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Handbook on implementing syndromic surveillance in migrant reception/detention centres and other refugee settings

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This report was commissioned by the European Centre for Disease Prevention and Control (ECDC), coordinated by Jonathan Suk and Laura Espinosa, and produced by the Italian Institute of Public Health (ISS team), led by Silvia Declich.

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Acknowledgements
ECDC would like to thank the PERPHECT (Preparedness in the European Region for Public Health Emergencies and Cross Border Threats) consortium leader (PHE). Agoritsa Baka, K Golfinopoulou, Theodoros Lytras, Takis Panagiotopoulos, G Theoharopoulos, Sotirios Tsiodras, Lambrini Veneti who contributed substantially to setting up syndromic surveillance in refugee camps in Greece are also acknowledged. Takis Panagiotopoulos, National School of Public Health in Greece, provided detailed comments on the draft version of this report. At ECDC, members of the Migrant Health Task Force: Massimo Ciotti, Karl Ekdahl, Philip Zucs, Frantiska Hruba, Bruno Ciancio, Joana Gomes Dias, Chantal Quinten, Mike Catchpole, all provided detailed comments on the draft version of this report.

Suggested citation: European Centre for Disease Prevention and Control. Handbook on implementing syndromic surveillance in migrant reception/detention centres and other refugee settings. Stockholm: ECDC; 2016.

Stockholm, October 2016

ISBN 978-92-9193-991-6

doi 10.2900/22710

Catalogue number TQ-06-16-112-EN-N

Contents

Introduction

The large volume of asylum seekers and irregular migrants entering continental Europe constitutes a public health challenge [1-3]. Migrant facilities in many European Union (EU) Member States have the potential to be overwhelmed with much higher numbers of migrants than the sites were originally designed for. Although migrants entering Europe tend to be in relatively good health, crowded living situations favour communicable disease spread.

In 2015, an ECDC-sourced Expert Opinion on public health measures in migrant centres and refugee settings recommended developing guidance on the implementation of syndromic surveillance [1,2]. At the same time, numerous country visits of the WHO PHAME project (Public Health Aspects of Migration in Europe) and of the International Organization for Migration (IOM) EQUI-HEALTH project 'Fostering Health Provisions for Migrants, Roma and Other Vulnerable Groups' flagged the need to develop or strengthen health information systems, including syndromic surveillance, in these settings [4-7].

The objective of this handbook is therefore to assist public health authorities in developing syndromic surveillance protocols that complement routine surveillance in migrant reception/detention centres and refugee hosting sites (hereafter referred to as 'migrant centres'). Such protocols can assist in the detection of events such as large outbreaks or single cases of outbreak-prone conditions that would require an assessment in order to trigger and guide an appropriate public health response.

The handbook considers both the technical and practical aspects of establishing syndromic surveillance systems. The technical examples and the suggested key phases of syndromic surveillance implementation are based on scientific evidence and in-the-field experience collected from peer-reviewed literature and other authoritative reports [4-33] and expert feedback. Participating EU Member States, the IOM and WHO contributed to the review of this handbook.

Box 1. Migrant reception and hosting sites

Asylum seekers and irregular migrants are often hosted in facilities run by governments or NGOs. In addition, in some cases, refugees gather in spontaneous unstructured camps, living in temporary shelters and cared for by NGOs. For the purposes of this handbook, they will collectively be referred to as 'migrant centres'. This term will be used to cover the spontaneous unstructured camps and the following types of settings whose definitions can be found at the European Migration Network (EMN) Asylum and Migration Glossary [34]:

- *Accommodation centre*: a place used for the collective housing of applicants for international protection.
- *Detention facility*: in the global context, a specialised facility used for the detention of third-country nationals in accordance with national law. In the EU return context, a specialised facility to keep in detention a third-country national who is the subject of return procedures in order to prepare the return and/or carry out the removal process, in particular when: (a) there is a risk of absconding; or (b) the third-country national concerned avoids or hampers the preparation of return or the removal process.
- *Reception centre*: a location with facilities for receiving, processing and attending to the immediate needs of refugees or asylum seekers as they arrive in a country of asylum.
- *Reception facility*: all forms of premises used for the housing of applicants for international protection and other categories of migrants and refugees.

