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Madiha S.M. Abdel-Razik [1], Hoda I.I. Rizk [1] and Mahmoud H.M. Hassan [2]

2006-2013 :

ABSTRACT The Egyptian Ministry of Health and Population surveillance system provides data about notifiable communicable diseases. This study aimed to provide information for decision-making to reduce the burden of communicable diseases in Egypt by analysis of the surveillance data for 2006–2013 to identify trends in the incidence of the diseases by governorate, season, age and sex. Composite risk-index scores were estimated to rank the 27 Egyptian governorates into 3 groups: high, medium and low risk. The 15 diseases with the highest incidence were food and waterborne diseases (5 diseases), vaccine-preventable diseases (7 diseases) and others, e.g. hepatitis C infection. Bloody diarrhoea and typhoid had the high incidence for 2006–2013. There were 11 high-risk governorates; Ismailia had the highest risk-index score. The findings suggest the need for specific interventions related to environmental sanitation and improving the childhood immunization programme, particularly in the high-risk governorates.

Surveillance des maladies transmissibles en vue de la prise de décision en

Égypte : 2006-2013

RÉSUMÉ Le système de surveillance du ministère de la Santé et de la Population égyptien fournit des données sur les maladies transmissibles à déclaration obligatoire. La présente étude avait pour objectif d'orienter la prise de décision visant à réduire la charge des maladies transmissibles en Égypte au moyen de l'analyse des données de surveillance entre 2006 et 2013, ainsi qu'à identifier les tendances de l'incidence des maladies par gouvernorat, saison, âge et sexe. Les scores de l'indice de risque composite ont permis de classer les 27 gouvernorats égyptiens en trois groupes : risque élevé, risque modéré, risque faible. Les 15 maladies ayant l'incidence la plus élevée était les maladies d'origine alimentaire et les maladies à transmission hydrique (cinq maladies), les maladies à prévention vaccinale (sept maladies) et d'autres maladies, telles que l'infection à hépatite C. La diarrhée sanglante et la typhoïde avaient l'incidence la plus élevée entre 2006 et 2013. On comptait 11 gouvernorats à haut risque, et Ismaïlia affichait le score d'indice de risque le plus élevé. Les résultats suggèrent un besoin d'interventions spécifiques en matière d'assainissement de l'environnement, ainsi que l'amélioration des programmes de vaccination des enfants, en particulier dans les gouvernorats à haut risque.

1Department of Public Health, Faculty of Medicine, Cairo University, Cairo, Egypt (Correspondence to: Hoda I.I. Rizk: hoda.rizk@kasralainy.edu.eg). 2Central Epidemiology and Surveillance unit, Ministry of Health and Population, Cairo, Egypt.

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Introduction

Public health surveillance is one of the essential features of epidemiological practice. It provides the scientific and factual data essential to allow public health practitioners to assess and monitor population health and make recommendations for action (1). As a result, decision-makers are able to set policies and strategies for public health prevention and control programmes for communicable diseases (2). Promoting the use of information in decision-making is pivotal for managing infectious diseases at national and international levels (3).

The final link in the surveillance chain is the application of data for prevention and control. Therefore, the main purpose of public health surveillance is to provide actionable health

information to public health staff, government leaders and the public to guide public health policy and programmes towards specific actions. Public health surveillance can also be used to assess public health status, provide early warning of outbreaks, define public health priorities, design and plan public health programmes, evaluate interventions and conduct research studies (4,5).

A surveillance system for communicable diseases has been in operation in Egypt for about a century with frequent interventions for improvement being made during this period (6). In 1999, in collaboration with the World Health Organization (WHO), United States Naval Medical Research Unit No. 3 and the Center for Disease Control and Prevention, Atlanta, United States of America, a comprehensive surveillance system was developed to collect information on 26 notifiable communicable diseases for the purpose of their control (7). In 2006, the Central Epidemiology and Surveillance Unit of the Ministry of Health and Population (MoHP) in Egypt developed an electronic system for reporting those diseases (National Electronic Disease Surveillance System); as a result, the list of diseases under surveillance changed in view of the identified pattern of diseases (8). Other surveillance systems for specific communicable diseases are operating in Egypt, such as sentinel surveillance for influenza like illness and severe acute respiratory infection (9) and a vertical programme for tuberculosis, HIV/AIDs and malaria. The vertical surveillance programmes are included as sources of data for the communicable disease surveillance system (10).

The annual reports on communicable diseases published by the MoHP provide a large amount of data and information about selected communicable diseases (11). The reports provide background on the activities of the MoHP for prevention and control of those diseases. In addition, the reports show trends over time for different diseases at the national level. However, the reports do not provide information about the pattern of communicable diseases by: month, age and sex of cases, and governorate. Furthermore, there is no feedback to governorates about the level of risk of the various communicable diseases in the governorate so as to allocate resources to high–risk areas.

