent were presented verbally to each participant. These describe the nature of the study and what it means to take part. The participants were informed that their participation is voluntary and they can withdraw at any time if they did not wish to take part in the questionnaire without any consequences. Participants who gave a verbal consent had this consent documented by the interviewers who then proceeded to ask the participants the questions (Appendix 2).

The document linking the names and phone numbers of potential participants was kept with the principal investigator who ensured that this was stored separately from all study data throughout the duration of the study. No participant identifier was documented on the questionnaire. Participant's anonymity was maintained in the electronic database since it could be identified only by a participant ID number.

The research personnel stored the hard copies of the questionnaires in a locked place which was only accessible by them, until they were handed over to the principal investigator. Data from the hard copies were entered into an electronic database on a personal computer which could only be accessed by password. There are no direct benefits to the individuals involved, other than the satisfaction of contributing to research.

2.4.2 Regulatory approval

As per the laws and regulations of the UAE, regulatory approval needed to be obtained from RAK Medical District as well as the administration of the institutions included in Part 2 of the study. All approvals were obtained prior to initiation of the study (Appendix 4).

2.4.3 Data management and security

Participants were assigned a unique research number, which was used on the questionnaires. The questionnaire responses are maintained under a unique research number, in a secure location. No individually identifiable information was included in the research database. The research number link to personal identifying information is maintained in a secure server physically separate from the research database, which is accessible only by the research personnel.

2.5 Variables

Independent and dependent (outcome) variables

In Table 2.2, the summary of the independent variables and the dependent (outcome) variables is shown.

Table 2.2: Summary of independent and dependent variables

Variables	Variable type	Categories
A. Demographic characteristics		
Age	Continuous	--
Gender	Binary	Male, Female
Nationality	Binary	Nationals, Non-Nationals
Marital status	Categorical	Single, Married, Separated, Divorced, Widowed
Residential address (area)	Categorical	Urban, Suburban
Type of residence	Categorical	Arabic house, Villa, Apartment, Workers
Living Condition	Categorical	Alone, Spouse, Family, Non-Family
Employment	Categorical	At work, Unemployed, Student, Retired, Looking after home or family, Long term sick or disabled, Other
Job type	Categorical	Armed forces occupations, Managers, Professionals ,Technicians and associate professionals, Clerical support workers, Service and sales workers, Skilled agricultural forestry and fishing workers, Craft and related trades workers, Plant and machine operator and assemblers, Elementary occupations
Monthly income	Categorical	<5000, 5000-14999, 15000-24999, 25000-34999, >35000
Education level	Categorical	Did not attend school, Completed primary school, Completed intermediate school, Completed secondary school, Completed College or university, Completed Master or PHD
B. History of infectious disease in past four weeks		Intestinal infections, respiratory infections, eye ear nose mouth infections, skin infections, urinary tract infections, other infections

2.6 Statistical analysis

Data were entered, coded and cleaned in Microsoft Excel 2007 and transferred to Stata version 15.0 for analysis.

2.6.1 Descriptive Analysis

The categorical variables (gender, nationality, marital status, residential address (area), type of residence, employment, job type, education level) were described using frequencies and percentages. Four weekly prevalence of infection were calculated for specific infections. Comparisons were made between groups based on plausible independent variables such as age, gender, work status and season.

2.6.2 Inferential Analysis

The data analysis was conducted using Stata version 15.0. Participants considered as having had an episode of infection (IID or respiratory) were compared with asymptomatic participants regarding several characteristics and exposures, including age, sex, marital status, living condition, living area, family income, work status, nationality category, and level of education. The Chi-square test or Fisher's exact test was applied to compare the prevalence of infection for categorical variables. The two-sample t-test was applied to compare the prevalence of infection for continuous variables. Univariate and multivariate logistic regression analysis were performed to ascertain the association between various socio-demographic variables and infection (IID and respiratory each of these done separately). A p-value of ≤ 0.05 and 95% confidence intervals (95% CI) were chosen to determine statistical significance.

Chapter 3: Results

3.1 Introduction

In Part 1 of this chapter, the estimated prevalence of self-reported infections in the RAK community is presented. In Part 2, a description of the existing surveillance system in RAK is presented.

3.2 Part 1: Community survey to estimate self-reported IIDs

3.2.1 Description of the study sample

A total of 1728 households were contacted by telephone, of which 822 responded to the telephone call (47.6% initial response rate) and were invited to take part in the study. Of these, 547 households agreed to participate (31.7% participation rate) and 275 refused. All household participants completed the consenting process before answering the questionnaire. Participants living in a family setting were asked if the interviewer could have access to the spouse and a child. In this way, the final study sample was 1254 individuals, with 391 being spouses and 316 being children (Figure 3.1).

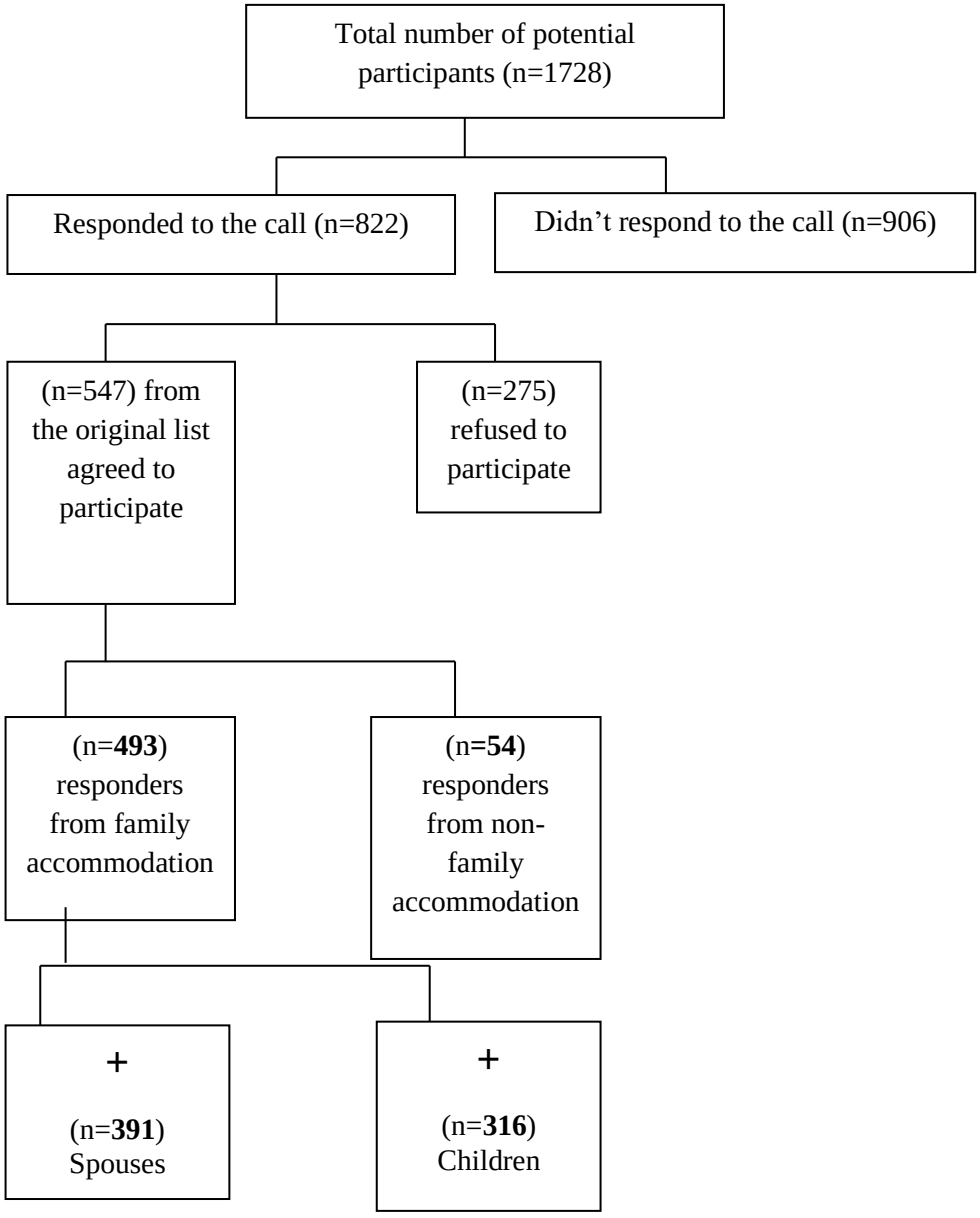

Figure 3.1: Description of the participants recruited.
Total study sample was (493+54+391+316) all shown in bold

The overall response rate of the individuals who responded and agreed to participate was 31.7%. The participation rate for UAE nationals was higher than for non-nationals (52.3% and 47.7%, respectively; $p = 0.044$). The participation rate was higher for male than for female subjects (57.3% and 42.7%, respectively; $p < 0.001$). Details of the study sample are summarized Table 3.1.

Table 3.1: Summary of those who participated and did not participate in the study

	Number of participants contacted initially[a]	Number participated from initial list[b]	Did not participate[c] **	Response rate (%)	p-values
All	1728	547***	1181	31.7*	
				Proportion	
Nationality***					
Nationals		656	175	52.3	0.044
Non-Nationals		598	100	47.7	
Gender***					
Male		718	256	57.3	<0.001
Female		536	19	42.7	

* Initial response rate=b/a * 100 (547/1728 * 100)

** Either refused to participate or couldn't be contacted

*** 1254 questionnaires came from 547 initial responders + 391+316 (b/1254 * 100)

3.2.1.1 Characteristics of study participants

One quarter of the study sample were children (25.2%), almost half of the participants (47.7%) were non-nationals, and almost half of the participants (49.0%) were from urban areas. Sixty-nine percent of participants were married and only 5.4% of participants live in non-family (bachelor accommodation). The majority of the participants are workers (employee) forming 41.9%. Most of the participants completed secondary schooling (29.9%) or college/ university (27.3%). Only 6.4% of the participants were with the average monthly Household income ≥ AED 35000. Details of the demographic characteristics are presented in Table 3.2.

Table 3.2: Demographic characteristics of the study sample (n=1254)

Characteristics	Participants n (%)
Age (years)	Total 1254 (100.0)
0-5	89 (7.1)
6-17	227 (18.1)
18-59	856 (68.3)
≥60	82 (6.5)
Gender	Total 1254 (100.0)
Male	718 (57.3)
Female	536 (42.7)
Marital Status	Total 1253 (100.0)
Single	370 (29.5)
Married	864 (69.0)
Separated/Divorced	5 (0.4)
Widowed	14 (1.1)
Living Conditions	Total 1245 (100.0)
Alone	64 (5.1)
Spouse	797 (63.6)
Family (living with extended family)	325 (25.9)
Non-Family (bachelor accommodation)	68 (5.4)
Employment Status	Total 1248 (100.0)
Currently working	523 (41.9)
Unemployed	4 (0.3)
Student	252 (20.2)
Retired	64 (5.1)
Looking after home/Family (care giver)	330 (26.4)
Long term sick/Disabled	2 (0.2)
Work details unknown	73 (5.9)
Geographical Location	Total 1254 (100.0)
Urban	614 (49.0)
Suburban	640 (51.0)
Nationality	Total 1254 (100.0)
Nationals	656 (52.3)
Non-Nationals	598 (47.7)
Level of Education	Total 1236 (100.0)
No formal schooling	169 (13.7)
Completed primary schooling	209 (16.9)
Completed intermediate schooling	131 (10.6)
Completed secondary schooling	369 (29.9)
Completed college or university	338 (27.3)
Completed Master or PhD	20 (1.6)
Contact with Animals	Total 1254 (100.0)
No	1006 (80.2)
Yes	248 (19.8)
Monthly Household Income, AED (USD)*	Total 1048 (100.0)
AED <5000 (~USD <1360)	231 (22.0)
AED 5000-14999 (~USD 1360-<4080)	355 (33.9)
AED 15000-24999 (~USD 4080-<6800)	232 (22.1)
AED 25000-34999 (~USD 6800-<9530)	163 (15.6)
AED ≥35000 (~USD ≥9530)	67 (6.4)

* Note. AED denotes Emirati Dirham; USD denotes United States Dollar †Based on USD 1.00 ≈ AED 3.67.

3.2.2 Prevalence of IID

The overall prevalence of participants reporting an IID in the 4- week period preceding the telephone interview was 4.2% (n = 53). IID were more prevalent in children than in adults (prevalence 9.8% compared with 2.3%; $p<0.001$). IID were significantly more prevalent in UAE nationals compared with non-nationals (prevalence 69.8% and 30.1%, respectively; $p\leq0.05$). Prevalence of IID for each month was calculated from the number of the IID cases reported from that month divided by the number of participants recruited that month, for each month from January to September. No data from October, November and December was collected. Higher prevalence's of IID were noted in February and March, during which prevalence was at least triple that seen in other months. The prevalence in August was zero although the recruitment (n=59) was almost same as month of January (n=57) (Figure 3.2). There is a significant difference between prevalence of IID infections in different months (p=0.008).

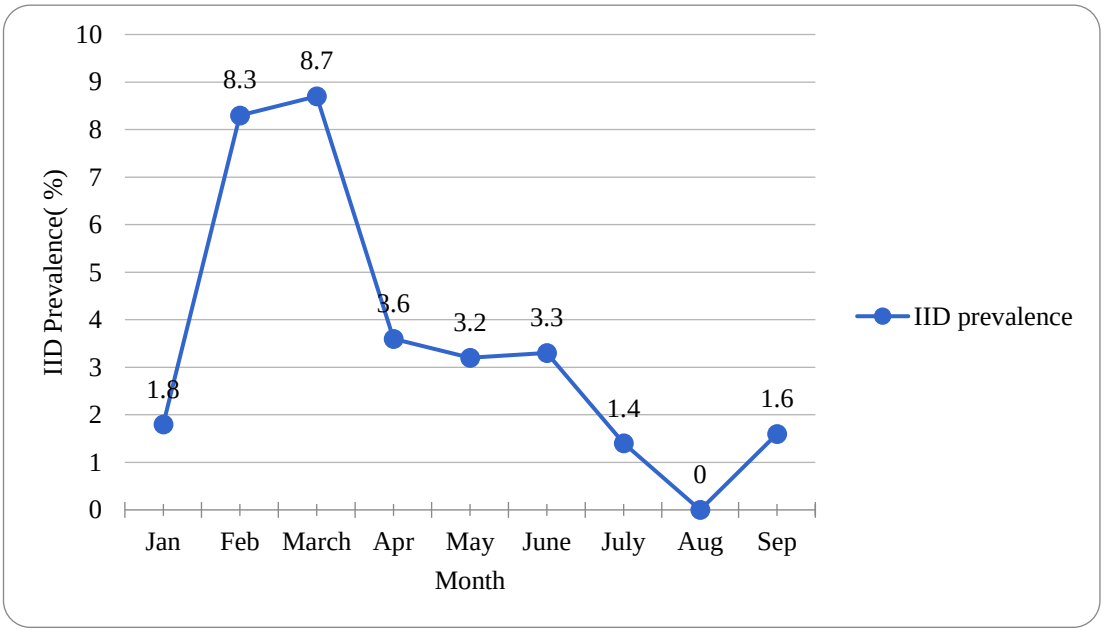

Figure 3.2: Prevalence of IID for each month from January to September 2017

Univariate analysis and multivariate analysis were done using logistic regression analysis, to explore the factors associated with IID.

3.2.2.1 Univariate analysis of IID

From the univariate analysis, the prevalence of IID was significantly higher in nationals than non-nationals ($p \leq 0.05$). Furthermore, those aged 18–59 years were significantly less likely to report an IID than participants aged 6–17 years ($p \leq 0.05$), and being married was protective from IID ($p \leq 0.05$). It is important to note that being married does not necessary mean that they are living with their spouse, since it's possible to be married but are living alone, especially among those from the migrant population.

Students were significantly more likely to report an IID ($p \leq 0.05$) and participants with an average monthly income of AED 15 000 (~USD 4080) were significantly more likely to report an IID than those with a lower average monthly household income ($p \leq 0.05$) as shown in (Table 3.3).

Table 3.3: Univariate analysis of factors associated with IID, RAK, 2017

Variables	OR	95% CI	p – value
Age (year)			
0-5	Ref		
6-17	0.43	0.20-0.92	0.030
18-59	0.13	0.06-0.27	0.000
≥60	0.06	0.00-0.51	0.010
Gender			
Male	Ref		
Female	1.41	0.18-2.44	0.220
Marital Status			
Single	Ref		
Married	0.18	0.10-0.34	0.000
Separated/Divorced/Widowed	1.85	0.51-6.68	0.346
living conditions			
Alone	Ref		
Spouse	1.29	0.30-5.53	0.726
Family	1.92	0.43-8.47	0.387
Employment Status			
At work	Ref		
Student	4.23	2.00-8.92	0.000
Retired	1.50	0.32-6.93	0.602
Looking after home/Family (care giver)	1.00	0.38-2.62	0.986
Other*	8.33	3.53-19.63	0.000
Geographical Location			
Urban	Ref		
Suburban	1.75	0.99-3.11	0.054
Nationality			
Nationals	Ref		
Non-Nationals	0.45	0.25-0.83	0.000
Level of Education			
No formal schooling	Ref		
Completed primary schooling	0.62	0.33-1.21	0.149
Completed secondary/intermediate schooling	0.31	0.14-0.72	0.006
Completed college or university	0.43	0.23-0.90	0.018
Contact with Animals			
No	Ref		
Yes	1.63	0.88-3.03	0.115
Monthly Household Income, AED (USD)**			
AED <5000 (~USD <1360)	Ref		
AED 5000-14999 (~USD 1360-<4080)	4.00	0.88-18.06	0.071
AED 15000-24999 (~USD 4080-<6800)	6.24	1.38-28.22	0.017
AED 25000-34999 (~USD 6800-<9530)	7.48	1.61-34.62	0.010
AED ≥35000 (~USD ≥9530)	7.26	1.30-40.60	0.024

*"Other" category refers to all these categories combined [work details unknown, long term sick/disabled, unemployed]

**Note. AED denotes Emirati Dirham; USD denotes United States Dollar †Based on USD 1.00 ≈ AED 3.67.

3.2.2.2 Multivariate analysis of IID

All variables were initially included in the model (age, sex, marital status, living conditions (family, non-family), employment status, degree of urbanization, nationality, level of education, contact with animals, and average monthly household income). Variables that were not statistically significant (i.e., $p>0.05$) were then removed one at a time and only the variables with a p-value of ≤ 0.05 were retained. Age, sex, employment status, and average monthly household income were the significant determinants in the final model. In the multivariate analysis, being female and having a middle-range monthly household income (AED 5000– 14,999 or AED 15 000–24 999) were positively associated with reporting an IID, while age ≥ 6 years was negatively associated with reporting an IID.

Furthermore, care givers [those who are looking after their home or family] are significantly associated with the IID ($p\leq0.05$) as shown in (Table 3.4).

Table 3.4: Multivariate analysis of factors associated with IID, RAK, 2017

Variables	Multivariable OR	95% CI	p – value
Age (year)	0.95	0.90-0.99	0.048
Gender			
Male	Ref		
Female	2.43	1.16-5.07	0.018
Employment Status			
At work	Ref		
Student	0.38	0.04-3.30	0.387
Retired	4.32	0.71-26.25	0.111
Looking after home/Family (care giver)	0.23	0.06-0.90	0.035
Other*	0.83	0.08-8.61	0.880
Monthly Household Income, AED (USD) **			
AED <5000 (~USD < 1360)	Ref		
AED 5000-14999 (~USD 1360-<4080)	3.99	0.85-1870	0.078
AED 15000-24999 (~USD 4080-<6800)	5.42	1.15-25.48	0.032
AED 25000-34999 (~USD 6800-<9530)	7.13	1.47-34.57	0.015
AED ≥35000 (~USD ≥9530)	6.16	1.02-36.88	0.046

*"Other" category refers to all these categories combined [work details unknown, long term sick/disabled, unemployed]

**Note. AED denotes Emirati Dirham; USD denotes United States Dollar †Based on USD 1.00 ≈ AED 3.67.

Out of the 53 participants with an IID, only half (49.0%) sought medical care and 13.2% asked pharmacists for advice on how to manage their condition. Of those who sought medical care, less than a fifth (18.9%) provided a stool sample and 5.7% of them were hospitalized. The majority of individuals who had an IID took medication (69.8%), of which 20.8% were without a prescription (i.e., over-the-counter medication). The IID affected the daily routine of many participants. For example, it stopped 11.3% of affected participants from going to work or to school. Of the 53 participants with an IID, 35.8% had additional concomitant infections (respiratory tract infection, skin infection, urinary tract infection, and/or eye, ear, nose and mouth infections). The most suggested causes of illness provided by the participants with an IID were the consumption of contaminated food (47.2%) and infection from another person (26.4%). The prevalence of IID showed seasonal variation, with the highest prevalence in February and March ($p \leq 0.05$) (Table 3.5).