How to use this handbook

This handbook is designed to assist national projects aimed at developing and implementing syndromic surveillance in migrant centres. It is best viewed as a starting point that would most likely require adjustments based on the specific contexts in which syndromic surveillance would be implemented.

The handbook proposes several key aspects to consider in establishing syndromic surveillance (Figure 1). Where technical examples are provided, these are based upon a protocol originally developed by the Italian Institute of Public Health [8-13], adapted by the Hellenic Centre for Disease Control and Prevention and the Greek National School of Public Health to meet health information needs in their context, and then further revised by ECDC with an aim to provide applicable options and alternatives to EU/EEA Member States.

Section 1 briefly introduces syndromic surveillance. Sections 2 and 3 describe steps in the phases of syndromic surveillance implementation (Figure 1). Guidance and technical examples focus primarily on the preparatory phase and touch upon the pilot methodology.

The annexes in this handbook are designed to facilitate the quick implementation of syndromic surveillance. These include templates that could be applied as is or adapted as needed, and a detailed description of an example set of syndromes that could be used for syndromic surveillance (Annexes 1–3).

1. Syndromic surveillance

The term 'syndromic surveillance' applies to surveillance using health-related data that precede aetiological diagnosis in order to identify as quickly as possible signals of sufficient probability of a case or an outbreak to warrant further public health response [35,36]. Syndromic surveillance provides information at an earlier stage than laboratory confirmation [37] and therefore has the potential to inform timely actions to reduce the impact of disease in a community.

Syndromic surveillance in migrant centres is designed to detect events relevant to public health promptly and to enable public health authorities to take appropriate action. It is not intended to replace health screening of migrants, or to provide specific information on the health status of migrants or follow up individuals over time.

Additionally, it must be stressed that syndromic surveillance is not intended as a substitute for existing surveillance systems but rather a complement to them; providing a readily implemented methodology that enables the integration of the migrant centres as a source of surveillance data. Should a cross-border event or other threat of international concern be detected, reporting should follow the rules of the existing early warning reporting systems [38,39].

The surveillance of influenza-like illness (ILI) has long been established. It relies on a clinical case definition of a syndrome to be reported. This approach has formed the basis for subsequent attempts at using syndromic case definitions for surveillance of disease for which laboratory confirmation is not deemed necessary or is not available. Syndromic surveillance was later developed with a focus on bioterrorism by using syndromes at presentation to health facilities, prior to diagnosis by clinicians, as an attempt to detect epidemics early that could be related to the deliberate release of a pathogen [35,40,41].

Syndromic surveillance has been applied in a wide range of public health settings, such as to monitor specific syndromes (e.g. acute flaccid paralysis), as well as a wider range of non-specific conditions (e.g. rash and fever, watery diarrhoea, etc.) during complex emergencies [42,43]. The usefulness of implementing syndromic surveillance has been widely documented during high-profile events such as the 2009 influenza pandemic [44], the Icelandic volcanic ash plume [37], water-borne outbreaks [45], heat waves [46], floods [47] and mass gatherings [48,49]. In addition, syndromic surveillance has been applied to complement existing routine surveillance to augment early warning [50] during the 2004 Olympics in Athens, Greece [51], and to assess the use of health emergency departments in the wake of the Paris terrorist attacks in November 2015 [52].