The aim of this study therefore was to provide information in those areas and identify the priority areas for intervention, with the overall goal of reducing the incidence of communicable diseases in Egypt.

The specific objectives were to:

Describe the epidemiological profile (person, time and place) for the 15 communicable diseases with the highest incidence in Egypt (2006–2013)

Categorize the governorates in Egypt according to their incidence of the 15 diseases as high, medium or low risk.

Methods

Study setting and design

The study was conducted in the Central Epidemiology and Surveillance Unit of the MoHP and was a retrospective review of communicable disease surveillance data from 2006 to 2013 by age, sex and governorate.

Data collection and management

The MoHP National Electronic Diseases Surveillance System for Communicable Diseases (2006–2013) was the source of the data on cases of communicable diseases. Cases are date-stamped based on the date of notification. The 2007–2014 reports of the Central Agency for Public Mobilization and Statistics were the source of total population data per year per governorate, and the population data by age and sex (12).

The 27 governorates in Egypt are categorized into 4 types: urban (Alexandria, Cairo, Port Said and Suez); Lower Egypt (Beheira, Dakahlia, Damietta, Gharbia, Ismailia, Kafr El–Sheikh, Menoufia, Qalyubia and Sharqia); Upper Egypt (Assiut, Aswan, Beni Suef, Fayoum, Giza, Luxor, Minia, Qena and Sohag); and Frontier Governorates (Matrouh, New Valley, North Sinai, Red Sea and South Sinai).

All communicable disease surveillance data for the year 2006 for all Egypt were reviewed (160 861 records) to identify the 15 communicable diseases with the highest incidence (Table 1). The surveillance data for these 15 diseases for the 8-year period 2006–2013 for the 27 governorates of Egypt were then reviewed and analysed (361 055 records).

Data were entered into Excel, version 2010. The incidence of each disease was estimated by year, age (

Governorates were ranked (1–27) according to the incidence rate for each year over the period 2006–2013. The incidence rates per 100 000 persons for each year from 2006 to 2013 were ranked (1–27), which represented a score for communicable disease risk. Score 1 was given to the governorate with the lowest incidence in a specific year and score 27 to the governorate with the highest incidence.

The magnitude of the communicable disease burden for each governorate was further measured and ranked according to an estimated composite risk index that considered time (8 years) and all 15 diseases. First, the risk index score for 15 diseases was calculated for each governorate by summing its ranking scores for each disease. The maximum risk index for a governorate for the 15 disease was therefore 405, assuming a ranking score of 27 for all the diseases (15 × 27). The composite risk index score for each governorate was calculated as a percentage of the maximum risk index level (405) to give the magnitude of risk for each governorate. Based on the composite risk index percentages, the governorates were categorized into 3 risk groups: high, medium and low. To determine the cut-off points for the groups, the range of the composite risk–index score was divided by 3; this was added to the lowest limit, to get the range of the lowest risk governorates and so on.

Ethical considerations

The study was approved by the Council of the Public Health Department, Faculty of Medicine, Cairo University, and MoHP staff. The data on reported cases in the surveillance records are anonymous.

Results

With total records for year 2006 (160 861 records), the diseases with lowest incidence were excluded from the study and 58 079 records were included. The excluded records were for the following diseases: encephalitis, HIV/AIDs, diphtheria, malaria, plague, tetanus neonatorum, acute food poisoning, botulism, viral haemorrhagic fever, Rift Valley Fever, cholera, swine flu, anthrax, pertussis, schistosomiasis, leprosy, fascioliasis, filariasis, and animal bites. The 15 diseases with the highest incidence in 2006 were: undifferentiated acute hepatitis, bloody diarrhoea (dysentery), typhoid/paratyphoid, brucellosis, hepatitis A, tuberculosis, rubella, meningitis, hepatitis C, measles, rabies, acute flaccid paralysis, hepatitis B, avian influenza and mumps.

Trend in incidence of the 15 communicable diseases, 2006–2013.