Table 3.5: Source of infection and management of IID infections (n=53)

Variables	IID (n=53)
	n (%)
Sought medical care	
Yes	26 (49.1)
No	27 (50.9)
Submit a stool sample	
Yes	10 (18.9)
No	43 (81.1)
Take medicine	
Yes	37 (69.8)
No	16 (30.2)
Hospitalized	
Yes	3 (5.7)
No	50 (94.3)
Medicine without prescription	
Yes	11 (20.8)
No	42 (79.2)
Illness affected anyone else	
Yes	14 (26.4)
No	39 (73.6)
Illness from consumption of food	
Yes	25 (47.2)
No	28 (52.8)
Illness stop work/school	
Yes	6 (11.3)
No	47 (88.7)
Other infections in past 4 weeks	
Yes	19 (35.8)
No	34 (64.2)
Accommodations	
Arabic house	16 (30.2)
Villa	29 (54.7)
Apartment	8 (15.1)
Group accommodation for labourers	0 (0.0)

3.2.3 Participants with other infections

For comparative purposes, information on prevalence of other infections was collected. The most common other infection was the respiratory infections with prevalence of 14.2%. The prevalence for other infections was too small for performing further analysis (0.8%).

3.2.3.1 Prevalence of respiratory infections

The prevalence of respiratory infection was (14.2%), with the majority occurring in January, February, March and April, from which 37.5% alone were found in February (Figure 3.3). There is a significant difference between prevalence of respiratory infections in different months (p=0.01).

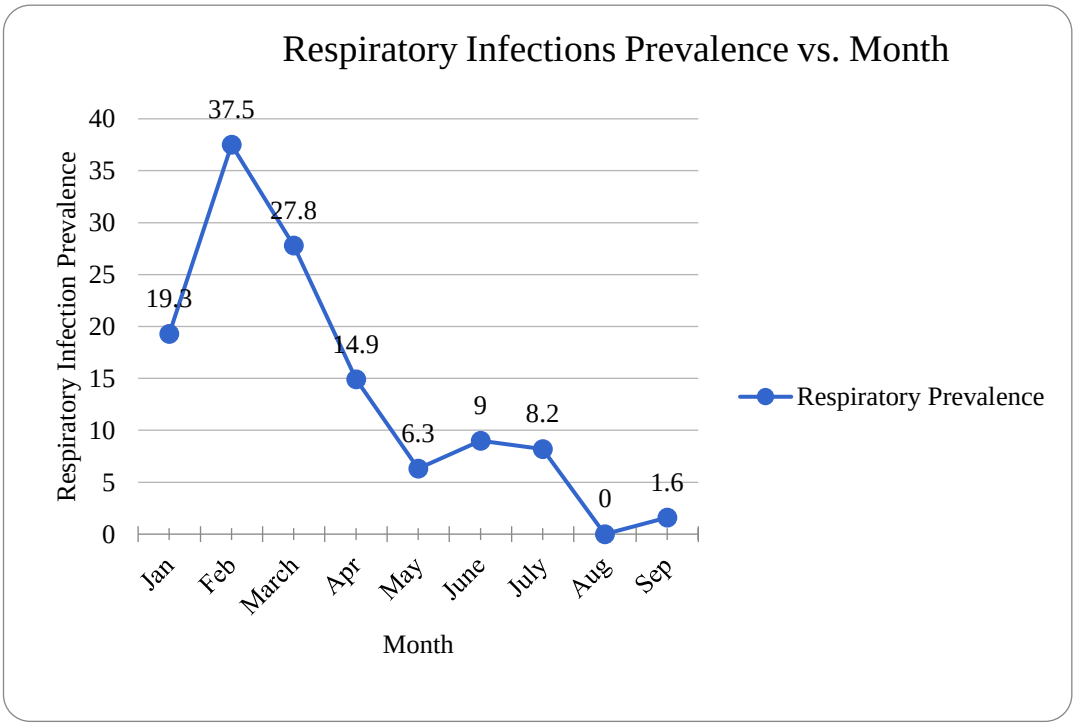

Figure 3.3: Prevalence of respiratory tract infection for each month from January to September 2017

The univariate and multivariate analysis were conducted using logistic regression analysis, to explore the factors associated with the respiratory tract infection.

Univariate analysis of respiratory infections

From the univariate analysis, compared with 0-5 age group, other age groups were significantly less likely to get respiratory infections ($p \leq 0.05$). Being married

was associated with a lower likelihood of getting respiratory infections ($p \leq 0.05$). Furthermore, respiratory infections were significantly high in students and in the "other" category ($p \leq 0.05$).

Compared to those with no formal schooling, participants in all the other education status categories were less likely to get respiratory infections ($p \leq 0.05$).

From the monthly household income, the following categories were positively associated with the respiratory infections (AED 5000-14999, AED 25000-34999 and AED ≥35000) $p \leq 0.05$ as shown in (Table 3.6).

Table 3.6: Univariate analysis of factors associated with respiratory tract infection, RAK, 2017

Variables	OR	95% CI	p – value
Age (year)			
0-5	Ref		
6-17	0.42	0.24-0.73	0.002
18-59	0.24	0.14-0.39	0.000
≥60	0.17	0.07-0.42	0.000
Gender			
Male	Ref		
Female	0.99	0.72-1.37	0.989
Marital Status			
Single	Ref		
Married	0.46	0.33-0.64	0.000
Separated/Divorced/Widowed	0.99	0.32-3.09	0.998
Living conditions			
Alone	Ref		
Spouse	0.67	0.34-1.33	0.260
Family	1.09	0.53-2.21	0.809
Employment Status			
At work	Ref		
Student	1.86	1.23-2.81	0.003
Retired	0.94	0.41-2.17	0.899
Looking after home/Family (care giver)	0.88	0.56-1.38	0.595
Other*	4.23	2.48-7.22	0.000
Geographical Location			
Urban	Ref		
Suburban	1.14	0.83-1.57	0.404
Nationality			
Nationals	Ref		
Non-Nationals	0.85	0.62-1.17	0.341
Level of Education			
No formal schooling	Ref		
Completed primary schooling	0.61	0.38-0.97	0.040
Completed secondary/intermediate schooling	0.37	0.22-0.60	0.000
Completed college or university	0.47	0.29-0.77	0.002
Contact with Animals			
No	Ref		
Yes	0.69	0.44-1.06	0.097
Monthly Household Income, AED (USD)**			
AED <5000 (~USD <1360)	Ref		
AED 5000-14999 (~USD 1360-<4080)	1.89	1.10-3.25	0.021
AED 15000-24999 (~USD 4080-<6800)	1.62	0.89-2.94	0.108
AED 25000-34999 (~USD 6800-<9530)	2.00	1.07-3.72	0.029
AED ≥35000 (~USD ≥9530)	2.78	1.32-5.87	0.007

*"Other" category refers to all these categories combined [work details unknown, long term sick/disabled, unemployed]

** Note. AED denotes Emirati Dirham; USD denotes United States Dollar †Based on USD 1.00 ≈ AED 3.67.

Multivariate analysis of respiratory infections

Multivariate analysis was carried out to identify the determinants of the respiratory infections. All the variables (age, gender, marital status, living conditions (family, non-family), employment status, degree of urbanization, nationality, level of education, contact with animals, and average monthly household income) were initially included in the model. The insignificant variables were removed one at a time and only the variables with a p value of ≤0.05 was retained. Age, living condition and average monthly household income were the significant determinants in the final model.

Multivariate analysis showed that being ≥60 years old and living with spouse were both significantly negatively associated with respiratory infections p≤0.05. Those having middle range household income (AED 5000-14999, AED 25000-34999 and AED ≥35000) were significantly more likely to get respiratory infections p≤0.05 as shown in (Table 3.7).

Table 3.7: Multivariate analysis of factors associated with respiratory tract infection, RAK, 2017

Variables	Multivariable OR	95% CI	p – value
Age (year)			
0-5	Ref		
6-17	0.35	0.10-1.22	0.101
18-59	0.22	0.03-1.65	0.143
≥60	0.10	0.01-0.89	0.039
Living conditions			
Alone	Ref		
Spouse	0.37	0.16-0.88	0.025
Family	0.70	0.29-1.69	0.441
Monthly Household Income, AED (USD)*			
AED <5000 (~USD <1360)	Ref		
AED 5000-14999 (~USD 1360-<4080)	1.95	1.04-3.64	0.035
AED 15000-24999 (~USD 4080-<6800)	2.04	0.91-4.53	0.080
AED 25000-34999 (~USD 6800-<9530)	2.73	1.16-6.44	0.021
AED ≥35000 (~USD ≥9530)	3.50	1.31-9.32	0.012

*Note. AED denotes Emirati Dirham; USD denotes United States Dollar [†]Based on USD 1.00 ≈ AED 3.67.

3.2.4 Comparisons of IIDs with other infections

Some comparisons between IID and respiratory infections were drawn, because it was the most common and the numbers of other infections was too small to be able to make any comparison. In contrast with IIDs, the prevalence of respiratory infections in males was similar to females (14.2%).

The prevalence of both IID and respiratory infections was found to be higher in children as compared to adults. For IIDs (9.8% vs 2.3%and respiratory infection (22.2% vs 11.5%) (see Table 3.8).

Table 3.8: IID vs. Respiratory infections

Infection (Total)	**IID (n= 53)**	**Respiratory (n= 178)**
	n (%)	n (%)
Nationality		
Nationals	37 (69.8)	98 (55.1)
Non – Nationals	16 (30.2)	80 (44.9)
Gender		
Male	26 (49.0)	102 (57.3)
Female	27 (51.0)	76 (42.7)
Age		
Children	31 (58.5)	73 (41.0)
Adults	22 (41.5)	105 (59.0)
Marital Status		
Single	34 (64.1)	78 (43.8)
Married	16 (30.2)	96 (54.0)
Separated/Divorced	1 (1.9)	0 (0.0)
Widowed	2 (3.8)	4 (2.2)
Degree of urbanization		
Urban	17 (32.1)	73 (41.0)
Suburban	36 (67.9)	105 (59.0)
Contact with animals		
No	38 (71.7)	154 (86.5)
Yes	15 (28.3)	24 (13.5)
Sought medical care		
Yes	26 (49.1)	91 (51.1)
No	27 (50.9)	87 (48.9)
Take medicine		
Yes	37 (69.8)	145 (81.5)
No	16 (30.2)	33 (18.5)
Took Medicine		
Yes with prescription	11 (20.7)	54 (30.0)
Yes without prescription	26 (49.1)	91 (51.0)
No Medicine	16 (30.2)	33 (19.0)

*All percentages (written in brackets) were calculated by the number of cases in that specific group divided by the total number of cases for that specific infection ie: 53 for IID, 178 for respiratory infections.

Participants with IIDs infections were less likely than those with respiratory infections to take medicine, both with or without prescription (Figure 3.4).

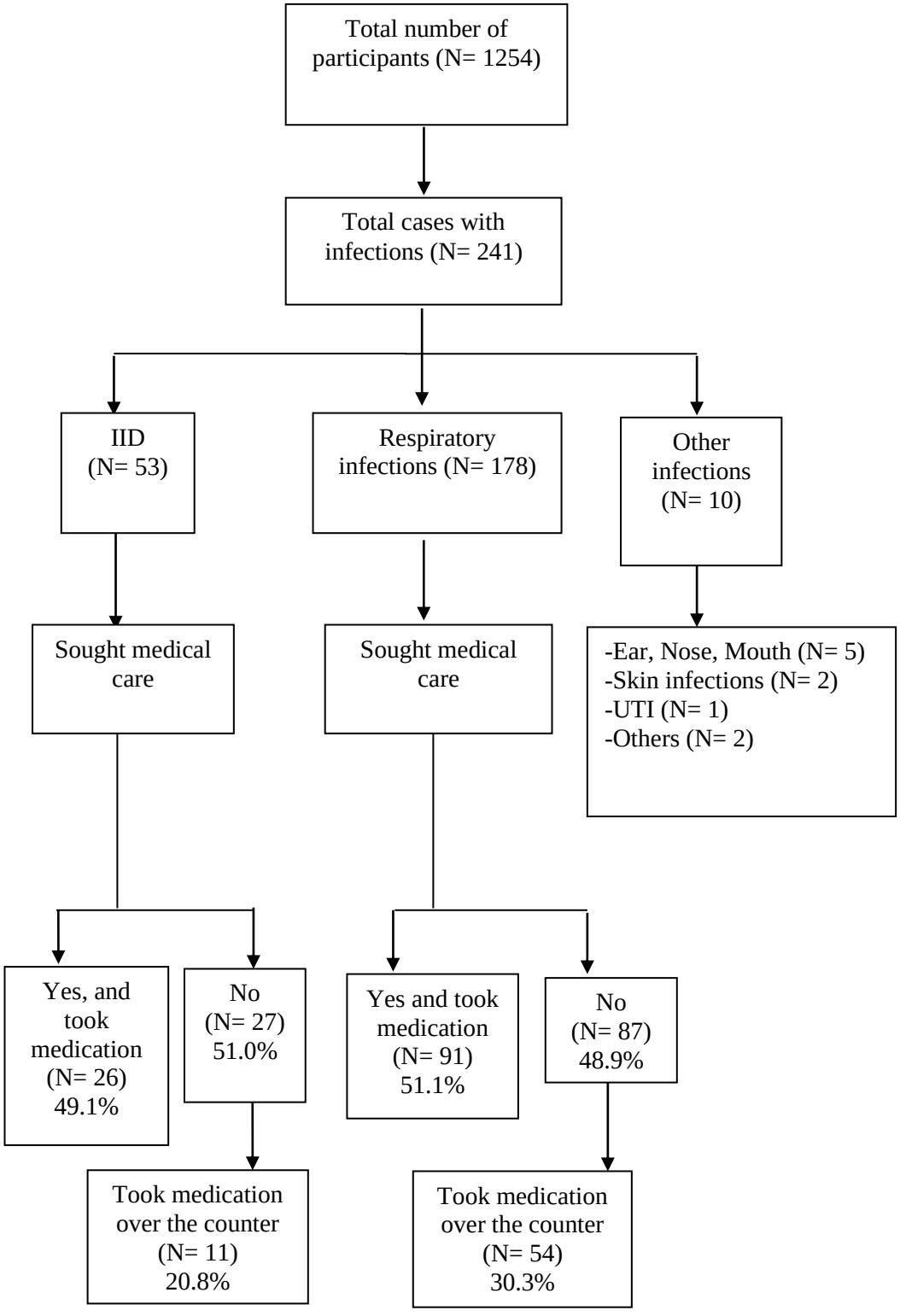

Figure 3.4: Overview of participants with infections and management

3.3 Part 2: ID surveillance system in RAK

This section presents a description of the surveillance system at the two levels of RAK: lower and higher. 1) The lower level is at the level of hospitals in which two government hospitals were included and 2) higher level (PMD) oversees the ID notifications from all healthcare settings in RAK and it is also responsible for screening of anyone coming to work in UAE, as per UAE law.

In the UAE, a pre-requisite for applying for a residency visa is to undergo certain laboratory tests. These include screening for Tuberculosis (TB), Hepatitis, certain Sexually Transmitted Diseases (STD) and (HIV/AIDS), which should be negative in order to be able to proceed with applying for the residency visa.

The information below was collected through several visits in person to PMD and the two government hospitals.

3.3.1 Government healthcare services in RAK – PMD

The PMD in RAK is under the jurisdiction of the MoHAP which has its headquarters in the emirate of Dubai (Figure 3.5). The PMD has both clinical and administrative services.

The clinical services include: clinics (for medical examination), vaccination department, laboratory, radiology department and infectious disease department. The administrative services include: human resource management, birth registration and death registration. It is at the district level that oversight of the hospitals is done, and that is reported to the higher levels (at the federal level).

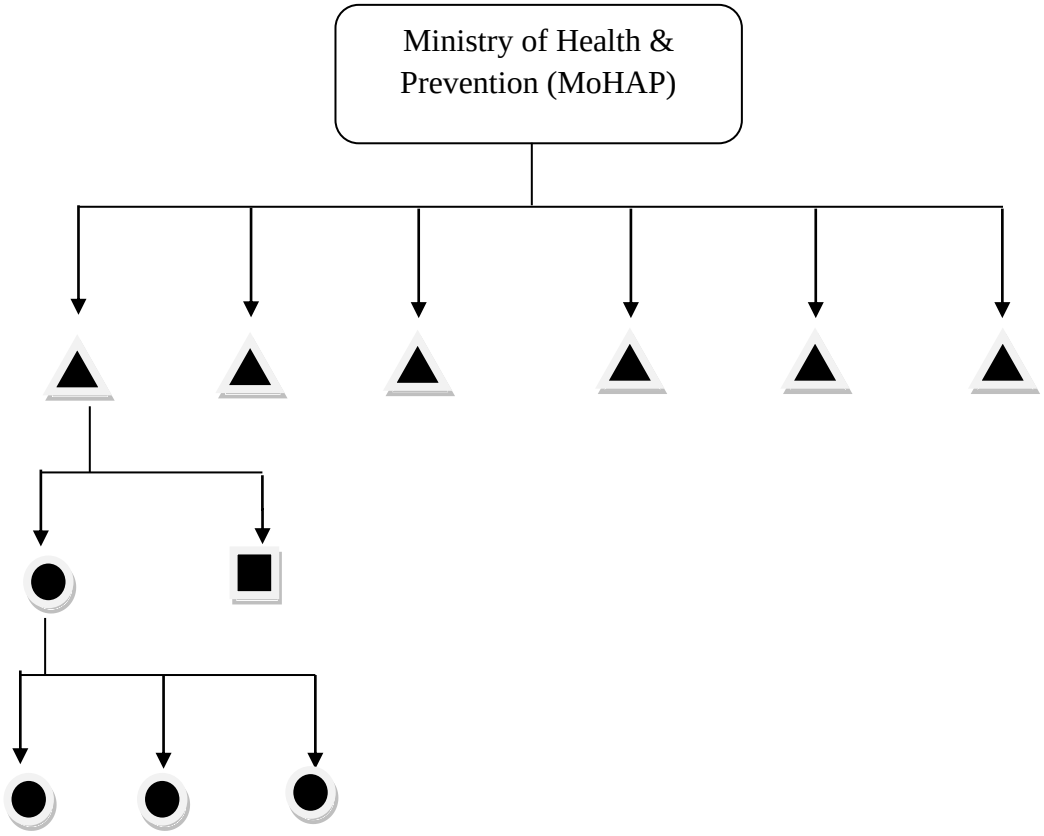

Figure 3.5: MoHAP covers: RAK, Ajman, Umm Al Quwain, Al Sharjah, Al Fujairah, Dubai

▲ : The Medical District, ● : Government hospitals, ■ : Preventive Medicine Department

The activities of PMD are in line with the surveillance programs initiated by the MoHAP and the guidelines they use are provided by MoHAP. The pathway of reporting the ID cases in RAK is outlined in Figure 3.6.

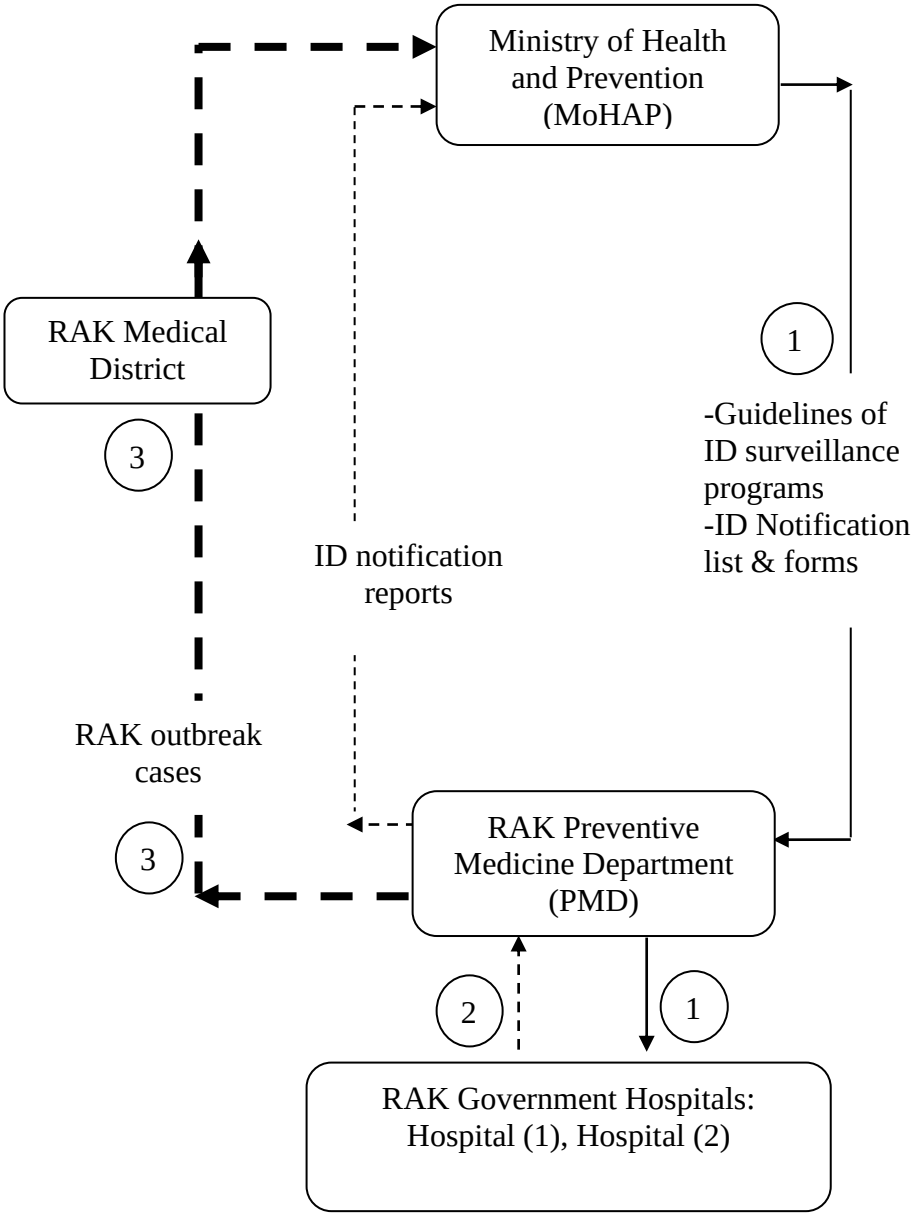

Figure 3.6: The pathway of reporting the ID cases in RAK.
Pathways: 1) Guidelines of ID surveillance programs, 2) ID notification reports, 3) Exclusive for outbreak cases. Solid lines indicate communication from higher level; Dotted lines indicate communication from Lower level.