1.1. Key phases in establishing syndromic surveillance

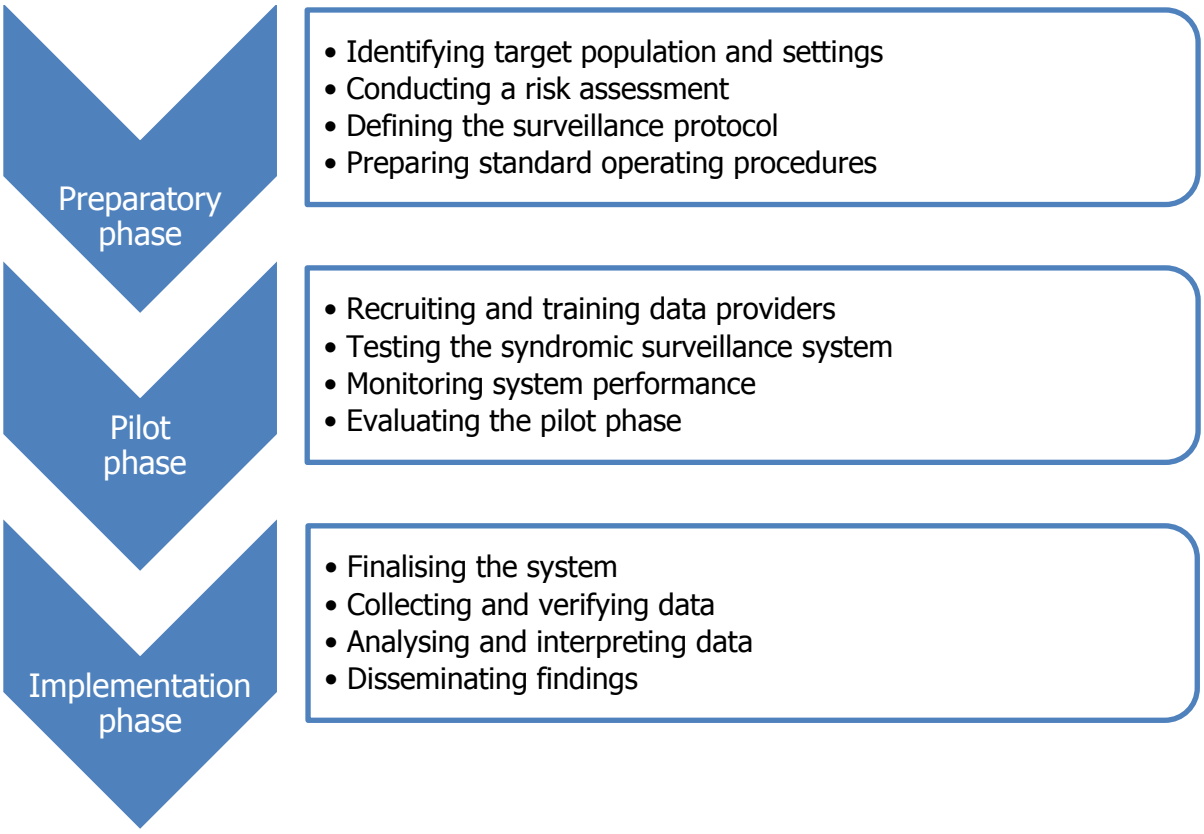
The implementation of syndromic surveillance requires three phases: preparation, piloting and implementation.

The preparatory phase involves the definition of the surveillance objectives and target syndromes based on a risk assessment, the definition of the population under surveillance and the setting up of appropriate tools and procedures for data collection and analysis. This handbook will focus primarily on this phase.

The pilot phase includes the steps needed to set up and test the processes, procedures and tools developed during the preparatory phase. The evaluation of the pilot phase allows for adjustments ahead of implementation of the surveillance system.

The implementation phase involves activating the protocols for data collection and analysis, acting upon arising statistical signals and adjusting the system as necessary.

Figure 1. Key steps in the phases of establishing syndromic surveillance in migrant centres



2. Preparatory phase

The preparatory phase can be divided into four steps:

1. Enumerating the target population and migrant centres
2. Conducting a risk assessment
3. Designing the surveillance protocol encompassing:
   - definition of surveillance objectives,
   - selection of syndromes for surveillance,
   - establishment of case definitions for the syndromes,
   - definition of the indicators for actions, along with their threshold for alert,
   - preparing report templates
4. Setting up data collection, analysis tools and standard operating procedures

2.1. Target population and migrant centres

The first step is to define the population involved in the situation. The description of the targeted population should include:

1. an estimate of the numbers of migrants
2. their location, in reception centres or in spontaneous unstructured settings
3. their country of origin
4. their demographic characteristics: age and gender.