The diseases were grouped into 5 categories: 1) undifferentiated (acute hepatitis); 2) food- and waterborne infections without preventable vaccines (bloody diarrhoea/dysentery and brucellosis), foodborne infections with preventable vaccines (acute flaccid paralysis/poliomyelitis (compulsory immunization to children) and typhoid fever (compulsory TAB vaccine for food handlers and hepatitis A virus vaccination for at–risk groups); 3) droplet infections with preventable vaccines (tuberculosis, rubella, meningitis, measles, mumps) and droplet infections without preventable vaccines (avian influenza); 4) bloodborne infections with preventable vaccines (hepatitis B) and bloodborne infections without preventable vaccines (hepatitis C virus); and 5) contact infection with preventable vaccines (rabies). As can be seen from the table, the 3 diseases with the highest incidence rates in 2006 were undifferentiated hepatitis (17.8/100 000), bloody diarrhoea (16.8/100 000) and typhoid fever (12.7/100 000). In addition, these 3 diseases had the highest mean incidence throughout the 8-year period, 2006–2013. Mumps emerged as a health problem in 2012 (incidence 15.2/100 000) with a further increase in the reported cases in 2013 (incidence 22.2/100 000 population).

The top 5 diseases for 2006 were undifferentiated acute hepatitis, bloody diarrhoea (dysentery), typhoid, brucellosis and hepatitis A. Together they accounted 60.3 cases/100 000 population in 2006 and 29.7 cases/100 000 in 2013 with an estimated reduction in incidence of 51%. Indeed throughout the period 2006–2013, bloody diarrhoea and typhoid/paratyphoid ranked the first and second diseases with the highest incidence

The diseases categorized as preventable because there is compulsory immunization of children against were: tuberculosis, rubella, measles, acute flaccid paralysis, and hepatitis B. (Although mumps has a compulsory vaccination, we categorized it as re-emerging diseases because in 2006 its incidence was **Incidence of the 15 communicable diseases by governorate, 2006–2013**

Table 2 shows the Egyptian governorates ranked according to the magnitude of the incidence of the 15 diseases for 2006–2013 and their composite risk index scores. For comparative purposes, the composite index score was assigned a risk status: green = low risk, yellow = medium risk and red = high risk. To divide the set of data into 3 groups the range of composite risk–index score was divided by 3 (71–28%/3 = 14%). Adding 14% to the lowest limit (i.e. 28%), the lowest risk governorates had composite index score of 28–28%/3 = 14%). Adding 14% to the lowest limit (i.e. 28%), the lowest risk governorates had composite index score of 28–42% (5 governorates). The medium risk governorates had composite risk index scores between 42% and 56% (11 governorates). The high risk governorates had composite risk index scores between 57% and 71% (11 governorates). Ismailia governorate had the highest composite risk index for communicable diseases (71%), followed by Matrouh (a frontier governorate with very low population density), Menoufia, and Beheira. Luxor had the lowest composite risk index (28%). The total risk score for communicable diseases for the 27 governorates was 5670 and the risk score for the 11 high-risk governorates (41% of governorates) was 2693, i.e. 47% of

total risks for all the Egyptian governorates. Therefore efforts directed at the high–risk governorates could reduce the risk of infectious diseases by 47% (from 40% for hepatitis A to 58% for meningitis).

Table 3 shows the epidemiological pattern of the 15 diseases according to age and sex of the cases, governorate and month. The cases were categorized by age into 2 groups: young dependent group

Figure 1 shows that throughout the period 2006–2013 there was an overall decline in the incidence of communicable diseases in Egypt.

Discussion

Our study addresses health policy, health systems, programmatic and community issues related to the epidemiology of communicable diseases in Egypt. The study capitalized on the available data in a well-established surveillance system in the MOHP. This allowed us to provide public health information related to place, person and time (health informatics) (13). The study emphasizes the importance of using country data after processing and aggregation of indicators for public health decision-making, a method advocated in other studies (14). This systematic processing of national level data allows information to be disseminated to the service providers involved in reporting cases to the surveillance system (15). This could prepare them to anticipate rather than react to an outbreak. Furthermore, simulation tools that use environmental, epidemiological and molecular (related to microbiology, genetics and vaccine preparations) data could help manage and analyse risks and inform appropriate actions by public health authorities (16).

Our study described the situation in Egypt regarding the communicable diseases with the highest reported incidence from 2006 to 2013. Compared with the list of catastrophic infectious diseases (17) (i.e. plague, viral haemorrhagic fevers, measles, smallpox, yellow fever, influenza, cholera, sleeping sickness, HIV, severe acute respiratory syndrome and dengue haemorrhagic fever), only measles and influenza were among the 15 communicable diseases with the highest reported incidence in Egypt in the past 8 years.