3.3.1.1 Structure of the ID surveillance system:

1) Surveillance structure

The guidelines used in PMD (under UAE Federal Ministry of Health and Prevention) are the most updated version of those provided by MoHAP. Currently, the PMD is working on 6 main surveillance programs which are: (1) TB (2) HIV/AIDS (3) Measles (4) Acute Flaccid Paralysis (AFP)/Poliomyelitis (5) Hepatitis (6) Severe Acute Respiratory Infections (SARI) with a seventh category (Other) that encompasses all other diseases mentioned in the ID notifiable list which are under the category "Other".

While these diseases are the main focus, other notifiable cases also need to be reported to MoHAP (Table 3.9). Only in cases of outbreaks at the level of RAK is it necessary to report to the local (RAK medical district) as well as the MoHAP.

2) Notification

The PMD receives IDs notifications from all healthcare settings in RAK. Some infections are required to be reported to PMD immediately (on the day of identification), while others are reported each week depending on the instructions on the IDs notification list from MoHAP (Table 3.9).

Table 3.9 is constructed based on the MoHAP Notifiable ID form in Appendix 5.

Table 3.9: Diseases which are "Immediately reportable and weekly reportable"

Immediately Reportable Diseases	Weekly Reportable Diseases
- AFP/Poliomyelitis - Anthrax - Botulism - Cholera - Diphtheria - Encephalitis - Food poisoning - Heamophilus influenzae b: Epiglottitis, Meningitis - HIV / AIDS - Legionellosis - Leprosy - Measles - Meningitis: Meningococcal - Plague - Rabies - Relapsing fever - Rubella, Congenital rubella syndrome - Tetanus, Neonatal Tetanus - Tuberculosis – Pulmonary - Typhoid / Paratyphoid fever - Typhus - Viral haemorrhagic fevers - Yellow fever	- Amoebiasis - Chickenpox - Giardiasis - Hepatitis A, B, C, D, E - Influenza - Intestinal Worms, Ascaris, Taeniasis - Malaria - Mumps - Pertussis - Scabies - Scarlet fever - Schistosomiasis - Sexually Transmitted Infections (STIs): Chlamydia, Gonorrhea, Syphilis - Shigellosis - Tuberculosis – Extra – pulmonary - Zoonotic Diseases: Brucellosis, Hydatid disease

3.3.1.2 Core functions of the ID surveillance system

1) Case Detection

A number of diseases from the ongoing surveillance programs had guidelines that were available at the time of data collection. These guidelines were complete, included clear case definitions and were updated by MoHAP. However, for several other surveillance programs that the UAE is working on, the MoHAP guidelines were not readily available at the time of visiting the site in RAK.

Completion of the notification and reporting are integrated into the daily work of health professionals. Learning is done hands on, since health professionals are not required to undergo specific training about ID surveillance.

2) Case confirmation

The ID notification forms (Appendix 5) and Weekly Zero Reporting Forms (Appendix 6) are reported from all RAK healthcare settings to the PMD. The ID notifications are reported monthly from PMD to the MoHAP. No ID notification cases are routinely reported to RAK medical district.

When a suspected case of infectious disease has been admitted to the hospital (children are admitted in government hospital number 1 and adults are admitted in government hospital number 2), personnel from PMD initiate the case investigation and contact tracing.

PMD personnel investigate the notifiable cases using investigation forms which are provided by the MoHAP. The investigation may involve a visit to the hospitals that hold the notifiable case in the isolation room. The purpose of the visit

is to ensure all basic information documented is complete and accurate and that appropriate referrals have been made.

PMD then follows up the case with regards duration of treatment, success of treatment, and any other action, such as investigating contacts as appropriate, until discharge.

For each type of infection there is a specific investigation form which contains questions related to the individual infection. Examples of these forms can be found at Appendix 7, which shows the meningitis case investigation form and Appendix 8, which shows the cholera case investigation form. The ICD personnel take appropriate and necessary action depending on the circumstances of the case. For example, in the case of measles, the action taken may be immunization of all the persons who were in contact with the affected individual.

The protocol of transferring laboratory specimens is not included in the PMD guideline. The protocol and the guideline of transferring the samples is only found in one of the governmental hospital's laboratories in RAK (in government hospital number 2), while the other laboratories do not have written guidelines, but rather follow locally established procedures that are passed on to new staff verbally.

In cases of outbreaks, a multidisciplinary team (from all relevant municipalities and other authorities) is formed to investigate, follow the cases and report to RAK medical district, who in turn reports to MoHAP.

When investigating the suspected case, the preliminary testing is done in local laboratories and confirmatory testing often involves sending microbiological samples from the patient to reference laboratories in the adjacent emirate of Sharjah

(Al Qassimi Hospital laboratory) and laboratories in emirate of Abu-Dhabi (Sheikh Khalifa Hospital). These reference laboratories have more advanced identification techniques like Polymerase Chain Reaction (PCR) that are not available in any of the microbiology departments in RAK.

3) Data analysis

Raw data from the hard copy notification forms is entered electronically into an excel spreadsheet, which in turn is sent to the higher federal authority (MoHAP) on a monthly basis. Pooling, processing and analyzing of raw data are done only at the level of the MoHAP. In the event of outbreak, cases can be reported from any area by any person in RAK by calling the PMD call center. Details of each case are forwarded to MoHAP where the data were processed.

The MoHAP is responsible for publishing ID data. This is regularly done in the form of incidence and prevalence of infectious diseases that form part of the annual health report.

4) Epidemic/ Outbreak preparedness and response

While there is no permanent team that it is dedicated for the outbreak management, whenever an outbreak occurs, the PMD immediately contacts the RAK medical district to form a team consisting of some of the PMD personnel, laboratory technician and some staff from the area (such as schools, restaurants) who reported the outbreak. This team is assigned to be responsible for managing, investigating and reporting the outbreak to the MoHAP through RAK medical district.

5) Quality monitoring activities

The external monitoring of the surveillance system is done by MoHAP which sends a team that may visit the PMD in order to check that this surveillance system is functioning as required. This includes evaluation of the forms which are used for different diseases and how they are filled, prevision of updated guidelines and discussion of any challenges. Most issues that immerge are addressed during the visits.

The monitoring team from MoHAP assesses the core elements of each ID surveillance system in the PMD by checking if the case definitions are applicable and the notifications are according to the guidelines. This team also evaluates the support functions of the system by checking the documented activities of each staff of PMD working on ID surveillance system such as their training of healthcare personnel. However, there is no evaluation of the key attributes that are used to assess surveillance system such as timeliness and completeness, since the data needed for such evaluation is not routinely documented. For example, the time of initial identification and time of notification of PMD are not documented to allow assessment of timeliness.

The internal monitoring is done by a team from the PMD to evaluate the work flow at the district level, measure the process that leads to specific outcome and finally identify any gaps or opportunity for improvements.

Findings are shared with the head of the PMD, after which a meeting is held with the concerned personnel to resolve issues and make progress. This PMD team also sometimes evaluates the surveillance system at the level of RAK government hospitals. The main purpose of these monitoring activities is their use for continuous

quality improvements. The internal monitoring is done on as needed basis and is not restricted to certain time and format.

3.3.1.3 Support functions of the ID surveillance system:

1) Guidelines

Development and update of guidelines is the responsibility of the MoHAP. The guidelines used by the PMD and hospitals at the district levels are those provided by the MoHAP.

2) Supervision

Since the PMD oversees the ID surveillance programs in RAK, it routinely receives reports from the hospitals and any healthcare setting and is responsible for resolving issues related to the surveillance ID at the level of RAK.

3) Training

Whenever a new ID program is presented from the WHO, the MoHAP organizes a training workshop for PMD staff from different emirates including RAK. Trained personnel are responsible for utilizing and passing on the training information as needed.

The training has a clinical component that focuses on how to manage cases and control spread of diseases, and an administrative component that is concerned with the reporting to the relevant authorities and stakeholders as appropriate. The PMD has an internal training program for its own staff that is run twice a month in the form of lectures related to IDs. The PMD may collaborate with other healthcare institutions to conduct some lectures after taking the approval and the lecture material from the MoHAP.

4) Resources

The PMD is working on 6 ID surveillance programs in which 2-3 staff are allocated for each program. Each team that is assigned to a program has the responsibility of gathering all relevant details of this disease in the investigation form and following up the cases (notification or outbreak) until treated. The transportation department provides transport for the samples as well as personnel during work related missions whenever needed.

Reporting at the level of the PMD is done by using a combination of computer and paper resources: All the notifications are initially completed on paper, on a unified format that is provided by the MoHAP. Outbreak cases differ from other cases in that the initial reporting is done by the phone. A computer is used to enter the notification data and then to send it (in an excel spreadsheet) to MoHAP by e-mail.

5) Coordination

The PMD collaborates with any stakeholders in RAK in order to fulfill its ID surveillance tasks. For example, it may coordinate with the hospitals' ICC members in investigating and discussing some of the ID notifiable cases. Coordination is necessary and evident during times of outbreak with the formation of a multidisciplinary team with the member of the health sector, municipalities and other stakeholders.

3.3.2 Government healthcare services in RAK – Hospitals

Hospital number 1

This hospital is the main public hospital in RAK. It is a tertiary care hospital which has 226 beds, 116 doctors and 318 nurses, which offers a full range of clinical services through its many specialist departments.

Within the hospital, infection prevention and control is the responsibility of the Prevention and Control of Infection Committee (PCIC) whose members are drawn from all relevant departments including clinical and non-clinical departments.

Hospital number 2

This hospital has a total of 158 beds covering a variety of specialties (medical, psychiatry, infectious diseases, intensive care unit and an isolation unit). The hospital has 32 doctors and 182 nurses. This Hospital specializes in internal medicine and geriatric care. Within the hospital, infection prevention and control is the responsibility of the PCIC.

3.3.2.1 Structure of the ID surveillance system:

1) Surveillance structure

Within the two government hospitals, infection prevention and control is the responsibility of the PCIC whose members are drawn from several relevant departments including administration, quality control, clinical departments, laboratory, pharmacy, supplies, engineering, housekeeping and continuous professional development department. Most of PCIC work is done by two nurses (members of the PCIC), which includes the daily monitoring of infectious cases that

are admitted in the hospital, writing monthly reports and contributing to teaching activities.

At the hospital level, ID surveillance focuses on the need, depending on the types of infections in different departments. For example, the IDs surveillance in hospital number 1 focuses on five infections which are: surgical site infections (SSI), methicillin resistant staphylococcus aureus (MRSA), ventilator associated pneumonia (VAP), urinary tract infection (UTI) and bloodstream infection (BSI). With the exception of MRSA, guidelines for these infections are prepared by the MoHAP and circulated to the hospitals. The MRSA guidelines are prepared by PCIC members in each hospital. While the MoHAP guidelines are used at the hospital level, they can be customized to meet the individual hospital needs. This seemed to be done regularly in hospital 2.

2) Notification

The infectious diseases case notification form is distributed by PMD to all RAK healthcare settings. The PCIC is responsible for ensuring that the form is available in the various hospital departments (Appendix 5).

3.3.2.2 Core function of the ID surveillance system:

1) Case detection

The PCIC of the two hospitals adopted the guidelines for their ID surveillance from the MoHAP, however made changes to them to better suit their settings, using CDC as a reference.

2) Case Confirmation

The ID notification form is completed for any patient who has an infection which is confirmed with a positive culture result conformation. This is done using the notification form, which is completed by the physicians and the ward nurse (Appendix 5). The completed notification is then sent immediately to the Infection Control Nurse (ICN), who makes the necessary documentation and then sends it to PMD. All the IDs notifiable cases forms and the weekly Zero reporting forms are sent to PMD after completion.

For cases of notifiable diseases coming to the hospital, continued management of the patients (especially laboratory testing) can only be done after the PMD has been notified and in turn communicates with the clinical team to proceed, which can sometimes cause a delay in patient treatment.

In both hospitals, the samples come from different hospital departments and wards, and are transferred in biohazard bags to the laboratory. In hospital number 1 there is no locally prepared guideline for transfer of samples, however the CDC guidelines are used. In some cases, the PMD collects the sample and performs the initial analysis in their laboratories before sending it to reference laboratories for further testing, in the emirates Sharjah and Abu-Dhabi. Positive results from the hospital laboratories are forwarded electronically to the ICN. The ICN checks these results and decides on the appropriate action.

3) Data analysis

The raw data collected on each notification form includes name, age, sex, nationality, ward and type of disease. However, at the hospital level this data only exists on the hard copy of the notification form, which is sent to the PMD.

At the PMD, data is entered into an excel spreadsheet which is sent by e mail to the MoHAP at the end of the month.

For other cases which do not fall in the ID notifiable list, each hospital sends summarized data to the ICD in the MoHAP by e mail.

The ID data analysis that is done in the hospitals is to understand what microbes are spreading, in which ward they are spreading and resistance patterns. This is very different from the analysis done in the context of surveillance programs and notifiable infections, which is done at the higher level.

4) Epidemic/ Outbreak preparedness and response

In the two government hospitals, any outbreak (within the hospital) or other positive results such as SSI, MRSA, VAP, UTI and BSI are considered to be important and require immediate action. When an infectious agent is detected in any sample, the microbiology department sends the positive culture results to the ICN office. When the ICN comes to the office, she screens the positive reports to decide the action that will follow. Since the screening can be done only using the office computer, there could be a time delay between the sending the report and taking action.

The PCIC in each hospital reports directly to the hospital executive director or his designee via the PCIC chair after their investigation and action. This arrangement seems to be effective in allowing infection-related problems within the hospital to be quickly brought to the attention of the senior management for whom hospital infection prevention and control is a priority.

When forming a team for the cases of outbreak in RAK (outside the hospitals), a laboratory technician will be included in the team and sometimes a member of PCIC.

5) Quality monitoring activities

Evaluation of the ID surveillance systems is done internally by PCIC members. The core functions (availability of case definitions) and support functions (availability of papers and computers) are evaluated every three months using custom developed tools. In case any gap is found in their surveillance system (e.g. timeliness of reporting), then the members of the PCIC meet to find solutions.

3.3.2.3 Support function of the ID surveillance system:

1) Guidelines

The two hospitals may customize the guidelines in order to meet their specific need, while ensuring that they are consistent with national and international guidelines. The PCIC of the hospitals would meet to discuss revisions of the guidelines and approve updates.

2) Supervision

The PCIC checks all the ID surveillance of the hospital and makes sure that the case definition used is according to their guidelines which are updated from MoHAP. PCIC also make sure to collect all the ID notifiable cases forms from all hospital departments.

3) Training

All healthcare personnel in the MoHAP need to complete mandatory competency training on a variety of topics that are related to their department at least

once a year. However, training on ID surveillance is not a component of the competency training programs.

Professional development of healthcare personnel working with IDs in the two hospitals is in the form of attending conferences, participating in training workshops and infection control programs, which include surveillance and management of medical waste.

4) Resources

Both computer and papers are used in the two hospitals: 1) computer to enter the hospital ID surveillance data and to send reports to the MoHAP, 2) papers such as notifications and zero weekly reports which are sent to the PMD. The transportation department supports the hospitals by transporting samples as well as transporting PCIC staff during work related missions.

5) Coordination

In each of the two hospitals, the respective PCIC meets quarterly, however in an emergency (such as an outbreak) it could meet more frequently. PCIC coordinates/ collaborates with PMD and may meet with them to help in controlling an outbreak case or to help in their investigation of some cases of notifiable diseases. PCIC also coordinates with RAK municipality to dispose their office waste and with Waqaya (a company that specializes in disposing medical wastes).

Miscellaneous

RAK infectious disease data is published as part of a bigger publication prepared by the MoHAP, which is the quarterly annual statistical report. There have been no peer-reviewed publications about the ID surveillance system in the UAE.

Table 3.10 shows the assessments of the ID surveillance system (structure, core functions and support functions) at different levels in RAK.

Table 3.10: Assessment of the ID surveillance system (structure, core functions and support functions) at different levels in RAK

	PMD		Government Hospitals	
	Clinical services	Administrative services	Hospital 1	Hospital 2
Structure				
Surveillance structure				
Availability of the structure	NA	✓	✓	✓
Training on surveillance	NA	✓	ND	ND
Notification				
Availability of notifiable disease list	NA	✓	✓	✓
Collaboration				
Collaboration with other sectors	NA	✓	*	*
Core Function				
Case Detection				
Availability of standard case definitions	✓	NA	✓	✓
Knowledge of programs that are under surveillance	✓	NA	**	**
Case Confirmation (of notifiable diseases)				
Capacity to transport specimens to higher level	✓	NA	✓	✓
Presence of specimen collection guideline	ND	NA	ND	✓
Follow up of specimen results	✓	NA	*	*
Data reporting	✓	NA	✓	✓
Availability of reporting form (ID notification)	✓	NA	✓	✓
Presence of zero reporting system	*	NA	*	*
Data Analysis				
Performing trend analysis	ND	NA	ND	✓
Calculate incidence and prevalence of diseases	ND	NA	ND	ND
Epidemic/ Outbreak preparedness and response				
Manual for standard case management	ND	NA	ND	✓

Table 3.10: Assessments of the ID surveillance system (structure, core functions and support functions) at different levels in RAK (Continued)

	PMD		Government Hospitals	
	Clinical services	Administrative services	Hospital 1	Hospital 2
Compare present and previous data	**	NA	**	✓
Involved in an outbreak investigation	✓	NA	*	*
Presence of epidemic rapid response team	*	NA	ND	ND
Quality monitoring				
Quality monitoring from a higher level	*	NA	✓	✓
Support Functions				
Guidelines				
Presence of guidelines	NA	*	*	✓
Supervision				
Presence of supervisory visits to the lower level	NA	✓	✓	✓
Training				
Training of the rapid response team	NA	*	ND	ND
Basic training on ID surveillance system	NA	✓	*	*
Post basic training on ID surveillance system	NA	*	ND	ND
Resources				
Presence of office	NA	✓	✓	✓
Presence of functioning telephone	NA	✓	✓	✓
Presence of functioning computer	NA	✓	✓	✓
Presence of functioning means of transportation	NA	✓	✓	✓
Coordination				
Coordination mechanism	NA	*	*	*
Miscellaneous				
Healthcare personnel need training on ID surveillance	NA	✓	✓	✓
Publications about surveillance system	NA	ND	ND	ND
Published statistics	NA	*	*	*

✓ Applicable.
* To some extent.
** Not clear/ insufficient information.
ND: Not Done
NA: Not Applicable

Chapter 4: Discussion

This is the first population-based study using a representative sample on the prevalence of and factors associated with IID in the UAE.

4.1 Prevalence of IID in the community

4.1.1 Comparison of the IID prevalence with other studies

In UAE

This cross-sectional telephone based survey has estimated the prevalence of IID caused by all pathogens to be 4.2% in a sample of the RAK community. It is difficult to compare the findings with other data from UAE, because there are no previous community studies about IID prevalence in UAE. The only two publications on IID found in UAE are hospital-based studies where data collection was from patients attending the health facility complaining of gastrointestinal symptoms. Although it is not possible to make a direct comparison between those hospital based studies and the RAK community based study, certain aspects which are relevant to both will be discussed.

The first study was conducted in the emirate of Dubai and reported crude incidence rate (CIR) of 21 IDs obtained from retrospective data from the Preventive Services and Communicable Disease Department of Dubai Health Authority during the period 1995-2013. The authors noted that, the overall CIR for IDs in Dubai decreased from 1486.82 in 1995 to 307.43 in 2013, possibly due to the improvement in the healthcare system. However, focusing on the IID as a subset of the total IDs, different trends could be seen.

Over the same time period from 1995 to 2013, the CIR for certain IIDs decreased (Bacillary Dysentery, Salmonellosis, Typhoid) however, for others (food poisoning and Amebic Dysentery) there was more than a 3-fold increase, and was expected to increase further [84]. The increasing CIR of certain IIDs may be due to the changes in the lifestyle, where more are eating outside the home or maybe spending more time outside the home which makes them more susceptible to diseases. The lesson learned from this study is that the general trends for IDs may not applicable to all IDs, and that by pooling all the data together, certain important issues may be overlooked.