To estimate the number of migrants, conduct a census of the migrant centres that will form the system's reporting units. The census should collect information on the number of settings, their main features (e.g. reception centre, spontaneous camp), location, dimension and on the health services provided. A generic data collection sheet for such a census is available in Annex 1. This data collection sheet can be adapted to different situations. This census should be kept up-to-date through repeated surveys, and should be complemented by data detailing the population flows in and out of the settings, when feasible. The availability of updated information on the migrant population present in migrant centres will enable indicators to be calculated based on the number of migrants present in a given setting at a given time (rates).

If it is not feasible to obtain detailed information on all migrant centres, or spontaneous regrouping of migrants occurs, a census of the organisations intervening in the health sector should be conducted, and information about each location gathered through such organisations.

2.2. Risk assessment

Rapid risk assessments are undertaken in the initial stages of events of potential public health concern and are challenging as they must be produced within a short time period, when information is often limited and circumstances can evolve rapidly. ECDC has produced guidance on how to conduct rapid risk assessments that could be adapted to this specific context [53].

The assessment should take into consideration the risk for epidemic-prone diseases:

- existing in the country of origin of the migrant population
- prevailing in countries through which the migrants may have travelled
- present at the location of the migrant centres in the host country
- favoured by the immunisation status, hygiene and sanitation conditions experienced by the migrants.

The assessment requires a review of the epidemiological situation of the countries of origin of the migrant population as well as of the countries they passed through on their journey. The diseases and conditions considered in the rapid risk assessment will mainly be epidemic-prone infectious diseases, but should encompass health issues that can affect the migrant population such as their nutritional status or climatic conditions that could result, for example, in heat-related illnesses. Mental health conditions may also be considered when relevant.

The outcome of the rapid risk assessment is a list of diseases and conditions that constitute a risk for the migrant population that can be prevented and controlled through the implementation of public health measures.

This document focuses only on the establishment of public health surveillance systems in these contexts, as a tool for the timely detection of the emergence of public health issues that require rapid investigation and implementation of control measures. The decision to establish a syndromic surveillance system takes into account the risks identified during the risk assessment, along with the capacity of the existing surveillance system to capture relevant surveillance information in a timely manner. Very often, migrants in reception centres or in

spontaneous campsites are being cared for by organisations not fully integrated into the healthcare structures reporting to the existing surveillance system. Therefore, syndromic surveillance is often useful in complementing the existing system and for the timely connection of the primary care providers in migrant centres with public health officers in charge of the investigation and response to public health emergencies.

2.3. Surveillance protocol

Surveillance objectives

The main objective of the syndromic surveillance system is to enhance early detection of single cases or outbreaks that require an assessment to trigger and guide appropriate public health measures.

The results of a risk assessment can also be the basis upon which local, regional and national health authorities can build to define the objectives of the syndromic surveillance system in the national context, and in the settings in which the surveillance system will be established.

Selection of syndromes for surveillance

The selection of the syndromes to place under surveillance results from the risk assessment and the surveillance objectives, keeping in mind the public health actions that would need to be taken in response to an event.

The syndromes presented below (Table 1, Annex 2) are designed to be consistent with epidemic-prone diseases, severe conditions or death. However, the intrinsic flexibility of the syndromic surveillance approach [54] allows countries to expand the scope of the syndromes according to national requirements, including non-communicable diseases, nutritional status, mental health and heat-related illnesses.

Case definition

It is important to stress that syndrome definitions can be designed to be more or less sensitive or specific with respect to the disease for which the syndrome is used as a proxy indicator. The final selection will depend upon the objectives of the system, the insights from the risk assessment on the epidemiology of the population under surveillance (Section 2.1) and the type of front-line healthcare workers who will be recording the information. For example, in a situation where the prevalence of tuberculosis is considered high, a more sensitive syndrome definition will be used as the syndromic proxy for surveillance given the higher positive predictive value of the syndrome, whereas in a situation with a low prevalence of tuberculosis, a more specific syndrome definition will be considered.

Once defined, syndromes are provided with short clear titles, taking into account the vocabulary and capacity of the reporting healthcare workers working within the specific migrant setting. For this reason, syndrome titles are often selected not only for technical reasons alone, but also for practical ones related to ensuring clarity, simplicity and consistent interpretation. This facilitates the collection of reliable data.