Our list of the top 15 communicable diseases is specific to Egypt in a certain time period. Other countries have different priority communicable diseases. For example, the health statistical year book in Saudi Arabia, which includes information about 30 notifiable communicable diseases, showed that the top reported communicable diseases in 2011 in Saudi Arabia were chickenpox, hepatitis B, brucellosis, dengue fever, hepatitis C, amoebic dysentery, salmonellosis, measles and hepatitis A (18). In Jordan in 2008, the top reported communicable diseases were

chickenpox, animal bites, non-meningococcal meningitis, hepatitis A, food poisoning, cutaneous leishmaniasis, mumps, bloody diarrhoea, schistosomiasis and measles (19). In Oman, for the period 2006–2012, the top reported communicable diseases were influenza-like illness, fever and rash illnesses, malaria, mumps, hepatitis A, food poisoning, unspecified viral hepatitis, pertussis and HIV/AIDS (20). In Lebanon, the top reported communicable diseases in 2012 were hepatitis A, typhoid fever, food poisoning, dysentery, meningitis, hepatitis B, brucellosis, pertussis, hepatitis C and malaria (21).

The top 5 communicable disease in Egypt (Table 1) were related to insanitary water and food supply, with the exclusion of mumps which was a re-emerging disease in 2012–2013 (22). This highlights the need for a multispectral approach to the prevention of communicable diseases. A number of the reported diseases are preventable because there is a compulsory immunization programme for children; these include tuberculosis, rubella, measles, mumps, acute flaccid paralysis and hepatitis B (23). Their high incidence highlights 2 challenging issues: obstacles for the health system to reach and provide coverage of children with effective vaccines at the primary health care level, and increasing the demand for compulsory immunization at the community level. The observed high incidence rates of mumps in 2012 (15.2/100 000) and 2013 (22.2/100 000) after years of low incidence is of concern. The re-emergence of such infections pose a threat at both national and international levels and is an issue that has been discussed within the concept of the global burden of infectious diseases (24).

The use of modelling in public health to compare interventions and costs is helpful to guide policy-making (25). Our study suggests that modelling could include 2 major interventions: strengthening the immunization system and improving water and food sanitation.

The results of our study provide evidence of the epidemiology of communicable diseases in Egypt regarding trend, place and person and seasonal variations, and highlight the importance of using different methods to guide decision-making towards specific priority areas for intervention. The ranking method in the current study was used to develop composite risk indices. Such methods for ranking communicable diseases have been considered in other studies (26,27). A systematic review that provided an evidence-based framework for identifying priority health interventions added an economic parameter, especially useful in low and middle income countries (28).

Our study added another dimension to the surveillance system by grouping the governorates into high, medium and low risk for the priority communicable diseases. We identified the governorates with the highest burden of communicable diseases. These 11 governorates comprise 51% of the Egyptian population. This information could help policy-makers direct

efforts to reducing the burden in these governorates and this could reduce the risk of infectious diseases in Egypt by 47% (range 40–58%).

Ismailia was the governorate with the highest risk index and hence the governorate that should have the highest priority for interventions to reduce the incidence of communicable diseases. Ismailia is one of the lower Egypt governorates and lies between Port Said and Suez. Certain environmental parameters could explain why it has a higher risk than other Suez Canal cities (Port Said and Suez) (29). Half of the population of Ismailia lives in rural areas, while Port Said and Suez are urban governorates. Ismailia has no access to either the Mediterranean Sea (as Port Said) or the Red Sea (as Suez). It is situated on El-Temsah Lake, where unmanaged sewage is disposed of and fishing takes place. Adding sewage with rich organic matter that consumes oxygen to the salt lake could cause fish to die; these are then easy to collect and are widely consumed. In our study, Ismailia was ranked the highest risk governorate for reported cases of typhoid/paratyphoid throughout the period 2006–2013. These findings indicate a persistence of an environmental risk of infection.

Governors of the 27 governorates and health authorities involved in the surveillance programme at all levels could use the information derived from our study to direct interventions to reduce the incidence of these 15 diseases and the overall burden of communicable diseases in Egypt.

There are some limitations to our study. Findings derived from the study on the ranking of communicable diseases by severity or incidence rate cannot be generalized outside of Egypt to other countries However, the methodology could be replicated in other countries. The data included in our analysis are derived from MoHP surveillance system. The accuracy of the reporting of the notifiable diseases according to the set diagnosis depends on the efficiency and effectiveness of the surveillance system in monitoring data at the peripheral and central levels. The surveillance systems capture cases occurring and reported to the health authorities. Some cases of disease are not reported to the public health authorities (under-reporting). The pattern of this underreporting varies by disease and governorate; it is a complex mix of health care-seeking behaviour, access to health services, reporting practices by doctors and others, and the performance of the surveillance system at the local level.

Conclusion

Proper analysis and presentation of surveillance data are essential in order to provide meaningful information necessary for decision-making so as to prevent and control communicable diseases at central and governorate levels. Our analysis suggests the need for specific interventions related to environmental sanitation and improving the childhood immunization programme.

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