The second study, conducted in the emirate of Sharjah, was a hospital based study that focused on intestinal parasitic infections over a one-year period from 2008-2009. The reported prevalence in the study sample (n=10514) was 7.7%. The higher rates of parasitic infections were found in the native Emirati population (15.7%) as compared with the expatriates (3.2%) [109]. Although this data does not reflect what is happening in the community, it is reasonable to expect that many asymptomatic cases did not seek medical care, and hence remained undetected [115, 116]. Similarly, in the current study no stool samples were collected, and hence no information about parasitic infection could be obtained, although it is likely that there are cases of parasitic infection in the community that were not identified.

In GCC countries

Only one community study on prevalence of IID in the GCC could be found. In KSA, a cross-sectional study involving school children age 7-12 years old reported that 14.9% of 1064 respondents (children) had diarrhea in the previous month [105]. In the current RAK study, prevalence IIDs in children 7-12 was 9.4%. One of the

differences that exist in the current RAK study is that the prevalence of IID in all ages was calculated where the KSA study the entire study sample comprised of children. It is possible that if more than one child per household were recruited, the prevalence would have been higher.

There is generally very limited number of studies on IID in the GCC, with most studies generally focusing on intestinal parasitic infections. The following section presents the findings and trends from those studies, with the understanding that no direct comparison between IID and intestinal parasitic infections were drawn.

Some of the GCC studies focused on comparing the prevalence of parasitic infections in expatriates and natives, because of the influx of migrants to these countries. In Qatar, a study investigating prevalence of intestinal parasitic infections in expatriates who had recently arrived for employment in food handling jobs between 2005-2006 reported prevalence of 33.9%. Those workers were believed to have carried the intestinal parasitic infections on arrival to Qatar [117]. Although the current study did not explore parasites, the UAE also has a high influx of workers who could be parasite carriers, making this a potentially relevant topic for future research.

In Kuwait, a study conducted on patients visiting hospitals reported the prevalence of intestinal parasitic infections to be 67%. In contrast with the study from Qatar a higher prevalence was found in Kuwaiti nationals than expatriates [118].

These findings are in agreement with a study conducted in Sharjah (UAE) investigating the parasitic infection that reported a higher prevalence in native Emiratis (15.7%) compared with non-Emiratis (3.2%) [109].

In the current RAK study which investigated IID rather than parasitic infections, nationals were more likely to get IID than non-nationals (5.6% and 2.7%, respectively, $P \leq 0.05$). While it is not possible to compare our results with the Sharjah study, because the Sharjah study focused exclusively on the parasitic infections, these two studies demonstrate that the prevalence of two different categories of gastrointestinal infection is higher in native Emiratis.

In the current study, it is notable that there were no cases of the IID reported from those who are living in group accommodation. Most of these individuals are workers making a living through skilled or unskilled labour, and tend to live in shared rooms that bring together 8 or more people under one roof. This finding is unusual, since many studies found that those who are living in crowded conditions are more susceptible to ID. Furthermore, most of the workers living together come from endemic areas, therefore it would be expected that prevalence of IIDs is comparable to, if not higher than, "native Emiratis" [115, 117]. It is possible that these workers feared that reporting any kind of illness might be taken against them and affect their work status, and therefore denied having any symptoms. If that is the case, this would have ethical implications. The other possibility is that these individuals come from a relatively low socioeconomic status and as a result they have a higher tolerance to conditions such as transient fever, intestinal cramps and diarrhea.

In developing Countries

The RAK study is comparable with other developing countries that measured the prevalence of the IIDs. A Chinese cross-sectional study conducted reported a prevalence of 4.2% of IID in individuals from all age groups (N=39686) [99].

Similar to what was found with GCC countries, many of the studies done on other developing countries focused on parasitic infections rather than intestinal infections. For example, in Ethiopia, a cross sectional survey conducted from April to June 2012 involving students from grade 1-8 (N=326) found the prevalence of intestinal parasitic infection to be 34.2% [103]. Another cross-sectional survey conducted in West Africa (Burkina Faso) in students aged 8-14 years (N=385) reported that more than three quarters of the participants had intestinal parasitic infections (86.2%) [100]. In Iran, a cross sectional survey conducted from October 2010 to March 2011 with 800 students (age 8-12 years) reported a prevalence of intestinal parasitic infections of 28.8% [95].

Since parasitic infections are considered a subset of IIDs, it may be expected that prevalence of IIDs in those populations is even higher and hence several-fold more than the prevalence reported in my study.

Furthermore, many of the developing countries have been involved in wars in the past decade, which is accompanied by a heavy burden of both communicable and non-communicable disease, both in those who remain in the disaster-struck deteriorated environments, as well as the thousands of refugees who are displaced into unfavorable living conditions that are crowded and lack hygiene and good sanitation [119]. As such, comparison of prevalence of disease in those populations, with others living under stable conditions would not be on equal grounds.

In developed countries

In several developed countries, the prevalence of IID was comparable with our study. For example, in the US, a retrospective cross-sectional telephone based survey conducted for 12 months reported a 6% prevalence of IID in the previous 4-week period prior to the interview in their sample of 12075 participants of all ages [43].

In Canada, prevalence of IID in the previous 4 weeks of the interview in a retrospective cross-sectional telephone based survey conducted for 12 months with participants from all age groups (N=3496) was 10% [54].

In Italy, a retrospective cross-sectional telephone based study conducted from July 2008 to June 2009 with 3490 participants from all age groups reported prevalence of 8.9% of the IID in the previous 4-week of the interview [90].

It is not clear why our prevalence is lower than what was found in studies in developed countries, although it is possible that the selection bias due to language barriers reported in those studies may account for the relatively higher prevalence as compared to our study.

4.1.2 Comparison of participants interviewing methods

4.1.2.1 Effect on response rate

Different methods of interviewing research participants have been compared extensively, with the aim of determining the easiest, most cost-effective method without compromising the quality of the data [120].

Response rate with telephone based method

Some studies found the response rate to be higher in face to face studies than those using telephone surveys [121]. In RAK, a cross-sectional telephone based method was used and found a low response rate of 31.7%. However, this “low” response rate was in the same range as studies done in Western countries, where there is generally much more public awareness about research.

Similarly, low response rates were found in several studies that used telephone survey as a method to interview their participants. For example; a study conducted in the Netherlands used a telephone survey found a response rate of 32.9% [50]. Another study conducted in Canada using telephone survey found the response rate of 36.6% [54]. It is interesting that the UAE study that was used as the basis for the sample size calculation had a higher response rate (65%) than all the studies mentioned above, possibly because the telephone base method in that study was preceded by an initial recruitment step that happened face to face.

Response rate with face to face method

Response rates have varied with the face to face interview method. Some studies showed a high response rate and others showed low response rate. For example, in Barbados, a cross-sectional study in which interviews were conducted face to face method reported a high response rate of 84%, and prevalence of IID 4.9% [27].

In a community setting in Pakistan, the response rate in a cross-sectional study to study the prevalence of intestinal parasitic infections in children aged 1 to 5 years reported a response rate of 62.3% and prevalence of infection 52.8% [102].

While in Iran (Tehran), a cross-sectional study conducted from January to December 2014 on study participants from all age groups from the community using the face to face method, reported a prevalence of 32.7% of intestinal parasitic infections. This study had a low response rate of 25.4%. In this study the authors mentioned that the reason for getting a low response rate is for some cultural reason, where the participants found it embarrassing to pass the stool samples to others [97].

Generally speaking, the response rate appears to be affected by the method used in interviewing the participants. Furthermore, it has been suggested that where the study is conducted can have a higher influence on response rate than method of interview. Studies that are conducted in a facility rather than a community seem to be associated with a higher response rate, and conversely, community based studies yield lower response rates regardless of the interviewing method (telephone and face to face) used [54, 97].

4.1.2.2 Effect on outcome measures

Telephone based method vs. Face to face method

This RAK study is the first study to use a telephone based survey to study the prevalence of IIDs in the UAE. This method was chosen, because the UAE culture is not familiar with research surveys and the telephone based method was considered to be less intrusive, and therefore more acceptable to potential participants, as well as being more cost effective [122].

Several population based studies investigated the IID using telephone based method. For example, a cross-sectional study conducted in Australia used a telephone based method to interview the participants (N=6087) from all age groups. The study found prevalence of IID in the previous 4 weeks prior to the interview to

be 6.4% [93]. In Malta, a cross sectional study conducted using a telephone based survey for one year involving 3504 participants from all age groups found prevalence of IID to be 3.18% [91].

For some studies, the only option is to use face to face method. For example, in communities where access to a telephone is not available for the entire population, if the telephone were used then it will bias the study because those who do not have a telephone would be excluded. It is not surprising, therefore, that the most common method used in the majority of developing countries is the face to face method to interview. It is important that the person conducting the interview does not influence the responses and thereby affect the results. In studies were the result is determined by laboratory testing, this kind of bias is eliminated. For example, a study in West Africa (Burkina Faso) reported that 86.2% of children had infection [100]. Although, the face to face method was used in the interview, it did not influence the results in that study because the outcome (parasitic infection) was confirmed through laboratory testing. In KSA, a face to face method was used to interview the participants. The prevalence of intestinal parasitic infections was found to be 32.2% [123].

Prevalence of IID in our study is similar to other studies that have the telephone interview method. For example; Malta reported 5% IIDs prevalence using telephone method in interviewing the participants [56]. In our study, the research assistants were trained on interview procedures and were specifically instructed to read the questions from the questionnaire as it was written and if needed, to explain the questions without influencing the participants by suggesting answers. Although this is expected to reduce the likelihood that different interviewers were associated

with different results, this can only be confirmed by kappa statistics to determine inter-rater variation.

4.1.3 Factors associated with IID

It is important to understand the factors associated with IID, since these factors will be the starting point to develop interventions to reduce prevalence.

Age

In RAK, children aged 5 years or below are more likely to have IID than those who are 6 years or above. Younger age has been found to be associated with IID in several studies. In the US, a retrospective cross-sectional telephone survey conducted for 12 months reported prevalence of IID to be 6% in the previous 4 weeks of the interview, and found that the rate of IID is highest among children below 5 years of age and lowest in those aged ≥ 65 years [43].

Similarly, in the Netherlands, a retrospective cross-sectional study conducted over one year (N= 1975) reported the IID prevalence found in the previous 4 weeks of the interview to be 7.4%. The factor significantly associated with community IID was age below 5 years [50].

It is hard to compare prevalence according to the age factor with the developing countries, since their focus was specific pathogens like parasites and in RAK study the IID covers all pathogens causing the infection. However, it is of interest that even in studies that restricted their outcome to parasites, children were found to be more likely to be infected than adults. In KSA (Riyadh), a community survey conducted reported a prevalence of 32.2% of intestinal parasitic infections in all population and from their multivariable analysis found a prevalence among

children under 12 years old (34.4%) [123]. One of the reasons suggested for infection being more prevalent children being more infected than other age groups is that they are not aware or lack education related to hand hygiene (education factor) [96]. In China, a prevalence of 12.6% of the IID was found in children ages from 0-4 years old and it was higher than all other age groups [99].

Monthly household income

In RAK, a middle range household income was positively associated with the IID. This is in contrast with reports from Malaysia and China in which no association was found between the monthly household income and the IID [98 and 99, respectively]. On the other hand, in Barbados, in agreement with our results, household income was positively associated with the IID, the reason for which was suggested to be higher frequency of eating outside [27]. In our setting, this could be due to eating outside the home, although further studies would be needed to confirm that.

Gender

In RAK, prevalence of IID was higher in females as compared with males (1.1% and 0.6% respectively). The current study findings are in agreement with those from a cross sectional telephone survey conducted in Canada that found that the prevalence of IID is higher in females than males. The higher IID prevalence in females was postulated to be due to their exposure to food (kitchen service), since they are the ones who cook for their families and kitchens are considered to be reservoirs for many food-borne pathogens [54].

In contrast, a cross-sectional study using face to face survey conducted in Barbados found that the prevalence of IID is higher in males than females. The

higher prevalence in males was suggested to be because of their tendency to eat more frequently outside the home, in a setting where food outside the home seems to be more contaminated [27]. In a cross sectional study conducted in US using a telephone survey, the prevalence of IID was found to be the same in the two genders [43].

In RAK, females had the higher number of cases of IID. This may be due to the fact that the females are more in contact with their children and taking care of them. Furthermore, the role those females are playing in the home such as cooking make them more susceptible to such infections.

Season

Seasonal variation is an important phenomenon that has been documented for IIDs. Several studies have found that IID prevalence was higher during winter months as compared with other seasons. In Malta, the factor associated with the prevalence of the IID in the community is the winter season [91]. In Italy, the prevalence of the IID peaks in (November-March) which considered as winter [90]. In the US, a higher prevalence of IID cases found during the winter season (December, January, February) [43]. In contrast, a study conducted in the Netherlands found that there were higher frequencies of IID during spring and autumn; however, the results of this study refer to the month of interview rather than the date of the event [50].

In the RAK study the prevalence of IID was not uniform throughout the study period, although the number of participants was comparable in all the study months. Highest prevalence was reported in the months of February, March and April, which are considered as spring in UAE. When evaluating studies for the effect of seasonal

variations on IID, it is important to note whether the month reported is the month of the interview or the month of the event. In most studies that collect data about the 4-week period prior to the interview, events described will be in the previous month. Furthermore, although the overall study duration was reduced by three months, the total target sample size was reached.

One way to ensure that the data obtain relate to a single month it is to conduct the interview during the last two days of the month, which ensures that any occurrences reported happened during that month. In the current study the interviews were allowed to be conducted throughout the month on any day in that month. However, participants who reported symptoms that were consistent with IID were requested to provide the date (s) of the beginning of their symptom (diarrhea), so that the results can be documented according to the exact month of infection and not the month of the interview. In our research, changing the study duration from 12 months to 9 months means that data from 3 months was omitted, spanning across two seasons. This omission means that any variations specific to those months will not be captured. In the UAE, October is associated with a significant 20 degree drop from the scorching 50 degree Celsius temperatures recorded in August. If it were hypothesized that drastic change in temperature may be associated with an increase in IID, then it might be expected to observe a higher prevalence of IID in November, because temperature during this month drop considerably. If that is the case, then inclusion of that data may cause increase of overall prevalence of IID. However, in the absence of supportive data, this cannot be confirmed.

In the current study data from different months were not grouped together, nor were the seasons discussed, because in the UAE there aren't four distinct seasons. Most of the year is quite hot, with temperatures above 30 degrees from April to October.

4.1.4 Underestimation of IID

It is of concern that underestimation in community studies is not uncommon. In the current study, the possibility that the prevalence of IID of 4.2% that is reported is in fact an underestimation of the real magnitude of the problem cannot be ruled out. Several factors have been associated with under-reporting [43].

Migrants

In RAK, there were no cases of the self-reported IID from those who are living in non-family accommodation. It has been previously found that there is lower reporting of IDs in migrants compared to natives [115]. Our finding that there were no reported cases of IID in the migrant population was unexpected. Most of these migrants have come to the UAE seeking job opportunities. Often the jobs are unskilled labour. Reporting an illness may be perceived as being a threat to their job security. One way to overcome this issue is to collect the data in the form of a self-administered questionnaire that is completed anonymously by participants, with all forms (completed and blank) being returned to a box to be collected by the research team.

Cultural issues

In our culture, certain issues are embarrassing, especially if they are discussed outside healthcare facilities. For example; some participants refused to complete the

questionnaire even after taking the initial consent from them. This refusal came after going through some questions like when asking them about skin diseases.

Language barriers

The existence of language barriers is one of the reasons for under-reporting. Many surveys are prepared in one language and do not consider potential participants living in the same area and having a different language than the native people language [120]. For example, in Canada, many participants were excluded from their study, because these participants did not understand the survey language [54].

It is important to include those foreign participants in community studies, since they are part of the community that is being studied and their exclusion would introduce selection bias.

In RAK, the survey tool was produced in three languages to make sure that those who excluded are not because of the language barrier.

4.1.5 Comparison of respiratory infections with IID

Comparison between studies investigating the factors associated with the respiratory infection is difficult possibly due to the differences in the methodology. For example, definition of respiratory infection has varied from one study to another. Presence of several symptoms concurrently (as such fever, cough and nasal discharge) has been considered to be necessary by some researchers [124], in contrast with a single symptom such as cough by others [125]. In the current study a very broad definition was used whereby a positive report of any one of the symptoms was taken to be indicative of upper or lower respiratory infection, provided it was not a chronic condition.

On review of the literature, very few community studies on respiratory infections around the world were found to have included participants from all ages. The prevalence of respiratory infections of 14.2% from all age groups in the current study is lower when compared with the prevalence of 19.85% from all age groups in the Australian study [126].

The study populations can have a significant effect on the reported respiratory infections, particularly with respect to age groups included, since children are generally more susceptible. When drawing a comparison between our study and other published studies, it is important to bear in mind the differences in methodology and the impact that these differences may have on the outcome.

Many of the published studies of respiratory infection in the community have focused on children. The discussion which follows is based on our calculation of prevalence of respiratory infection in the sub group of our study sample compared with other studies.

Age

In RAK, those aged ≥ 60 years old were less likely to get respiratory infections than those who were 5 years old or below. Similarly, in the Australian study, those of age group over 60 years old were less likely to experience respiratory infections than children less than 5 years of age [126]. Although the underlying reasons were not explored, this difference is possibly due to the life style of the elderly people who tends to be more conservative in terms of their social habits or eating habits that may impact immunity.

The plethora of studies on respiratory infections in children has reported prevalence's ranging from 7% to 52% [127,128]. In RAK, the prevalence of respiratory infection in children aged 0-5 years old is found to be 34.8%, which may be under estimating the actual prevalence in children in our community, because only one child is selected from each household, while it is likely that in a household with many children, more than one child would be affected.

An exhaustive and comprehensive search of the published and unpublished literature (country health reports) and to the best of my knowledge there are no studies in the prevalence of respiratory infections in the Middle East. Below is the comparison of the current study results with few studies that considered to be closest to the current study in terms of methodology (the definition of the respiratory infection and the recall period during the study on which the participants had to provide information).

A similar cross-sectional population-based study conducted in Malawi reported a prevalence of respiratory infections of 32.6% in children 0-59 months was comparable to the current study results [129].

In India, lower prevalence's of respiratory infections was found compared with our study. For example; in Lucknow (India), a cross-sectional study conducted in children under age of 5 years. The prevalence of ARI in this age group was 23% [130].

Another cross-sectional study conducted in Gujarat (India) reported that the prevalence of ARI in children under 5 years old is 22% [131].

In the current it was found that the community infections, both respiratory and intestinal appear to be more prevalent in younger children.

Monthly household income

In RAK, a middle range household income was positively associated with the respiratory infections. Studies found that low income is associated with respiratory infections. For example; in Madagascar, low income was found to be a risk factor for many respiratory infections in children under age of 5 years [132].

Similarly, lower socioeconomic status was found to be a significant factor associated with the ARI in a cross-sectional study conducted in India in children under 5 years of age [128]. On the other hand, a cross-sectional population study conducted in Indonesia found that there is no significant association between the household income and the incidence of ARI in children [133].

Living conditions

The prevalence of respiratory infections in those living with spouses is lower than those who are living alone. This could be related to the nature of the job of people living alone or to the fact that those who are married generally have better living accommodation in the UAE.

It is difficult to compare this factor with published studies, because living conditions (with reference to who the study participant is living with) is unique to our region. Workers accommodation is a facility that has been introduced in our region to cope with the high influx of unskilled labourers that are employed by companies such as building contractors, cleaning services and others. With regards living together, only married couples can legally live together. Whereas in many

other countries the marital status could be single, while at the same time they are living together as a married couple.

Season

In the current study, during the colder months there was a higher prevalence of respiratory infection. Seasonal variation is an important phenomenon that has been documented for respiratory infections.

Several studies have found that respiratory infections prevalence was higher during winter months than other season. In the Middle East there are large areas covered with desert and in summer the weather is very hot and humid, but in winter the temperature drops significantly [134].

Another study conducted in KSA investigating respiratory infections found that the respiratory infections peaked in winter months [135].

A study conducted in Australia found that during winter, people were at highest risk to get ARI and less likely to get ARI in summer, while there were no significant difference was seen between autumn and spring [126]. Similarly, in the current study, the respiratory infections peaked in colder months.

4.2 Infectious disease surveillance system in RAK

4.2.1 Structure and core function

In this study, the ID surveillance system in RAK was described, one of the seven emirates making up the UAE, at two levels (district, hospitals). The building blocks required for a potentially good ID surveillance system were in place and this is consistent with the standard of health services in the country, which are

comparable with international standards [136]. However, the way that different parts of the system function individually and collectively are crucial in determining the effectiveness and quality of the system as a whole, as will be discussed in the following section.

The PMD is the higher-level authority in RAK which oversees the ID surveillance system at the hospitals. However, it also has additional responsibility of performing the ID screening that is mandatory for all visitors applying for residence permits in the UAE. This situation seems to be unique to the UAE, since globally it is unusual for higher authorities to be directly involved in clinical work. More commonly, it is the hospitals and clinics that carry out the clinical tasks related to infectious diseases.

For example, in the state of Maharashtra in India, the higher levels (National surveillance unit, State surveillance unit and the District surveillance unit) are responsible for the administrative work such as receiving data and giving feedback, while lower levels are responsible for the clinical work [137]. Similarly, in Korea, the lower levels report ID cases after performing all clinical tasks related to the case, such as sample analysis, confirmation and investigation. The higher levels in turn receive the reports and pursue with administrative tasks such as data analysis and feedback [57].