Annex 2 presents a more detailed table of the 13 syndromes presented in Table 1. For each syndrome, target diseases or conditions are provided, each supported with comments on the rationale and design of the syndrome definitions and a list of possible public health actions that could be triggered by the syndromes in a migrant setting.

Table 1. Example set of syndromes to be monitored

Syndrome
Acute respiratory infection with fever
Prolonged productive cough
Bloody diarrhoea
Non-bloody gastroenteritis
Rash and fever
Meningitis, encephalitis
Lymphadenitis with fever
Acute paralysis
Sepsis or unexplained shock
Fever and bleeding
Acute jaundice
Skin parasites
Unexplained deaths

Table 1 and Annex 2 are derived from a list of syndromes developed by the Italian Institute of Public Health [8-13] and adapted by the Hellenic Centre for Disease Control and Prevention and the Greek National School of Public Health. This list takes into account the ECDC review of expert opinion on the current migrant situation in Europe [1,2,53], as well as current methods for syndrome selection [30].

Indicators for action

Each syndrome should be defined along with the indicator that will trigger the decision to launch a public health investigation and response.

Indicators are compiled from the data collected and may be expressed as:

A number of cases presenting with the syndrome
The number of cases related to specific syndromes is a measure of the burden of the syndrome in the population under surveillance. It may be useful for planning purposes and to scale the public health intervention in the community. However, it is not possible to quantify the risk from the number of cases alone; it must be related to the size of the population giving rise to the cases.

A proportion of migrants presenting with a specific syndrome
The rate at which a syndrome is reported in a population is expressed by dividing the number of cases having occurred in a migrant setting every day by the population present in the migrant centres on that day. An estimation of the risk can be made for the population in which it is calculated. The expression as a rate enables a comparison across migrant centress and over time, accounting for changes in the population.

A proportion of visits related to a specific syndrome
When the population present in a migrant centre or a spontaneous campsite is not precisely known, the number of syndromes reported for a given day in a migrant centre can be expressed as the proportional morbidity: the proportion of consultations for this syndrome in this setting on this day out of all consultations in this setting on this day.

A public health intervention should be triggered when an indicator reaches a defined threshold for action. Thresholds for action can be established in two different ways:

As an absolute value
For example, one case of haemorrhagic fever syndrome or one case of suspected measles should trigger an investigation to confirm the diagnosis and control any further spread.

As a relative change over time
For example, for diseases more frequent in a community, such as diarrhoea, a few sporadic cases may not indicate a public health issue while an increase over time may indicate an emerging public health threat that should trigger an investigation. The threshold may be expressed as an absolute increase (a doubling, or a tripling of cases) or as a statistical increase, based on a simple comparison with data observed on previous days.

Finally, the action resulting from any indicator surpassing the threshold should be precisely defined and expressed as a standard operating procedure. As an example, if one case of rash and fever suggestive of measles is identified in a migrant centre, the following actions are immediately triggered:

- The nurse in charge of the clinic calls the surveillance coordinator for the area to inform him/her of the finding
- The child is isolated from other children in the migrant centre
- The child is referred to the local laboratory for a confirmatory test.

2.4. Data requirements

Daily data requirements for a syndromic surveillance system include:

- number of newly observed syndromes (numerator), stratified by age group, not by gender
- number of consultations in the setting (proxy for denominator)
- estimation of migrants hosted in the setting (denominator).

Only new patients are reported, while patients presenting for follow-up consultations and already reported to the system on first consultation should not be reported again.

Stratification by age group should be limited to a few age groups consistent with the epidemiology of the syndromes under surveillance. For example, vaccine-preventable diseases such as measles should be expected among children under five years of age, while severe watery diarrhoea among adults may indicate a cholera outbreak. The standard approach is to focus on children under five years of age, those between five and 14 years old, and 15 years and over. In structured settings, the age categories used to register migrants should also be used

for reporting syndromes, e.g. 0–4, 5–17, 18 and over, if the age of 18 years is used to define an adult. The number of consultations should be collected daily, stratified by the age categories used for reporting the syndromes.

In organised reception centres where a register of incoming and outgoing migrants is kept, data should be gathered daily from the register, stratified by the age categories used for reporting the syndromes.