It is possible that in RAK, having this extra clinical role at the higher level may impact other duties. This would be likely, considering that the same personnel carry out duties on both divisions of the PMD.

4.2.1.1 Surveillance programs

The WHO health profile of the UAE (2015) report specifies several ID programs that the country is working with. These are HIV and Hepatitis, TB, malaria, neglected tropical diseases and vaccine preventable diseases [138]. Collectively, in the PMD, there was awareness of all of the programs that the UAE is working on, although most personnel were focused only on one or two programs with which they were directly involved. In contrast, at the hospital level, all ID management was done within the framework of the clinical work, with limited reference to surveillance programs. A study in Khartoum (Sudan) found that all the staff at different levels working in the ID surveillance system knew the diseases under surveillance [139]. It seems that training of staff at all levels is a priority in their settings. In Qatar, training of their staff was found to improve the quality of notification this is probably because of increased awareness about ongoing surveillance programs and diseases for which notification is necessary [78].

4.2.1.2 Guidelines

The WHO considers the availability of a guideline for each disease to be a basic element in any surveillance system [138]. Public health agencies at the national level should have the responsibility to make an effective policy on reporting and controlling IDs that the country reports to WHO [34]. In the UAE, guidelines are prepared centrally at the main Ministry of Health headquarters. These are passed on to the surveillance systems at the district/ emirate level, and from there, further down to the hospitals. The district and hospital levels are not involved in preparation of the guidelines however; if necessary they are able to tailor the guidelines to meet their specific needs.

Similarly, in KSA, the MoH is the authority that is responsible for making policies, following up and evaluating infectious disease programs, through the central Infectious Disease Department [140]. In Egypt, the Ministry of Health and Population (MoH) is responsible of developing guidelines and providing feedback to other lower levels. A subdivision of the MoH, the Central Epidemiology Surveillance Unit, works on establishing the ID surveillance system [141]. By contrast, in the US and Australia, the formulation of the procedures for the notifiable diseases surveillance system is done by the contributions of both the regional and the government organizations [29]. Only one of the three facilities included in this study had guidelines for IDs. It is interesting to note that this same hospital has Joint Commission International (JCI) accreditation. Furthermore, even for diseases for which the guidelines exist, these guidelines are primarily used by PCIC members and are not used by the other health professionals in their surveillance activities.

The guidelines that the district and hospital levels receive from MoHAP cover the IDs with regards diagnosis, management and reporting. However, no clear instructions were found about specimen transportation to reference laboratories. Recently, laboratories in government hospitals have been taken over by a private company. It is not clear what could be the impact of the new privatization of the laboratories in these facilities on the ID surveillance system. However, what is certain is that collaboration between the new administration and the MoHAP is necessary to develop laboratory guidelines that should be part of the surveillance system.

Case definition

For IDs case detection, definition of the case is vital in order to ensure that data from around the globe can be compared [139]. In the current study, the guidelines were available for specific diseases such as TB, HIV, AFP/Poliomyelitis. Although the guidelines were clear with case definitions, their limited distribution, particularly at the lowest levels, indicates that they are not used in routine identification and reporting of cases. At the lower levels there is no manual for ID case definitions, since the ID management is done from a clinical perspective, health professionals seem to find it easier to refer to the built-in information that is part of its electronic health information system.

Similarly, in Khartoum (Sudan), the health facilities did not have a manual for ID case definitions; to deal with possible errors that could occur due to this issue, frequent supervision visits were conducted at different levels to confirm that cases were properly defined. The unavailability of a case definition reference affects the quality of case detection and increases the workloads for those who conduct the supervision visits [139].

4.2.1.3 Notification

The WHO requires member states to report to it health emergencies with a potential of international concern [21]. IDs are considered to be a health issue of concern, for which it is mandatory to report to WHO all diseases listed on the notifiable disease list. Compilation of the list is left to the discretion of the country [29].

In the UAE, the list of the notifiable IDs is prepared by MoHAP, which ensures that the same list is circulated and is unified across all the 16 government

hospitals and other private hospitals under the MoHAP. The other health authorities (Health Authority Abu Dhabi and Dubai Health Authority) in the UAE use the same list as MoHAP and expand on it, resulting in their own longer list.

Most countries have developed their list of notifiable diseases, although the number of diseases in the list differs from one country to another. Each country decides which diseases to include in its list based on public health issues that are considered to be issues of concern [28]. Countries have differed as to how many diseases to include on their list, although the three diseases specified by WHO (yellow fever, cholera, plague) are found on lists from all countries.

For example, China has a list of 39 notifiable diseases unified for the entire country, and healthcare personnel use a standard and unified format to enter the ID notifiable cases information [38, 142]. In the Netherlands, the list of 43 notifiable IDs is used across the country [38].

In Egypt, the surveillance system is developed to be able to collect 26 notifiable diseases [141], while Oman has a unified notifiable IDs list (29 notifiable IDs) [143] and KSA has a unified notifiable IDs list (47 notifiable IDs). This list is provided by their MoH, the notifiable cases reported from the lower levels to the health sector which then reports to the regional health affairs – public health, which then reports the cases to the MoH [140]. In Sri Lanka, the ID notifiable list consists of 27 diseases that should be notified [69], while Pakistan needs to notify any of the 46 IDs on its list [67].

Updating the notifiable list

The list of notifiable diseases should not be static, but rather should be updated as new health concerns emerge. It is necessary to update the list of notifiable IDs to avoid issues related to reporting [34]. For example, in Khartoum (Sudan), their ID notifiable form was not updated since its establishment, and as a result this weakened the system and reduced the data accuracy [139].

Since in RAK the original ID notifiable form has been used for many years, emerging diseases such as Middle East Respiratory Syndrome (MERS) which make the headlines in local newspapers [144] are reported as an added item on the notification form.

4.2.1.4 Reporting

Following case identification and confirmation, reporting is the next major step in ID surveillance systems. Many different issues have been reported regarding surveillance systems around the world; the most important of these problems will be discussed below.

Under-reporting

Under-reporting of IDs has been well-documented in the published literature. Reporting rates have not been assessed in this study.

However, the marked differences in number of reports coming from the government and private sectors, and specifically the low number of ID reports coming from the latter seem to indicate that there was under-reporting. This is similar to a study in Pakistan (Gilgit – Baltistan), where the electronic ID surveillance system that was introduced in that area did not include the private

sectors, which resulted in exclusion of about 80% of their private healthcare facilities [71].

In Mumbai (India), the private health sector serves nearly 70% of the population. However, the surveillance data (notification system activities) collected by public health does not include the private health sector, possibly because it is under a separate agency/authority and is not controlled by the MoH [68].

This is in contrast with the KSA, where the reporting rate for the notifiable cases from the private sectors is relatively higher (87%) as compared with the public sector (74%) [145]. However, it is important to note that in that study a large number of notification forms received from government hospitals were incomplete, and so were excluded, resulting in an apparently higher reporting rate from the private sector.

The surveillance system does not fulfill its purpose if the private health sector is not included, so it is important to have systems that include all stakeholders, coupled with regular communication, to avoid issues related to reporting the cases [68]. In order to increase rate of reporting, the surveillance system in the UAE needs to take measures to include both government and private health sectors in a single system.

The completeness of ID notifiable forms

The completeness of the notification form was evaluated in several studies in other countries by assessing a sample of notification forms. In RAK, there seems to be an issue with completeness of forms that was understood through the information provided through the interviews. However, this is rectified at the district level by

PMD personnel, in order to ensure that the final forms that are sent to the central MoHAP are complete. As a result of this practice, degree of completeness of forms would give different results depending on where they were assessed – at the district level prior to any steps by the PMD personnel to complete the messing information, or at the central MoHAP level after receiving checked forms from the district level.

Similarly, in a KSA study, although reporting rate was relatively high for the notification step, the documents were commonly found incomplete in sections related to vaccination history of the case [145].

Qatar has the issue of incomplete forms of the notifiable diseases. The missing information has been attributed to the presence of a language barrier when communicating with the high number of expatriates with IDs [146].

Zero reporting

According to WHO, zero reporting is recommended, which is reporting of the absence of disease cases which are under the surveillance. This is important to make sure that all notifiable diseases have been counted, and that diseases for which the count is zero are because there are no cases rather than neglected cases that have not been counted [30]. In South Africa, the zero reporting by the lower levels is not mandatory and not required in their national diseases surveillance system. As a result, many positive cases were not reported. For example, the number of positive results of Meningococcal meningitis reported from the laboratories was 230, while only 105 notifications were received [39].

In Jeddah (KSA), there are 4 sectors that provide health services, all of which receive zero weekly reports that are completed and sent from all health centers and

hospitals [145]. Similarly, in RAK, all the lower levels send their zero weekly reports (AFP, Measles and Meningitis) to their higher level. Although it is not mandatory by WHO, zero reporting is recommended is to ensure that all the positive cases were reported and to serve as a reminder for all who notify.

4.2.1.5 Method of reporting

Reporting is considered to be the basis of health surveillance systems [147]. Different methods of reporting have been used in different surveillance systems, such as paper-based methods, electronic methods and, in some circumstances, a combination of both. Each method of reporting has its advantages and disadvantages. Below is a discussion of some of the problems that have been described with each method.

Paper

Using paper forms is the simplest method that can be used in most settings and does not require electronic equipment. Countries with limited resources such as Sri-Lanka depend on a paper based reporting in their ID surveillance system. All the activities in their system from registering to reporting are performed manually and they have noticed that an additional filtration process (which is time consuming) is necessary to avoid duplication [69].

In India, data collected on paper causes many operational issues such as inaccurate or incomplete data, duplication of efforts and delays in detection of outbreaks which leads to a delay in the response for the intervention [21].

Likewise, in RAK, the data is collected on paper and transported physically to different premises (the PMD), which may potentially delay disease notification.

Future work that assesses the timing of different steps in the reporting pathway is needed to further explore this point.

Electronic

According to the WHO, timeliness (interval between two steps) should be assessed fully from the time of infection to the reporting. Timeliness is particularly important during epidemics, and can have a significant impact on the spread of disease. Issues with reporting have been documented in surveillance systems across the world. Introduction of electronic reporting into ID surveillance systems has improved timeliness [148]. For example, moving to electronic methods in reporting have been shown to be beneficial in Ghana, where the ID surveillance system initially relied on paper; when internet base reporting was introduced, the completeness and timeliness of the data increased [73].

The introduction of electronic resources like e-notification, e-mail, electronic system and phones enhanced the ID surveillance system in Indonesia, providing a faster, more efficient and cost-effective tool for collecting data. Using these tools reduces the time of reporting the cases [149, 150]. Furthermore, a study carried out in China found a significant increase in the reporting speed after introducing online notification [38].

The Netherlands uses the electronic communications mechanisms for reporting, and found that it is important for the surveillance system in controlling the ID outbreaks, since time is of the essence in such emergency situations [38].

In Qatar, the notification for their IDs improved because of introducing new technological facilities such as a fax machine which was used for the notification

over 24 hours. This led to a reduction of the reporting time from figures over 2.5 days in 2012 to 1.5 days in 2013 [78].

However electronic systems do not always enhance ID surveillance. Problems could arise if the infrastructure needed to support the advanced technology is not available. For example, in Maharashtra (India), 97% of the 34 districts receive the notification data from the settings (46 facilities and 25 laboratories) in paper based formats; some of these districts experience regular problems with internet connectivity, leading them to shift back to the paper based formats in reporting [137].

At the level of RAK, the PMD converts the data on paper to an electronic form which is sent to MoHAP. Since there is no electronic system integrating the surveillance reporting at different levels, the existing resources (time and personnel) are further drained in order to complete the necessary task.

4.2.1.6 Other reporting issues

Another reporting issue documented in US, was the failure of healthcare providers to report many ID cases, either in order to protect the patients' privacy or because there is no motivation or rewards for reporting [58].

According to the law in UAE it is mandatory to notify any ID that mentioned is in their ID notifiable list [151].

In RAK, although physicians are the only health personnel authorized and obligated to report ID cases, at the same time they have no active role in the surveillance program as a whole. For example, they are not involved in developing the guidelines at any stage, nor do they have tailored training programs that prepare them for fulfilling their reporting duties as per the guidelines. ID training for

physicians should be a mandatory component of continuous professional development.

Expanding the responsibility of reporting to include not just the physicians, but also the laboratories has improved reporting in some settings. This has been shown to be essential to improve the reporting and the timeliness as in Netherlands study [66] and other developed countries such as New Zealand where electronic reporting is done by laboratories as well as physicians [152]. In Sweden, the ID surveillance system improved by the double electronic reporting from both physicians and laboratories. It was concluded that using this combined reporting made their ID reporting system highly sensitive in their settings [153].

Similarly, in Oman, laboratories have an essential role in reporting, alongside physicians. Laboratory staff must notify any positive results related to priority diseases or an unusual organism through their electronic reporting system [143]. A study in Qatar mentioned that the physicians are the ones who notify ID cases while laboratories' role is restricted to confirmation of the cases [78]. This is in contrast with RAK (lower levels), where the laboratories' role in the ID surveillance system does not extend beyond running the clinical test. The full responsibility of reporting these diseases relies on the physicians. Using electronic methods coupled with other forms of communication as needed with the ICD.

4.2.1.7 Laboratories resources

The laboratory plays a central role in both detection of ID cases and confirmation [154]. In Khartoum (Sudan), the laboratories at any level have no written guidelines for the sample collection and transport, although this is done through institutionally-established routine practice. Furthermore, the majority of

district hospitals, health centers and facilities were unable to perform culture testing for any of their notifiable diseases. Functioning laboratories were found in almost all healthcare facilities with the ability to collect blood, stool and urine, however very few of these laboratories were able to collect sputum specimens [139].

This could possibly be due to the fact that sputum collection required specific procedure and the sample should be examined under the microscope (by a microbiologist) as an initial step prior to sending to further analysis.

In RAK an important gap is the absence of standard guidelines for handling and transportation of samples, since many of the samples need to be transported to the reference laboratories in other emirates for further testing (such as TB culturing).

This could be expected to prolong the process timeline in the ID surveillance pathway, especially in the absence of standardized procedures. The lower level laboratories are able to perform culture for some of their notifiable diseases, in contrast to the higher level laboratories in RAK, where it is not possible to perform any type of culture. All RAK laboratories are functioning and are able to collect blood, stool, urine and sputum specimens.

4.2.1.8 Data management /analysis

The surveillance system and reporting the IDs should provide information on the prevalence and incidence of the disease, and allow quick identification and rapid response to disease outbreaks [34]. However, in many developing countries this is not the case. For example, in Ghana, the paper based forms are sent from the lower level to the district health directorate, which enters these forms by health information officers into electronic form [73]. In Sudan, the data analysis of the ID surveillance

system was not done in all the lower levels of health facilities. It was done only by few facilities in the lower level which had computers for their data analysis [139].

In our setting, the data management from ID notification forms is carried out by the PMD. However, this does not include performing a detailed analysis and looking for trends. As a result, it is difficult to predict outbreaks or understand changes in disease patterns, such as re-emergence of certain diseases.

The central MoHAP is the only authority that receives data from all the 7 emirates and pools it to report national ID surveillance statistics. It is their responsibility to have information about disease patterns, resistance patterns and trends, because it is necessary in planning and ensuring that the services available meet the local needs. It is still important at the level of individual hospitals to perform this analysis to estimate increases in the number of ID cases in order to plan for better management (improved facilities and services).

At the PMD level, it is important to know about the increases in the cases of the IDs, to plan and to upgrade the resources to ensure they meet the needs. For example, isolation rooms in healthcare facilities are important not only to manage existing cases, but also contain spread of disease.

4.2.1.9 Epidemic /outbreak response

The WHO surveillance guidelines mention the rapid response team as one of the indicators to assess the core function of the surveillance system [30]. In Maharashtra (India), it was reported that all of their districts had a rapid response team and the majority of these districts had a clear defined epidemic management committee [137]. In contrast to Sudan, where none of their lower levels knew about

the number of the cases on the outbreaks (acute watery diarrhea in 2006 and Rift Valley fever in 2007) and the outbreaks were managed centrally, because the lower levels have no functioning epidemic managements committee. Furthermore, no established rapid response team was available; instead, when needed, the team was formed and activated [139].

In RAK, a team will be formed to deal with any outbreaks or emergencies only when there is a need, which may be time consuming. Having a trained team which is ready for such crises may reduce the time for containing such situations.

It is understandable that the highest medical authority in RAK, medical authority in RAK (medical district), gets involved in times of ID outbreaks.

However, getting it involve in a more regular basis is likely to make it easier to fulfill its role to form a team by mobilizing experts from different specialties to deal with the situation. Ongoing involvement of RAK medical district in the PMD surveillance system through regular meetings and initiation of activities at the district level and continuous quality improvement programs are expected to enhance both emergency and non-emergency function of the surveillance system.

4.2.1.10 Quality monitoring (feedback)

The feedback that the higher level in RAK (PMD) receives from MoHAP about their work is valuable in making improvements. This would be even more effective in bringing about change if there was a before and after assessment for any intervention.

In contrast to Oman, the department of the surveillance distributes electronically a weekly feedback report to all concerned on notified IDs, with the

goal of the improving the efficiency of the surveillance that it is essential for their surveillance system and without which the surveillance system will not function efficiently (poor motivation) [143]. In Ghana, the healthcare facilities do not have regular feedback from their higher level; the only feedback they got is during irregular meetings in their facilities with their head of units in the lower levels [72].

The surveillance system evaluation should be regular to ensure that the system is performing its duties efficiently [153]. In Pakistan, regular monitoring for the surveillance system existed and was performed by district personnel and field program officers [71].

Similarly, in RAK, the PMD performs the monitoring ID surveillance system for their lower levels, but excludes the private health facilities, because of the complicated administrative procedures required to enter their facilities.

There is a general kind of monitoring. However, it is not well structured in terms of steps (analysis, feedback, implementation of plan and follow up). Furthermore, the elements of the monitoring plan should follow those outlined by WHO [28] such as timelines, flexibility, usefulness and sensitivity. This would make it easier to compare with other WHO data.

4.2.1.11 Supervision

The surveillance system will not be complete without supervision, because, as mentioned in the WHO guidelines, supervision is one of the elements of the support function which is used to evaluate a surveillance system. Supervision is the process in which the healthcare personnel in the lower level is guided and supported by the higher levels [30].

In my study, the senior personnel in the PMD supervise the performance of the other personnel in the PMD and in the lower level as well, by visiting the hospitals or answering their questions by phone regarding any issue related to the ID notification. This supervision helps in improving the surveillance system performance. In Ghana, the supervision of the ID surveillance system is absent or irregular, because of the lack of interest of the surveillance activities and of other resources (transport between the different levels and lack of human resources) [72]. Lack of supervision may lead to lack of the motivation which leads to a lower number of notifiable reports received from the lower level personnel (under-reporting).

4.2.1.12 Training

Training is a key element of the surveillance system [143]. Insufficient training of the healthcare personnel could have a negative impact on the overall work performance [13].

The MoHAP offers programs of core topics related to IDs such as hand hygiene, sterilization and antibiotic resistance. The training on the specific ID programs that the UAE is working on is usually offered for the personnel who are working on it. Other healthcare personnel who are involved in the ID surveillance system (physicians, nurses, laboratory technicians) need to get the training in the context of the surveillance program, so that they can be more proactive in making these programs achieve their goals. Developing a (train the trainer program) may be suggested as a way of increasing ID training at the level of the hospitals.

4.2.2 Putting it together

4.2.2.1 Collaborative efforts

In RAK, most parts of the surveillance system seem to be fulfilling the tasks that are assigned for their specific departments. However, looking at the bigger picture, gaps can be identified in the surveillance system.

A main reason for this is that the efforts are not concerted. The obstacles may be different in different parts of the system, resulting in a fragmented surveillance pathway. All parts of the ID surveillance system and related activities should be integrated into one system in which there is transparency and open communication in all directions.

4.2.2.2 Optimization of resources

Lack of human resources is a common complaint that echoes not only in the UAE surveillance system, but in other parts of healthcare in the UAE and other countries. Whenever there is a lack of resources, whatever those may be, optimization of the existing resources becomes imperative in order to get the best outcome. Using a single unified system for the healthcare services in UAE and using whatever resources that it has in the most effective way would certainly improve the current surveillance system.

4.3 Recommendations for further progress

Several suggestions are made to move forward and further develop our surveillance system.

4.3.1 Structure of surveillance system

Ensure the distribution of the guidelines to all healthcare personnel including practical and clinical details that including clear case definitions, laboratory confirmation criteria and an updated notifiable list with clear instructions about cases reporting.

Establish a mechanism to connect and involve stakeholders at different levels in the preparation of the ID surveillance system with their feedback to establish an effective continuous quality improvement program.

Unify the electronic system and connect it with MoHAP and include the private sectors in this system. Furthermore, the involvement and cooperation of the laboratories in this system is vital.

It is important to have multilingual personnel working on the ID surveillance system, to be able to communicate with the different nationalities.

Targeted training of health professionals, using customized material that is based on WHO training and tailored to local needs.

4.3.2 Future research in the community

For studying IID in a community like RAK, it is important to think about a mechanism to get more response from the workers group. Furthermore, these types of surveys (health related) should be supported by an authority, so the participants will feel comfortable to share their information and health concern.

When selecting the samples from a community, it is important to make sure that it is pooled from the latest updated database. Thus it is important for those authorities to update their databases to support better research.