Frequency of reporting

Completeness and timeliness of data reception is crucial. The feasibility of syndromic surveillance should be assessed in each context among potential reporting units. Data collected by the syndromic surveillance system need to be compiled and reviewed daily at national and subnational levels as well as at migrant setting level. More detailed reports may be produced at longer time intervals, such as weekly.

Reports are produced as summary tables including numbers of syndromes reported by day and age group. When daily counts of migrants by age group are available, rates (number of cases for a syndrome in an age group divided by the number of migrants of that age group present at the same time) are added. If only the number of consultations by age group is available, the proportion of visits for each syndrome in each age group is indicated.

Statistical thresholds

While several statistical methods are reported in the literature for the analysis of syndromic surveillance data, most rely on the availability of historical data for the population under surveillance. However, long-term historical data on residents are not usually available in migrant centres, especially in the early phase of the situation.

Statistical thresholds are defined by computing an expected case number/rate/proportional morbidity based on the number of cases reported in the past, and a confidence interval around this value within which an observed number of cases would be considered not to depart significantly from past observations. The observed case number/rate/proportional morbidity for each syndrome and age group is checked daily to detect a value exceeding the limits of the confidence interval, possibly indicating an increase in transmission in the setting.

Expected number of cases

As many communicable diseases are subject to seasonal variation, in a stable population the expected number of cases often looks at values observed in the past at the same time of the year. In a migrant centre, historical data are only available for the most recent period, and, therefore, the expected number of cases uses the average number of cases observed in the migrant population in the previous seven days. A moving average approach is used to update daily the expected number of cases. The same moving average approach is used for the number of migrants present (denominator) and for the number of consultations to calculate an expected number of cases, incidence and proportional morbidity. Alternatively, other models taking into account the trend in observed cases can be used to derive the expected number of cases [55].

Confidence intervals and statistical alerts

The confidence interval around the expected value is defined by the likelihood that an observed value is consistent with a stable, non-epidemic situation. It is expressed as a percentage. A 95% confidence interval around an expected value provides the range of values outside of which a value would have only 5% or less chance of being observed in a stable non-epidemic situation. The limit of the range of expected values uses different statistical probability distributions depending on whether it is expressed as a number of cases or a rate/proportion:

- A Poisson distribution is applied to calculate a confidence interval around the expected number of cases
- A binomial distribution is applied to calculate a confidence interval around the proportional morbidity or incidence.

Surveillance experts usually use a 95% confidence interval for considering a possible departure from expected values and triggering the appropriate public health response. In a specific situation, the level of confidence can be decreased, e.g. to 90%, to be more sensitive in detecting an event, or increased, e.g. to 99%, to be more specific and only trigger an investigation for a highly significant statistical increase. An example is given in Figure 2.

Interpretation of an alert signal

An alert is triggered if the observed number of syndromes, proportional morbidity of a syndrome or incidence of a syndrome for a given day, is higher than the upper bound of the confidence interval.

However, a statistical alert does not determine an epidemic, but it does require an investigation before establishing an emerging outbreak. Random variations during a stable epidemiological situation can generate false alerts. This means that whenever one tests 100 observed values against 95% confidence intervals, five alerts are likely to be detected by chance only. When analysing data from a syndromic surveillance system monitoring 13 syndromes,

one alert is therefore likely to appear every second day by chance only. This is multiplied by the number of settings if analysis at the migrant setting level is also carried out.

An alarm consists of an alert triggered on the same syndrome for two or more consecutive days.

Example of use of thresholds and confidence intervals

Figure 2 and Figure 3 present theoretical examples to highlight differences in behaviour between the three indicators (number of cases, incidence and proportional morbidity). The 95% confidence interval in Figure 2 and Figure 3 is only available after the first seven days, as it uses the average of the values observed on the first seven days to estimate the expected value for Day 8.

Figure 2 exemplifies an increase for a syndrome reported in a setting with a stable population and stable attendance at the clinic. This would be a situation in which an infectious disease starts spreading. In such instances, the three indicators are increasing in parallel and trigger an alert on 24 April 2016.