4.4 Strengths and limitations

This study provides the first prevalence estimates for IID from a representative sample of the RAK (UAE) population. Despite the strengths of the study design, there are a number of potential limitations that need to be discussed. Recall bias (where the participants telescope their illness events in the past into the observation period) is one of the potential limitations that is frequently found in self-reported IID studies and may lead to an overestimation of IID prevalence [44, 56]. However, the participants were asked about the exact date of their symptoms in order to minimize this issue. There is also the possibility that the results in fact under-estimate the true prevalence. With this being a population-based study investigating IID, and in view of the fact that in UAE culture discussing issues related to the bathroom and excretion outside the clinical setting is considered embarrassing, it is possible that some participants did not admit to having had an IID in order to avoid an uncomfortable conversation with the interviewer. Furthermore, it is notable that there were zero cases of IID reported from participants living in group accommodation. Most of these individuals are male expatriate workers who have come to the UAE from countries endemic for infectious diseases, to make a living through skilled or unskilled labour. This finding is unusual, since many studies have found that those who are living in high-density shared accommodation are more susceptible to IID [115,117].

It is plausible that these workers feared that reporting any kind of illness might be taken against them and affect their work status and job security. In addition, it is possible that collecting such data from the migrant population using anonymous data collection methods might overcome deliberate underreporting in future studies. A final possibility is that these individuals have a relatively low socioeconomic status and as a result they have a higher tolerance to conditions such as transient fever, intestinal cramps, and diarrhoea. One point to consider is whether the study recruitment method introduced any selection bias or underrepresentation of individuals from large households. The primary aim of the sampling and recruitment strategy was to recruit a representative sample of the general population in RAK. Previous population-based telephone surveys performed by our research group in the UAE [155] found that the telephone number and billing for a household is usually linked to a male head of the household. This is primarily due to the social hierarchical structure in the UAE population [155]. In consideration of this phenomenon, it was aimed to recruit one male, one female, and one child from each household. This recruitment strategy was developed to minimize the likelihood of recruiting a predominantly male sample and to maximize the possibility of recruiting a representative sample of males, females, and children.

We did not collect data on the number of people living in each household, only whether the respondent lived alone, with a spouse, family, or non-family. It would be prudent for future population-based cross-sectional studies in the Gulf region to collect data on the number of individuals living within a household and to explore the relationship between household occupancy and the prevalence of IID. Some households in the UAE employ expatriate domestic workers to help with childcare and/or food preparation. We did not collect information on whether a

household employed a domestic worker, the number of domestic workers, or the duties performed by the domestic workers. The presence of an expatriate domestic worker within a household may potentially increase or decrease the prevalence estimates of IID in the UAE. Future studies may want to consider including these members of the household in their sampling and recruitment strategy, or at least collect information on the number of domestic workers and their role within the household.

Many surveys are prepared in one language and do not consider potential participants living in the same area and speaking a different language to the native language [120]. For example, the telephone survey in Canada was only conducted in English and 9% (n = 568) of the 6047 people did not participate due to language problems [54]. In the present study, the survey tool was produced in three languages to minimize selection bias (i.e., excluding participants due to a language barrier) and maximize the recruitment of a representative sample of the RAK population, which is a multi-national population.

It was not possible to present prevalence estimates weighted or standardized by the population composition of RAK. Accurate and reliable population estimates and composition (e.g., by nationality or by UAE national and non-national) of the RAK population are not publicly available. The UAE Government reports that RAK is the fourth largest emirate with an estimated total population of 300 000 [156]. The last publicly available census data for the UAE is from 2005, which estimated the total population of RAK to be 210 063 (61.6% male; 41.8% UAE national) [157]. The population sampled in 2017 was 57.3% male and 41.8% UAE national. However, it is not possible to gauge the true representativeness of the sample without

recent data on the population growth of the UAE national and non-national populations in RAK over the past 12 years. Finally, the prevalence estimates reported in this study can only be generalized to the RAK population. There are considerable differences in population size and composition across the seven emirates that may influence the epidemiology of IID within different emirates. Based on the last 2005 census data, Ras Al Khaimah had the fourth largest population (n = 210 063) and the second highest proportion (41.8%) of UAE nationals compared to the emirates of Abu Dhabi (n = 1 399 484; 25.0% UAE nationals), Dubai (n = 1 321 453; 10.4% UAE nationals), and Sharjah (n = 793 573; 17.4% UAE nationals), which had larger populations with a greater proportion of expatriates [157].

4.4.1 Challenges in choosing the method for contacting the participants

Face to face

One of the challenges associated with community based studies is being able to reach a target population and getting a response from them. This challenge is magnified in the communities that lack in awareness and acceptance of these kinds of studies.

Face to face method may be more accepted if the research personnel come from a healthcare facility. While this may be the preferred method to collect data from participants at health institutions or schools for example, access of researchers to participants at their home is problematic. In the UAE culture, it would not be acceptable for researchers to ring the bell and enter the home of the potential participants and so it was expected that this method may result in a lower response rate.

Email

Another way to reach the participants is by e-mail. However, because of the simple nature of our community in which the research has been done and the fact that not all have access to the e-mail may exclude many potential participants.

Telephone method

Accessing the participants by phone was the best method for the current study, although it was still considered an acceptable to ask detailed health related questions over the phone by someone who was not affiliated with a health facility or was treating the patients.

4.5 Limitation in the ID surveillance system

The findings from this study are not representative of the overall health system in the UAE, because it was conducted in one emirate only. Furthermore, it did not include the highest authority (MoHAP).

This part of the study cannot be generalized to all other emirates, because in each emirate not only is the population different, but also the healthcare system [85] and hence the surveillance system that existing within it. The surveillance system would be expected to be the same with regards basic structure and function, while being tailored to the needs and requirements of each emirate.

In this study, the quality issues of the ID surveillance system in RAK were not examined. This study only focused on the structure, core and support functions of this system.

There has never been published evaluation of the ID surveillance system in the UAE. The fact that at the time of doing the study the researcher was considered to be an outsider to the system that was being assessed, made it more challenging to get the information needed.

In conclusion, IID at the population level remains largely undetected through many surveillance methods. In this population-based study, the prevalence of IID was estimated to be 4.2% in a representative sample of the RAK population. The factors associated with IID were being female and age below 6 years. Since this is the first population-based telephone survey of IID in the UAE, it is possible that the prevalence reported is a conservative estimate. Future IID studies in the UAE may want to target specific high-risk groups such as expatriate workers living in shared accommodation, who may have a higher prevalence of IID.

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Appendices

Appendix 1: Questionnaire in Arabic

استبيان الأمراض المعدية في رأس الخيمة

مجري المقابلة	رقم الهاتف
تاريخ المقابلة	يوم المقابلة
معرف المكالمة	

اسم المشارك في الاستبيان	
رقم الهوية	
هل المشارك في الاستبيان طفل	☐ نعم ☐ لا
لو كان المشارك طفلاً، يرجى ذكر اسم وعلاقة الشخص الذي يجيب على الأسئلة	

المحاولات

المحاولة	التاريخ	الوقت (البداية)	تم إجراء الاتصال	الموافقة، المقابلة
1				
2				
3				
4				

- السلام عليكم. اسمى---------- وأتصل بالنيابة عن إدارة الصحة العامة التابعة لقسم الصحة. هل يمكنني من فضلك التحدث إلى (المشارك فى الاستبيان).
- *نود التعرف على الأمراض المعدية التي عانيت منها على مدار الأسابيع الأربعة الماضية.*
- *سنكون في غاية الامتنان إذا تفضلت بالإجابة على استبيان قصير لن يستغرق أكثر من 10 دقائق*

"هل توافق على المشاركة؟"

☐ نعم
☐ لا

"جميع المعلومات التي تقدمها مجهولة الهوية وسوف يتم التعامل معها بسرية تامة".

القسم أ: خصائص المنزل

أ1. ما هو نوع المنزل/الإقامة التي لديك؟ _____

أ2. كم عدد الأفراد الذين يعيشون في المنزل عادةً؟ _____

يعيش بمفرده	
مع الزوج/الزوجة	

مع الأسرة	
كم عدد من دون 18 عامًا؟	
كم عدد من تجاوز 18 عامًا؟	

الخادم منزلي	
كم عدد الاشخاص؟	

في مدينة جامعية أو بيئة مجتمعية	
كم عدد الأشخاص؟	

أ3. إذا كان المشارك في الاستبيان أقل من 18 عامًا، هل وافق أحد الوالدين على إجراء المقابلة مع الطفل:

هل وافق أحد الوالدين؟ ☐ نعم ☐ لا [تتوقف المقابلة في حالة عدم الموافقة]

القسم ب: المعلومات الديموغرافية الخاصة بالمشارك في الاستبيان

[اشرح أن السبب الوحيد وراء طلب هذه المعلومات هو تقييم ما إذا كان الأشخاص المشاركون في هذا الاستبيان الهاتفي ممثلين لمجموع السكان. جميع الإجابات ستظل مجهولة الهوية].

ب1. العمر بالأعوام: _____

ب2. النوع ☐ ذكر ☐ أنثى

ب3. الجنسية ☐ إماراتي ☐ غير إماراتي (حدد): _____

ب4. ما هي وظيفتك الحالية أو آخر وظيفة عملت بها؟ _____

ب5. ما هي حالتك الوظيفية الحالية؟ _____

1= في العمل
2= بلا عمل
3= طالب
4= متقاعد
5= أقوم بالاعتناء بالبيت أو الأسرة
6= مريض مرضًا طويلاً أو من ذوي الاحتياجات الخاصة
7= غير ذلك
77= لا أعلم/لست متأكدًا
99= أرفض الإجابة

ب6. هل لديك اتصال بالحيوانات في العمل أو المنزل؟

☐ نعم ☐ لا [إذا كانت الإجابة بلا، يتم الانتقال إلى ج1]

ب7. [إذا كانت الإجابة بنعم]، أين _____ نوع الحيوانات _____

طبيعة الاتصال_____

القسم ج: آخر مرة تعرضت فيها للإسهال و/أو القيء

ج1. على مدار الأسابيع الأربعة الأخيرة، هل شعرت (أو طفلك) بأي من الأعراض التالية؟ يرجى وضع علامة على جميع ما ينطبق على حالتك.

الأعراض	نعم	لا	غير متأكد	عدد الأيام [إذا كانت الإجابة بنعم، كم عدد الأيام التي استمرت فيها هذه الأعراض؟ اكتب عدد الأيام في الخانة المقابلة للأعراض]
إسهال (براز مائي رخو)				
إسهال مصحوب بدم				
قيء (مع الشعور بالمرض)				

[أجب عن الأعراض الثانوية فقط إذا تم وضع علامة على أي من الأعراض المذكورة أعلاه، في حالة عدم وجود أعراض، يتم الانتقال مباشرة إلى د1]

الأعراض الثانوية	نعم	لا	غير متأكد
غثيان (مع الشعور بالمرض)			
ألم بالبطن (ألم بالمعدة)			
فقدان الشهية			
درجة حرارة مرتفعة (الرعشة والعرق)			
سعال ورشح وانسداد الأنف والتهاب الحلق			
صداع			

ج2. هل لا يزال أي من هذه الأعراض موجودًا؟ يرجى وضع علامة في المربع المناسب

الأعراض	نعم	لا	غير متأكد
الإسهال (براز مائي رخو)			
إسهال مصحوب بدم			
قيء (مع الشعور بالمرض)			

ج3. في أي يوم (يوم/شهر/عام) بدأ الإسهال و/أو القيء؟

___ / ____ / _____

ج4. [إذا كانت الإجابة بنعم على الشعور بالإسهال في السؤال ج1]، كم مرة دخلت (دخل طفلك) الحمام في أكثر يوم (24 ساعة) شعرت فيه بهذا المرض؟

عدد المرات _____غير متأكد_____

ج5. [إذا كانت الإجابة بنعم على الشعور بالقيء في السؤال ج1]، كم مرة تقيأت (أو طفلك) في أكثر يوم (24 ساعة) شعرت فيه بهذا المرض؟

عدد المرات _____غير متأكد_____

[ملاحظة – لا تدفع المشارك للإجابة بعدم التأكد – سنحاول دائمًا الحصول على تقدير لعدد المرات]

ج6. هل ذهبت (أو أخذت طفلك) للطبيب بخصوص هذا المرض؟
☐ نعم ☐ لا [إذا كانت الإجابة بلا، يتم الانتقال إلى ج9]

ج7. [إذا كانت الإجابة بنعم]، في أي يوم (يوم/شهر/عام) ذهبت (أو أخذت طفلك) للطبيب لأول مرة بخصوص هذه الأعراض؟

___ / ____ / _____

ج8. [إذا قمت باستشارة طبيبك الممارس العام]، هل كان الغرض الحصول على التشخيص والعلاج أم بسبب طلبك الحصول على شهادة طبية للعمل؟
☐ التشخيص والعلاج ☐ شهادة طبية للعمل

ج9. هل قمت بالتواصل مع أي خدمات أخرى أثناء فترة مرضك (أو طفلك)؟

مقدم خدمات خارج ساعات العمل	
المراكز الصحية التي لا تشترط الحصول على موعد مسبق	
المشورة من أحد الصيادلة	
المواقع الإلكترونية المرتبطة بالصحة	
النقاش مع ممرضة ممارسة	
لا يوجد	

شدة المرض:

ج10. هل منعك مرضك (أو مرض طفلك) من ممارسة أنشطتك اليومية العادية؟
☐ نعم ☐ لا ☐ غير متأكد

ج11. هل منعك مرضك (أو مرض طفلك) من الذهاب إلى العمل أو المدرسة؟
☐ نعم ☐ لا ☐ غير متأكد
[إذا كانت الإجابة بنعم]، كم عدد الأيام؟ _____

ج12. هل تأثر شخص آخر بمرضك (أو مرض طفلك)؟
☐ نعم ☐ لا
[إذا كانت الإجابة بنعم]، اذكر التفاصيل
_____

الأدوية المستخدمة:

ج13. هل تناولت (أو طفلك) أي أدوية لهذه الأعراض؟
☐ نعم ☐ لا [إذا كانت الإجابة بلا، يتم الانتقال إلى ج17]

ج14. [إذا كانت الإجابة بنعم]، هل تناولت أدوية بدون وصفة أم بوصفة طبية؟

(أ) بدون وصفة طبية: ☐ نعم ☐ لا

(ب) بوصفة طبية: ☐ نعم ☐ لا

(ج) غير ذلك، يرجى التحديد _____

ج15. اسم الدواء (الأدوية)؟ _____

ج16. على مدار كم يوم تناولت الأدوية؟ _____

دخول المستشفى:

ج17. هل ذهبت (أو أخذت طفلك) إلى أي قسم من أقسام المستشفى بسبب هذه الأعراض؟
☐ نعم ☐ لا

ج18. هل دخلت (أو طفلك) المستشفى؟
☐ نعم ☐ لا [إذا كانت الإجابة بلا، يتم الانتقال إلى ج20]

ج19. كم يوم أمضيت (أو أمضى طفلك) في المستشفى _____(اكتب "صفر" إذا كانت الإجابة بالنفي)

التحليل:

ج20. هل طُلِبَ منك (أو من طفلك) تقديم عينة براز للتحليل؟

☐ نعم ☐ لا [إذا كانت الإجابة بلا، يتم الانتقال إلى ج22أ] ☐ غير متأكد

ج21. [إذا كانت الإجابة بنعم]، ماذا كانت نتيجة التحليل الخاص بك (أو بطفلك)؟
1= السالمونيلا
2= العطيفة
3= الشيغيلة
4= الإشريكية القولونية
5= فيروس
6= غير ذلك (يرجى التحديد)_____
77= لا أعلم/لست متأكدًا
99= أرفض الإجابة

ج22أ. هل تعاني (أو طفلك) من أي إسهال متكرر أو أي مرض مزمن آخر يرتبط بالأمراض المعوية؟
☐ نعم ☐ لا [إذا كانت الإجابة بلا، يتم الانتقال إلى متلازمة القولون العصبي 1]

ج22ب. [إذا كانت الإجابة بنعم]، يرجى التحديد _____

مرض/متلازمة القولون العصبي:

1. هل تم إخبارك (أو طفلك) أنك تعاني من متلازمة القولون العصبي؟
☐ نعم ☐ لا [إذا كانت الإجابة بلا، يتم الانتقال إلى ج23أ]

2. [إذا كانت الإجابة بنعم]، ما طول المدة التي عانيت (أو طفلك) منها؟ _____

3. من أخبرك بأنك (أو طفلك) تعاني من متلازمة القولون العصبي؟
☐ الطبيب ☐ غيره من الطاقم الطبي ☐ تشخيص ذاتي ☐ غير ذلك

4. هل عانيت (أو طفلك) من أعراض متلازمة القولون العصبي في الشهر الماضي؟
☐ نعم ☐ لا

ج23أ. هل أجريت (أو طفلك) جراحة في المعدة أو الأمعاء، والتي ربما قد سببت الإسهال نتيجة لها في الأشهر الستة الماضية؟ ☐ نعم ☐ لا [إذا كانت الإجابة بلا، يتم الانتقال إلى ج24]

ج23ب. [إذا كانت الإجابة بنعم]، يرجى التحديد
_____

ج24. ماذا تعتقد أنه مسئول عن مرضك (أو مرض طفلك)؟

ج27أ. الطعام [يعتقد الشخص المشارك في الاستبيان أن العدوى من الطعام]	
ج27أ. المياه [يعتقد الشخص المشارك في الاستبيان أن العدوى من المياه]	
ج27ب. عدوى – انتقال العدوى من شخص لآخر	
ج27ج. غثيان الصباح	
ج27د. خمار	
ج27هـ. انسداد في الحلق (يسبب القيء)	
ج27و. مرض مزمن (مثل متلازمة القولون العصبي أو داء كرون)	
ج27ز. جراحة حديثة في المعدة/الأمعاء	
ج27ح. تناول أدوية	
ج27ط. غير ذلك	

القسم د: حالات العدوى الأخرى

د1. هل أصبت (أو طفلك) بأي عدوى أخرى في الأسابيع الأربعة الأخيرة؟

☐ نعم ☐ لا [إذا كانت الإجابة بلا، يتم الانتقال إلى هـ1]

د2. طبيعة العدوى

☐ عدوى الجهاز التنفسي ☐ عدوى العين أو الأذن أو الأنف أو الفم

☐ عدوى الجلد ☐ عدوى المسالك البولية ☐ عدوى أخرى

د3. تاريخ البداية: يوم/شهر/عام ___ / ____ / _____

د4. المدة: _____

د5. هل ذهبت (أو طفلك) للطبيب؟ ☐نعم ☐ لا

د6. هل تناولت (أو طفلك) أدوية؟ ☐ نعم ☐ لا

د7. هل دخلت (أو طفلك) المستشفى؟ ☐نعم ☐ لا

د8. هل تلقيت (أو طفلك) علاجًا آخر (جراحة)؟ ☐ نعم ☐ لا

د9. ما هي "الجرثومة" التي سببت العدوى؟

☐ بكتيريا ☐ فيروس ☐ فطريات ☐ غير متأكد

القسم هـ: السفر للخارج في الأسبوعين السابقين لبدء المرض

هـ1: هل سافرت (أو طفلك) خارج دولة الإمارات العربية المتحدة في الأسبوعين الماضيين أو في الأسبوعين السابقين لبدء المرض؟

☐ نعم ☐ لا [إذا كانت الإجابة بلا، يتم الانتقال إلى و1]

هـ2. [إذا كانت الإجابة بنعم]، كم المدة بالأسابيع _____، كم المدة بالأيام _____

هـ3. ما هو تاريخ سفرك (أو طفلك) بالخارج؟

تاريخ البداية: يوم/شهر/عام ___ / ____ / _____

تاريخ الانتهاء: يوم/شهر/عام ___ / ____ / _____

هـ4. إذا أقمت (أو طفلك) بالخارج، يرجى توضيح اسم الدولة/الدول _____

القسم و. بيانات شخصية إضافية

و1. أين تسكن في رأس الخيمة؟ _____

و2. هل تعمل في رأس الخيمة؟ ☐ نعم ☐ لا [إذا كانت الإجابة بلا، يتم الانتقال إلى و4]

و3. [إذا كانت الإجابة بنعم]، أين تعمل في رأس الخيمة؟ _____

و4. ما هي حالتك الاجتماعية؟
1= أعزب [يتم الانتقال إلى و6]
2= متزوج
3= منفصل/مطلق
4= أرمل
77= لا أعلم/لست متأكدًا [يتم الانتقال إلى و6]
99= أرفض الإجابة [يتم الانتقال إلى و6]

[إذا كانت الإجابة عن السؤال و4 الخيار رقم 2 أو 3 أو 4، يتم الانتقال إلى و5]

و5. هل لديك أطفال؟
1= نعم
2= لا
77= لا أعلم/لست متأكدًا
99= أرفض الإجابة

و6. ما هو أعلى مستوى تعليمي وصلت إليه؟
1= لم أذهب إلى مدرسة / لا يوجد تعليم مدرسي رسمي
2= أكملت المدرسة الابتدائية
3= أكملت المدرسة الإعدادية
4= أكملت المدرسة الثانوية
5= حصلت على شهادة جامعية
6= حصلت على درجة الماجستير أو الدكتوراه
77= لا أعلم/لست متأكدًا
99= أرفض الإجابة

و7. ما هو متوسط إجمالي الدخل الشهري لأسرتك بالدرهم الإماراتي؟
1= أقل من 5.000
2= 5.000 إلى 14.999
3= 15.000 إلى 24.999
4= 25.000 إلى 34.999
5= أكثر من 35.000
77= لا أعلم/لست متأكدًا
99= أرفض الإجابة

و8. إذا كنا بحاجة إلى طرح المزيد من الأسئلة، هل يمكننا الاتصال بك مرة ثانية؟
☐ نعم ☐ لا

شكرًا جزيلاً على حسن تعاونكم! إذا كان لديكم استفسارات أو تعليقات، يرجى الاتصال بالشخص التالي:
فاطمة حمدان العلكيم الزعابي
052- 6009175 – 050- 4536444

تعليقات مجري المقابلة:

Appendix 2: Questionnaire in English

Survey of Infectious Disease in Ras Al Khaimah

Interviewer	Telephone number
Date of interview	Day of interview
Call ID	

Name of subject	
Subject ID No.	
Is subject a child	☐ Yes ☐ No
If subject is a child, Name and relation of person answering questions	

Attempts

Attempt	Date	Time (start)	Contact made	Consent, interview
1				
2				
3				
4				

- Hello. My name is _____ and I'm calling on behalf of the Public Health Department of the Health Division. May I please speak to (subject) or (parent in case of a child).

- *We would like to find out about infectious illness experienced in the four weeks.*

- *We would be very grateful if you could answer a brief questionnaire, which should take no longer than 10 minutes.*

"Do you consent to take part?"

☐Yes

☐ No

All information you provide is anonymous and will be treated in strict confidence".

Section A: Household Characteristics

A1. What sort of house/accommodation do you have?

_____

A2. How many people usually live in your household?

_____

Alone	
With spouse	

With family	
How many are under 18 years old?	
How many are over 18 years old?	

As domestic servant	
How many persons?	

In a dormitory or communal setting	
How many persons?	

A3. If the subject of the survey is under 18 years, was parental consent given to interview the child:

Was parental consent given? ☐ Yes ☐ No [No consent, interview halts]

Section B. Demographic information on respondent

[Explain that we only require this information to assess whether the people participating in this Telephone Survey are representative of the general population. All responses will remain anonymous].

B1. Age in years: _____

B2. Sex: ☐ Male ☐ Female

B3. Nationality: ☐ Emirati ☐ Non-Emirati (specify): _____

B4. What is your current or most recent occupation?

_____

B5. What is the current employment status?

1= At work
2= Unemployed
3= Student
4= Retired
5= Looking after home or family
6= Long-term sick or disabled
7= Other
77= DK/NS
99= Refused

B6. Do you have contact with animals at work or home?
☐ Yes ☐ No [If "No" go to C1]

B7. [If "Yes"], Where_____ Type of animals_____

Nature of contact_____

Section C: Recent experience with diarrhea and/or vomiting

C1. In the past four weeks have you *(your child)* experienced any of the following symptoms? Please tick all that apply.

Symptom	Yes	No	Not Sure	Number of Days [If answered "Yes" How many days did these symptoms last? Write the number of days in the box]
Diarrhea (loose watery bowel movements)				
Diarrhea with blood in it				
Vomiting (being sick)				

[Only answer secondary symptoms if one of above symptoms ticked, for no symptoms go straight to D1]

Secondary Symptom	Yes	No	Not Sure
Nausea (feeling sick)			
Abdominal pain (tummy pain)			
Loss of appetite			
High temperature (shivering and sweating)			
Cough, runny/blocked nose, sore throat			
Headache			

C2. Are any of these symptoms still present? Please tick

Symptom	Yes	No	Not Sure
Diarrhea (loose watery bowel movements)			
Diarrhea with blood in it			
Vomiting (being sick)			

C3. On what date (DD/MM/YYYY) did the diarrhea and/or vomiting begin?

___ / ____ / _____

C4. [If you answered "Yes" to having diarrhea in Question C1], how many times did you *(your child)* go to the toilet on the worst day (24 hours) of this illness?

Number of times_____ Not sure_____

C5. [If you answered "Yes" to vomiting in Question C1], how many times did you *(your child)* vomit on the worst day (24 hours) of this illness?

Number of times_____ Not sure_____

[NB – Do not prompt "Not Sure" as a response –we will always try to get an estimate of frequency]

C6. Have you been *(take your child)* to see the doctor about this illness?
☐ Yes ☐ No [If "No" go to C9]

C7. [If "Yes"], on what date (DD/MM/YYYY) did you *(your child)* first see the doctor about these symptoms?

___ / ____ / _____

C8. [If you consulted your doctor GP], was it to seek diagnosis and treatment or because you required a medical certificate for work?

☐ Diagnosis & treatment ☐ Certificate for work

C9. Did you contact any other service during the course of your *(your child's)* illness?

Out of hours provider	
Walk in centre	
Advice from pharmacist	
health related websites	
Discuss with practice nurse	
None	

Severity of illness:

C10. Did your *(your child's)* illness prevent you from going about your normal daily activities?

☐ Yes ☐ No ☐ Not sure

C11. Did your *(your child's)* illness stop you from going to work or to school?

☐ Yes ☐ No ☐ Not sure

[If "Yes"], how many days? _____

C12. Was anyone else affected by your *(your child's)* illness?

☐ Yes ☐ No

[If "Yes"], details_____

Medications used:

C13. Did you *(your child)* take any medications for the symptoms?

☐ Yes ☐ No [If "No" go to C17]

C14. [If “Yes”], Did you get the medication over the counter or on prescription?

(a) Over the counter: ☐ Yes ☐ No

(b) On prescription: ☐ Yes ☐ No

(c) Other, please specify_____

C15. Name of medication(s)? _____

C16. How many days were medications taken for?
_____

Hospitalization:

C17. Did you go *(take your child)* to any hospital department due to these symptoms?
☐ Yes ☐ No
C18. Were you *(was your child)* admitted to hospital?
☐ Yes ☐ No [If “No” go to C20]

C19. How many days did you *(your child)* spend in hospital_____ *(enter ‘0’ if none)*

Testing:

C20. Were you *(your child)* asked to submit a stool sample for testing?
☐ Yes ☐ No [If “No” go to C22A] ☐ Not Sure

C.21. [If “Yes”], what was the result of your (*your child’s*) test?
1=Salmonella
2=Campylobacter
3=Shigella
4=E. coli
5=Virus
6=Other (specify)_____
77= DK/NS
99= Refused

C22A. Do you *(your child)* suffer from any relapsing diarrhea or other chronic illness related to intestinal disease?
☐ Yes ☐ No [If “No” go to IBS1]

C22B. [If “Yes”], please specify _____

Irritable Bowel disease/syndrome:

IBS1. Have you *(your child)* ever been told you have IBS?
☐ Yes ☐ No [If "No" go to C23A]

IBS2. [If "Yes"], how long have you *(your child)* suffered from it?
_____

IBS3. Who told you *(your child)*, you had IBS?
☐ Doctor ☐ Other medical staff ☐ Self-diagnosed ☐Other

IBS4. Have you *(your child)* had your IBS symptoms in the past month?
☐ Yes ☐ No

C23A. Have you *(your child)* had any stomach or bowel surgery which may have caused diarrheal illness as a consequence in the past six months?
☐ Yes ☐ No [If "No" go to C24]

C23B. [If "Yes"], please specify:
_____

C24. What do you think was responsible for your *(your child)* illness?

C24A. food [Subject thinks infection from food]	
C24B. water [Subject thinks infection from water]	
C24C. Infection - person to person spread	
C24D. Morning sickness	
C24E. Hangover	
C24F. Obstruction in throat (causing vomiting)	
C24G. Chronic illness (e.g. IBS, Crohns disease)	
C24H. Recent stomach/bowel surgery	
C24I. Medication	
C24J. Other	

Section D: Other infections

D1. Have you *(your child)* had any other infection in the past 4 weeks?
☐ Yes ☐ No [If "No" go to E1]

D2. Nature of infection
☐Respiratory tract infections ☐Eye, Ear, Nose & Mouth infections

☐Skin infections ☐Urinary tract infections ☐Other infections

D3. Start date: DD/MM/YYYY ___ / ____ / _____

D4. Duration: _____

D5. Did you *(your child)* see a doctor? ☐ Yes ☐ No

D6. Did you *(your child)* take medication? ☐ Yes ☐ No

D7. Were you *(your child)* admitted to hospital? ☐ Yes ☐ No

D8. Did you *(your child)* have any other treatment (surgery)?
☐ Yes ☐ No

D9. What was the "germ" causing this infection?
☐ Bacteria ☐ Virus ☐ Fungi ☐ Not sure

Section E. Foreign travel in the two weeks before your illness started

E1. Did you *(your child)* travel outside the UAE in the last two weeks, or in the two weeks before you became ill?
☐ Yes ☐ No [If "No" go to F1]

E2. [If "Yes"], how long in weeks _____, how long in days _____

E3. What dates were you *(your child)* away?

Start date: DD/MM/YYYY___ / ____ / _____

End date: DD/MM/YYYY___ / ____ / _____

E4. If you *(your child)* stayed aboard please state which country/countries _____

Section F. Further personal details

F1. Where in RAK do you live? _____

F2. Do you work in RAK? ☐Yes ☐No [If "No" go to F4]

F3. [If “Yes”], Where in RAK do you work? _____

F4. What is your marital status?

1=Single [go to F6]
2=Married
3=Separated/divorced
4=Widowed
77= DK/NS [go to F6]
99= Refused [go to F6]

[If CODED 2-4 at F4 go to F5]

F5. Do you have children?

1 = Yes
2 = No
77= DK/NS
99= Refused

F6. What is your highest education level?

1=Did not attend school /no formal schooling
2=Completed primary school
3=Completed intermediate school
4=Completed secondary school
5=Completed college or university
6=Completed Master or PHD
77= DK/NS
99= Refused

F7. What is the average total monthly income received by your household in AED?

1=Less than 5,000
2=5,000 to 14,999
3=15,000 to 24,999
4= 25,000 to 34,999
5=Greater than 35,000
77= DK/NS
99= Refused

F8. If we need to ask further questions, may we contact you again?

☐ Yes ☐ No

Thank you very much for your cooperation! If you have questions or comments, please contact the following persons:
Fatima Hamdan Al-Alkeem Al-Zaabi
050- 4536444, 052- 6009175

INTERVIEWER COMMENTS:

Appendix 3: Questionnaire in URDU

Survey of Infectious Disease in Ras Al Khaimah

Interviewer	Telephone number
Date of interview	Day of interview
Call ID	

Name of subject	
Subject ID No.	
Is subject a child	☐ Yes ☐ No
If subject is a child, Name and relation of person answering questions	

Attempts

Attempt	Date	Time (start)	Contact made	Consent, interview
1				
2				
3				
4				

- Hello. Mera nam _____ or mai Public Health Department of the Health Division se tarafse. Aape se bat kar saktaho?
- Hamlog apsi bochna chahrahaihi kya in char haftah me koi bemari aai?

- *We would be very grateful if you could answer a brief questionnaire, which should take no longer than 10 minutes.*

"Do you consent to take part?"

☐Ha
☐ Na

All information you provide is anonymous and will be treated in strict confidence".

Section A: Household Characteristics

A1. Aap kis tharah ke qar par rahthe ho?_____

A2. Kitne log aap ke qar par rahthe ho?_____

Akele ho	
Beevi ke saath	

Qarwalom ke saath	
18 saal ki umr se kam kitne he?	
18 saal ki umr se oopar kitne he?	

Qar ki nokrani	
kitne log saat me he?	

Kamare mem ya logom ke beech mem	
kitne log saat me he?	

A3. Agar Aap ki umra athara (18) saal se kam hai, gharwalo ki ijazat li hai:

Ijazat li hai ? ☐ Ha ☐ Na [No consent, interview halts]

Section B. Demographic information on respondent

[Explain that we only require this information to assess whether the people participating in this Telephone Survey are representative of the general population. All responses will remain anonymous].

B1. Umra (saal): _____

B2. Sex: ☐ Male ☐ Female

B3. Nationality: ☐ Emirati ☐ Non-Emirati (Kaun se muluk se ho): _____

B4. Abhi kya kaam karthe ho /aakhiri kaam kon sa tha? _____

B5. Abhi aap kis position me kaam karthe ho? _____
1= Nokari
2= koi kaam nahi
3= Padayi karthe
4= Avkaash
5= Qarwalom ko dekbhal karthe ho
6= Beemar ho ya vikalang ho
7= koi aor karan
77= DK/NS
99= Mana karna

B6. Qar ya kaam par koi jaanwar se sampark he?
☐ Ha ☐ Na [If “No” go to C1]

B7. [If “Yes”], kaha_____ kis thrah jaanwar_____
kis thrah ka sampark_____

Section C: Recent experience with diarrhea and/or vomiting

C1. Pichle chaar haphthom me aap (aapke bache) ko dast/ ya ulti? Please tick all that apply.

Symptom	Ha	Nahi	Malum nahi	Number of Days [If answered “Yes” How many days did these symptoms last? Write the number of days in the box]
Dast				
Dast mem qoon				
Ulti				

[Only answer secondary symptoms if one of above symptoms ticked, for no symptoms go straight to D1]

Secondary Symptom	Ha	Nahi	Nahi maloom
Jee michlana			
Pet dard			
Bhook nahi lagana			
Bhukar			
Qansi, jukam, gale mem dard			
Sar dard			

C2. Se sare lakshan abhi bhi he kya?

Symptom	Ha	Nahi	Nahi maloom
Dast			
Dast mem qoon			
Ulti			

C3. Kon si thareeq ko dasth, ulti, shuroo hua?

___ / ____ / _____

C4. [If you answered “Yes” to having diarrhea in Question C1], Kitni dafa toilet gaye ho (24 qantah) is beemari sah?

Kitni bar _____ Malum nahi _____

C5. [If you answered “Yes” to vomiting in Question C1] , Kitni baar ulti kiya (24 qantah) is beemari sah?

Kitni bar _____ Malum nahi _____

[NB – Do not prompt “Not Sure” as a response –we will always try to get an estimate of frequency]

C6. Kya aap (aapke bache) ko doctor ko dikaya?

☐ Ha ☐ Na [If “No” go to C9]

C7. [If “Yes”], Kon si taarikh ko (DD/MM/YYYY) aap (aapke bache) pahli baar docor ke pas gaye thay ?

___ / ____ / _____

C8. Kisi doctor ke paas ilaj keliye gaye ya certificate keliye gaye?
☐ Ilaj keliye ☐ Certificate keliye

C9. Beemari ke samay aapne (aapke bache) kisi aur ki seva lee?

Kamka ke samay ke alava	
Clinic me gaye	
Pharmacy se salah leliye	
Website pe search kiya	
Kisi nurse ko puchha	
Khoi nahi	

Severity of illness

C10. Kya beemari ke karan aap (aapke bache) ko apna roj ka kaam nahi kar sakthe thay?
☐ Ha ☐ Na ☐ Malum nahi

C11. Beemari ke vajah se aap (aapke bache) kaam par ya school nahi ja sakthe thay?
☐ Ha ☐ Na ☐ Malum nahi

[If "Yes"], Kitni denh? _____

C12. Aap ki (aapke bache) beemari ka asar kisi aur par hua he kya ?
☐ Ha ☐ Na ☐ Malum nahi
[If "Yes"], Kiskoh_____

Medications used

C13. Aapne koi dawa li is beemari ke liye?
☐ Ha ☐ Na [If "No" go to C17]

C14. [If “Yes”], Aapne (aapke bache) dawa Dr ki parchi se li ya bina parchi ke?

(a) Bina parchi ke: ☐ Ha ☐ Na

(b) Parchi se: ☐ Ha ☐ Na

(c) Or koi tarike se, to batavo _____

C15. Dawa ka naam ? _____

C16. Kitne dinom thak dawa li ? _____

C17. Hospitalization /Aap kisi hospital me gaye thay?
☐ Ha ☐ Na

C18. Hospital me bharthi huey thay ?
☐ Ha ☐ Na [If “No” go to C20]

C19. kitne din hospital me bharthi rahe (enter ‘0’ if none)
_____

Testing

C20. Aapne apna (aapke bache) maal test kiya?
☐ Ha ☐ Na [If “No” go to C22A] ☐ Malum nahi

C.21. [If “Yes”], Natheeja kya tha mal test ka?
1=Salmonella
2=Campylobacter
3=Shigella
4=E. coli
5=Virus
6=Other (specify)_____
77= DK/NS
99= Nahi batana chahri

C22A. Aap (aapke bache) ko bar bar pet ki taklif ya bimari (dast) hoti?
☐ Ha ☐ Na [If “No” go to IBS1]

C22B. [If “Yes”], or to batao _____

Irritable Bowel disease/syndrome:

IBS1. Aap (aapke bache) ko Kesine pataya IBS hai?
☐ Ha ☐ Na [If “No” go to C23A]

IBS2. [If “Yes”], aap (aapke bache) ko yeh pemari kapsi hai?
_____

IBS3. Aap (aapke bache) ko Kesne pataya IBS hai?
☐ Doctor ☐ Qoi our hospital si ☐ Khod ko pata chala ☐Malum nahi

IBS4. Aap (aapke bache) ko IBS alamat mahsoos hoa pechle maheni?
☐ Ha ☐ Na

C23A. Aap (aapke bache) ko koi pet ka operation kiya aur iske baad dast ka problem hua chai mahine thak ?
☐ Ha ☐ Na [If “No” go to C24]

C23B. [If “Yes”], or to batao:
_____

C24. Aap (aapke bache) ko ye bemare kaise howe?

C24A. Kana [Subject thinks infection from food]	
C24B. Panei [Subject thinks infection from water]	
C24C. Infection – kese se lage	
C24D. Supamai koch takleef	
C24E. Benase	
C24F. Gale ka takleef (causing vomiting)	
C24G. Roos ka bemari (e.g. IBS, Crohns disease)	
C24H. Pet ka koi operation	
C24I. koi dawayiam kaatha he	
C24J. Koi or tarike se	

Section D. Other infections

D1. Aapk (aapke bache) ko koi aur beemari ya infection hai pichle chaar hafthom meh?
☐ Ha ☐ Na [If “No” go to E1]
D2. kis tarah ka infection
☐ Sasqi bemare hai ☐ Aaq,Kan, Naq or Mo ka bemare

☐ Jeld ke bemare ☐ Beshab mai koi takleef hai ☐ Koi or bemare

D3. Shuroo kab hua: DD/MM/YYYY ___ / ____ / _____
D4. kitne din: _____

D5. Aap (aapke bache) ko Dr ko dikaya? ☐ Ha ☐ Na

D6. Aap (aapke bache) ko dawa li? ☐ Ha ☐ Na

D7. Aap (aapke bache) ko hospital meh bharthi huy kya?
☐ Ha ☐ Na

D8. Aap (aapke bache) ko koi aur ilaj kiya kya? ☐ Ha ☐ Na

D9. Roganu kon sa tha?
☐ Bacteria ☐ Virus ☐ Fungi ☐ Maloom nahi

Section E. Foreign travel in the two weeks before your illness started

E1. Aap (aapke bache) ko beemari ke do haphthe pahle UAE ke bahar gaye thay?
☐ Ha ☐ Na [If "No" go to F1]

ya thay

E2. [If "Yes"], kitne haphthe ke liye _____, kitne din ke liye_____
E3. Konsi taryek ko paher tai?

Taryek ka shoro: DD/MM/YYYY___ / ____ / _____

Taryek ka khatam: DD/MM/YYYY___ / ____ / _____

E4. Aap (aapke bache) ko kon si country me tahare thay? _____

Section F. Further personal details

F1. RAK me kaha rahthe ho? _____

F2. Kya aap RAK me kaam karthe ho kya? ☐Ha ☐Na [If "No" go to F4]

F3. [If "Yes"], RAK me kaha kaam kartha ho? _____

F4. Shaadi shuroo ho kya?

1=Nahi howi [go to F6]
2=Shadi shoda hai
3=Separated/talaq
4=Widowed/baiwa
77= DK/NS [go to F6]
99= Nahi batana chahri [go to F6]
[If CODED 2-4 at F4 go to F5]

F5. Bache he kya?

1 = Ha
2 = Na
77= DK/NS
99= Nahi batana chahri

F6. Parayi kaha thak ki?

1=School nahi qaya
2=Completed primary school
3=Completed intermediate school
4=Completed secondary school
5=College ko qaya
6=Master ya PHD parleiah
77= DK/NS
99= Nahi batana chahri

F7. Mahina mem kitna income he AED me?

1= 5,000 se kam
2=5,000 to 14,999
3=15,000 to 24,999
4= 25,000 to 34,999
5= 35,000 se zeyada
77= DK/NS
99= Nahi batana chahri

F8. Aap se agar aur zyada jankari chahyie tho kya hum aap se baath kar sakthe he kya?

☐ Ha ☐ Na

Thank you very much for your cooperation!
If you have questions or comments, please contact the following persons:

Fatima Hamdan Al-Alkeem Al-Zaabi
050- 4536444, 052- 6009175

INTERVIEWER COMMENTS:

Appendix 4: RAK medical district approval

UAEU Faculty of Medicine and Health Sciences

جامعة الإمارات العربية المتحدة
United Arab Emirates University

Date: November 3, 2014

التاريخ: 3 نوفمبر 2014

Dr. Abdullah Al Naemi
Director of Ras Al Khaimah Medical District
Ras Al Khaima

سعادة الدكتور عبد الله النعيمي
مدير منطقة رأس الخيمة الطبية
رأس الخيمة

Dear Sir,

تحية طيبة وبعد ، ، ،

Re: **Data for PhD Project**

الموضوع : **معلومات لمشروع بحث طالبي**

As part of her PhD research fulfillment, our student **Ms Fatima Hamdan Al Alkeem Al Zaabi**, No. 201280047 has to conduct a a PhD research study on "**Infectious Disease Surveillance Systems in Ras Al-Khaimah**".

نرجو أن نفيدكم بأن الطالبة **فاطمة حمدان عليكم الزعابي**، من طلاب الدكتوراة بكلية الطب والعلوم الصحية بجامعة الإمارات العربية المتحدة. وكجزء من متطلبات دراستها ترغب المذكورة فى اجراء دراسة بحثية عن: **"نظم مراقبة الأمراض المعدية بمنطقة رأس الخيمة الطبية "**.

To do this she would like to collect data from the relevant units in charge of infectious disease surveillance in Ras Al Khaimah Medical District, during the period from November 2014 to December, 2015.

وتمهيدا لإنجاز الدراسة ترغب المذكورة فى اللقاء بالمسؤولين عن الوحدات المسؤولة عن مراقبة الأمراض المعدية بمنطقة رأس الخيمة الطبية وذلك بغرض تجميع البيانات، وذلك خلال الفترة من نوفمبر الجاريالحالي وحتي ديسمبر 2015.

I should be most grateful if you could extend to her all possible assistance to carry out her research project.

وعليه نرجو منكم التكرم بالإيعاز لمن يلزم بالسماح لها ومساعدتها في تجميع المعلومات والبيانات المطلوبة لإنجاز البحث المشار اليه.

Yours faithfully,

وتفضلوا بقبول وافر الشكر والتقدير ، ، ،

Dr. Iain Blair,
Acting Chairman,
Institute of Public Health,
College of Medicine & Health Sciences,
United Arab Emirates University

د. إيان بلير
رئيس معهد الصحة العامة بالإنابة
كلية الطب والعلوم الصحية
جامعة الإمارات العربية المتحدة

c.c. Ast. Dean for Students Affairs
CMHS

* نسخة لسعادة العميد المساعد لشؤون الطلاب
كلية الطب والعلوم الصحية

Appendix 5: Infectious diseases case notification form

United Arab Emirates
MINISTRY OF HEALTH
Preventive Medicine Department _____

دولة الإمارات العربية المتحدة
وزارة الصحة
إدارة الطب الوقائي _____

Infectious Disease Case Notification Form نموذج التبليغ عن الأمراض المعدية

Name: _____ الاسم الثلاثي: _____

Nationality: _____ الجنسية: D.O.B: ___/___/___ تاريخ الميلاد: Age: ___ العمر: Sex: _____ الجنس: _____

Place of Work: _____ مكان العمل: Occupation: _____ المهنة: _____

Residence Address/Street: _____ شارع: Area: _____ الحي: City: _____ عنوان السكن / المدينة: _____

Mobile: _____ هاتف متحرك: Work Tel.: _____ هاتف العمل: Home Tel.: _____ هاتف المنزل: _____

Sponsor's Mob.: _____ متحرك الكفيل: Sponsor's Name: _____ اسم الكفيل _____

Health Card No. | | | | | | | | | | | | | | رقم البطاقة الصحية: _____

Signature: _____ توقيع الطبيب: _____

Doctor's Name: _____ اسم الطبيب: _____

Hospital / Clinic: _____ مستشفى / عيادة: _____

Date of Notification: ___/___/___ تاريخ البلاغ: ___/___/___

Stamp الختم الرسمي

Date of Onset: ___/___/___ تاريخ بداية المرض: ___/___/___

Diagnosis: _____ التشخيص: _____

Laboratory Investigation: Yes ☐ No ☐ الفحص المخبري: ☐ نعم ☐ لا

Hospital Referral: Yes ☐ No ☐ هل حول المريض الى المستشفى؟ ☐ نعم ☐ لا

Date of Admission: ___/___/___ تاريخ الدخول: ___/___/___

Hospital Name: _____ اسم المستشفى: _____

Ward: _____ قسم الدخول: _____

Hospital File #: _____ رقم ملف المستشفى: _____

التبليغ الفوري: الرجاء الابلاغ عن الحالات المؤكدة والمشتبه بها هاتفياً وارسال النموذج بالفاكس (الارقام خلف النموذج)

A. Immediately Reportable Diseases : Please notify suspected/confirmed case(s) immediately by telephoning & fax (numbers on back)

- ☐ AFP / Poliomyelitis ☎
- ☐ Anthrax ☎
- ☐ Botulism ☎
- ☐ Cholera ☎
- ☐ Diphtheria ☎
- ☐ Encephalitis ☎
- ☐ Food Poisoning ☎ Specify:_____
- ☐ Heamophilus influenzae b (Hib) ☎
  - ☐ epiglottitis ☎ ☐ Meningitis ☎
- ☐ HIV / AIDS ☎
- ☐ Legionellosis ☎
- ☐ Leprosy ☎
- ☐ Measles ☎
- ☐ Meningitis ☎
  - ☐ Meningococcal ☎
  - ☐ Other: _____ (Specify)
- ☐ Plague ☎
- ☐ Rabies ☎
- ☐ Relapsing fever ☎
- ☐ Rubella ☎ ☐ Congenital rubella syndrome
- ☐ Tetanus ☎ ☐ Neonatal Tetanus ☎
- ☐ Tuberculosis - Pulmonary ☎
- ☐ Typhoid / Paratyphoid fever ☎
- ☐ Typhus ☎
- ☐ Viral haemorrhagic fevers ☎
- ☐ Yellow fever ☎

B. Weekly Reportable Diseases : التبليغ الاسبوعي:

- ☐ Amoebiasis
- ☐ Chickenpox
- ☐ Giardiasis
- ☐ Hepatitis
  - ☐ A ☐ B ☐ C ☐ D ☐ E
- ☐ Influenza
- ☐ Intestinal Worms ☐ Ascaris ☐ Taeniasis
  - ☐ Other:_____ (Specify)
- ☐ Malaria
- ☐ Mumps
- ☐ Pertussis
- ☐ Scabies
- ☐ Scarlet Fever
- ☐ Schistosomiasis
- ☐ Sexually transmitted Inf. (STIs)
  - ☐ Chlamydia ☐ Gonorrhea
  - ☐ Syphilis ☐ Other:_____(Specify)
- ☐ Shigellosis
- ☐ Tuberculosis - Extra-pulmonary
- ☐ Zoonotic Diseases
  - ☐ Brucellosis ☐ Hydatid disease
  - ☐ Other:_____ (Specify)

Infectious Diseases Notification Federal Law No. 27 (1981) القانون الاتحادي رقم (٢٧) لسنة ١٩٨١، في شأن الوقاية من الأمراض السارية

PM - 26

Appendix 6: Weekly zero reporting form

Form 1-1a

From Hospital and Health centers

نموذج التبليغ الصفري الأسبوعي

Weekly Zero Reporting Form

Medical District : _____

Name of Health center

Investigator: _____

Month / Year	One Week (Thursday-Wednesday)		Cases		
	From	To	AFP	Measles	Meningitis

Note: If there is any case(s) Please fill the relevant investigation form.

IMPORTANT

Investigation of all cases is important to

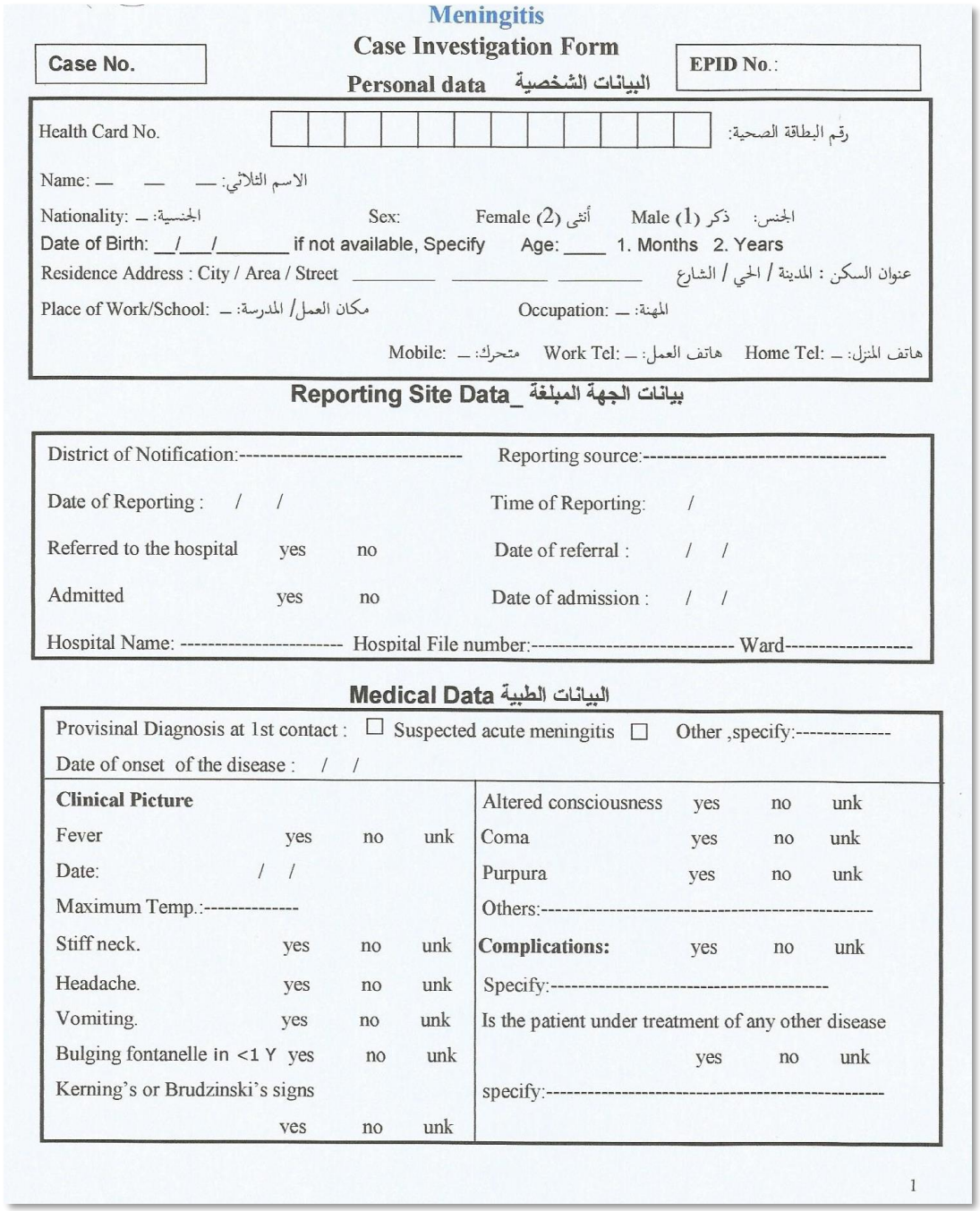
monitor the effectiveness of the implementation

strategies for the Prevention & Control of Diseases

للأهمـــــية

تقصي جميع الحالات هام جداً لمراقبة

Appendix 7: Meningitis case investigation form



Meningitis

Case Investigation Form

Case No. | **EPID No.:**

Personal data البيانات الشخصية

Health Card No. | رقم البطاقة الصحية:

Name: — — — :الاسم الثلاثي

Nationality: — :الجنسية Sex: Female (2) أنثى Male (1) ذكر :الجنس

Date of Birth: __/___/_____ if not available, Specify Age: ____ 1. Months 2. Years

Residence Address : City / Area / Street _____ _____ _____ عنوان السكن : المدينة / الحي / الشارع

Place of Work/School: — :مكان العمل/ المدرسة Occupation: — :المهنة

Mobile: — :متحرك Work Tel: — :هاتف العمل Home Tel: — :هاتف المنزل

Reporting Site Data_ بيانات الجهة المبلغة

District of Notification:---------- Reporting source:----------

Date of Reporting : / / Time of Reporting: /

Referred to the hospital yes no Date of referral : / /

Admitted yes no Date of admission : / /

Hospital Name: ---------- Hospital File number:---------- Ward----------

Medical Data البيانات الطبية

Provisinal Diagnosis at 1st contact : ☐ Suspected acute meningitis ☐ Other ,specify:----------

Date of onset of the disease : / /

Clinical Picture				Altered consciousness	yes	no	unk
Fever	yes	no	unk	Coma	yes	no	unk
Date:	/ /			Purpura	yes	no	unk
Maximum Temp.:----------				Others:----------			
Stiff neck.	yes	no	unk	**Complications:**	yes	no	unk
Headache.	yes	no	unk	Specify:----------			
Vomiting.	yes	no	unk	Is the patient under treatment of any other disease			
Bulging fontanelle in <1 Y	yes	no	unk		yes	no	unk
Kerning's or Brudzinski's signs	yes	no	unk	specify:----------			

1

Vaccination Status بيانات التطعيم

Was the patient previously vaccinated (including vaccination for Uomra & hajj) ?

yes no unk

Meningococcal A&C yes no unk

Date: ___/___/_____

Meningococcal A, C, Y, W135 yes no unk

Date: ___/___/_____

Hib: yes no unk

1st dose:_____/ /____ 2nd dose:__/ /_____ 3rd dose:___/ /

Others, _____ (Specify) Date: ___/___/_____

Epidemiologic Investigation التقصي الوبائي

Did the patient visit any health facility in early symptoms yes no unk

Was the patient treated with antibiotic before admission to the hospital yes no unk

Specify:----------

Was the patient a contact of a person with similar illness in previous 5-10 days prior to his illness?

yes no unk

If yes :was this case ☐ suspected ☐ confirmed

Was this contact a:

☐ household ☐ school ☐ workplace ☐ Hospital ☐ relative ☐ Others

10 days prior to illness did the patient travel within UAE? yes no unk

Where: _____

Dates ___/___/____

Did the patient travel abroad preceding disease (including Hajj)? yes no unk

Where to: _____

Departure Date ___/___/____

Arrival Date ___/___/____

Were there exposure to household visitors in the past 10 days? yes no unk
(either from inside or outside UAE, including comer from hajj)

Whom _____ from where:_____

Dates ___/___/____

Laboratory data بيانات المختبر

Sample	Date Taken	Date Received at Lab	Adequate	Date of Results	Date result at PMD	Result
CSF						
Blood						

CSF examination:

Appearance: ☐ Clear ☐ turbid

Color: ☐ bloody ☐ yellowish ☐ other

White cell count/ mm^3:_____(0-5) % polymorph:-------- % lymphocytes:----------

Glucose: _____ (REF: 45-100 dl)

Protein:_____ (REF15-50 dl)

Direct smear: ☐ gram-ve diplococcic

& Gram stain ☐ gram +ve diplococcic

☐ gram -ve bacilli

☐ other:_____

☐ No organism

Latex test : ☐ +ve ☐ -ve

Culture results:

1- N. meningitides

Serotyping: group: ☐A ☐B ☐C ☐Y ☐W135 ☐ XYZ

☐ Others:_____ ☐ Not typed

2- H. influenzae

group: ☐ b ☐ others

3- S.pneumoniae

group: specify _____

4- other organism, specify:_____

5- No growth

Sensitivity test: Sensitive Moderate sensitive Resistance

_____ _____ _____

_____ _____ _____

_____ _____ _____

Blood culture : ☐ yes ☐ no

If yes : ☐ +ve ☐ -ve

Type of organism: _____

Final Classification and Outcome التصنيف و النتيجة النهائية للحالة

Is the case : ☐ Confirmed ☐ Suspected ☐ Discarded

If Confirmed, is it by ☐ Laboratory ☐ Epidemiological Link ☐ Clinically

Final diagnosis: ☐ viral meningitis ☐ N.Menin. ☐ H.influ. ☐ S.pneumonia

☐ TB ☐ unspecified bacterial ☐ otherbactrial: _____

If Discarded, any final diagnosis :_____

Day month year

Date of final diagnosis | | | |

Outcome

1. Under RX	2. Recovered	3. Died	4. Recovered with Complication	5. Discharged against advice	6. Referred	7. Unknown
		Dates __/__/_		Dates ___/___/____	Dates ___/___/____	

Investigator Comment:

Name of investigator: _____Signature: _____ Date : ___/___/_____

Comment by Department of Disease Control and Prevention:

Name: _____Signature: _____ Date : ___/___/_____

Appendix 8: Cholera case investigation form

United Arab Emirates
Ministry of Health
Preventive Medicine Department

دولة الإمارات العربية المتحدة
وزارة الصحة
إدارة الطب الوقائي

Cholera/Vibrioses
Case Investigation Form

Case No.

EPID No.:

Personal data البيانات الشخصية

Health Card No. | | | | | | | | | | | | رقم البطاقة الصحية:

Name: — — — الاسم الثلاثي:

Nationality: — :الجنسية Sex: Female (2) أنثى Male (1) ذكر :الجنس

Date of Birth: __/___/_____ if not available, Specify Age: ____ 1. Months 2. Years

Residence Address : City / Area / Street _____ _____ _____ عنوان السكن : المدينة / الحي / الشارع

Place of Work/School: — :مكان العمل/ المدرسة Occupation: — :المهنة

Mobile: — :متحرك Work Tel: — :هاتف العمل Home Tel: — :هاتف المنزل

Reporting Site Data_ بيانات الجهة المبلغة

District of Notification:---------- Reporting source:----------

Date of Reporting : / / Time of Reporting: /

Referred to the hospital yes no Date of referral : / /

Admitted yes no Date of admission : / /

Hospital Name: ---------- Hospital File number:---------- Ward----------

Medical Data البيانات الطبية

Provisional Diagnosis at 1st contact : ☐ Suspected cholera ☐ other: specify----------

Date of onset of the disease : / /

Clinical Picture				**Complication**			
Sudden onset of Diarrhea	yes	no	unk	Dehydration	yes	no	unk
If yes: with pain	yes	no	unk	Renal failure	yes	no	unk
Watery	yes	no	unk	Acidosis	yes	no	unk
Duration:----------				Hypoglycemia	yes	no	unk
Anorexia	yes	no	unk	Others: specify :----------			
Nausea	yes	no	unk				
Vomiting	yes	no	unk				

1

Vaccination Status بيانات التطعيم

Was the patient vaccinated ? yes no unk.

If yes

1st t dose ___/___/____

booster ___/___/____

others:----------

Epidemiological Investigation التقصي الوبائي

Was the patient a contact of confirmed or suspected case of cholera yes no unk

If yes : name:---------- relation:----------

In the 1-7 days prior to illness did the patient travel within UAE? yes no unk

Where: _____

Dates ___/___/____

History of travel abroad in the last 1-7 days prior to illness yes no unk

When? _____ Where? _____

Date of the last entry to UAE: ___/___/____

Food source in the 1-7 days: ☐ Home made ☐ Restaurant

If restaurant, name of the restaurant:_____

During the 1-7 prior to onset of illness, did patient eat any of the following

☐Crabs ☐ Shellfish ☐ Other seafood: specify_____

Specify the source:----------

Water source	☐ Tap	☐ Bottled	☐ Tanker	☐ others___:_____
Water storage	☐ On roof	☐ On ground	☐ under ground	☐ others_____
Sewage	☐ Sewered	☐ Septic tanks	☐Exposed	☐ other_____
Refuse:	☐ Covered	☐ Exposed	☐ others:_____ _	
Washing facilities:		☐ Adequate	☐ Inadequate	
WC	☐ Number	☐ clean	☐ unclean	
Kitchen	☐ Available	☐ Not available		
Flies	☐ Present	☐ not present	☐ unknown	
Rodents	☐ Present	☐ not present	☐ unknown	
Other animals	☐ Present,	Specify_____	☐ not present	

Was the patient employed as a food handler yes no unk

If yes, does the patient have a health certificate yes no unk

What is the date of last certificate? ___/___/_____

Place of work:----------

Laboratory data بيانات المختبر

Sample	Date Taken	Date Received at Lab	Type of Test	Adequate	Date of Results	Date result at PMD	Result
Stool			Organism isolation				
			Serotyping biotype				

Suspected food, drinks or water samples

Type of sample	Date taken	Results

Final Classification and Outcome التصنيف و النتيجة النهائية للحالة

Is the case : ☐ Confirmed ☐ Discarded

If Confirmed, is it by Laboratory ☐ Epidemiological Link ☐ Clinically

Final diagnosis: ☐ V. cholera O1 ☐ V cholera O139 ☐ V cholera non O1 (NAG)

If Discarded, any final diagnosis :_____

Day month year

Date of final diagnosis ☐☐☐

Outcome

1. Under RX	2. Recovered	3. Died	4. Recovered with Complication	5. Discharged against advice	6. Referred	7. Unknown
		Dates __/__/_		Dates ___/___/____	Dates ___/___/____	

Investigator Comment:

Name of investigator: _____Signature: _____ Date : ___/___/_____

Comment by Department of Disease Control and Prevention:

Name: _____Signature: _____ Date : ___/___/_____