Figure 2. Distribution of observed values, expected values and the 95% CI of the expected values for a syndrome by day in a setting with a stable population and health facility attendance experiencing an increase in reporting for a syndrome

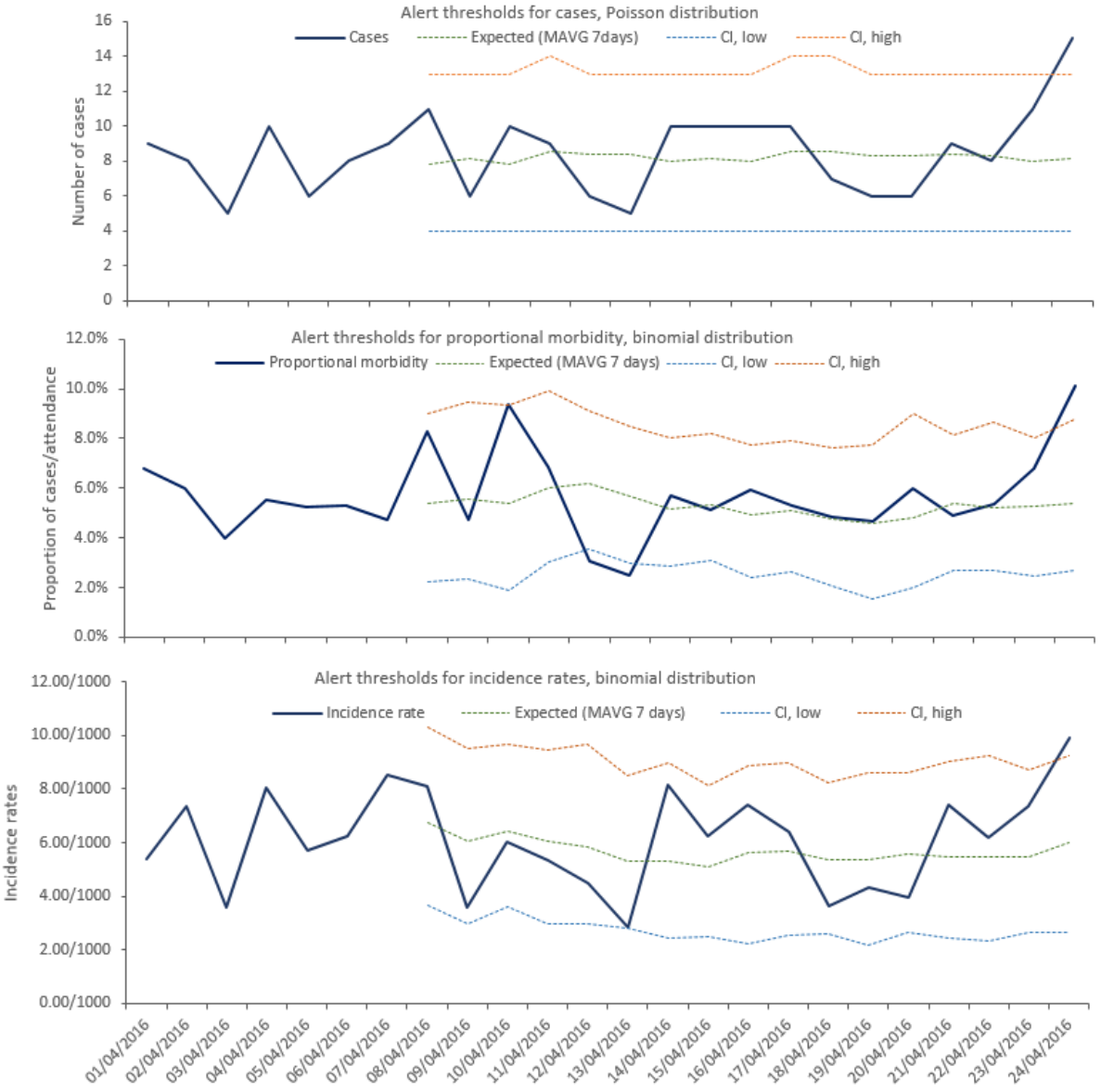
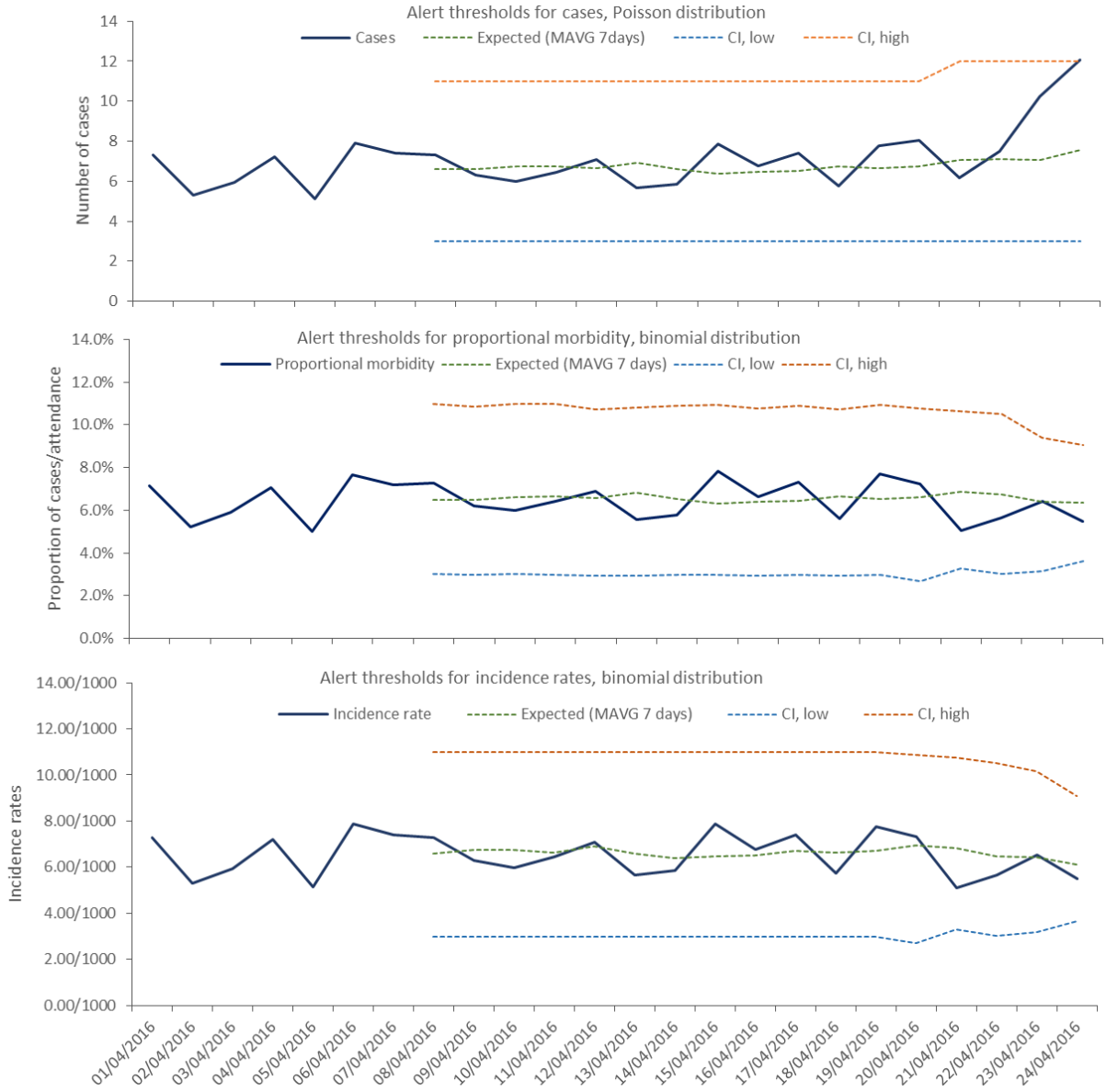


Figure 3 shows how the three indicators would behave in a setting experiencing a recent increase in population, resulting in a parallel increase in attendance at the health facility and in the number of syndromes reported. This would correspond to a situation where disease transmission does not increase, but the population gradually does, resulting in a significant increase of the number of cases reported. While the upper limit of the 95% confidence

interval is passed on 24 April 2016 for the indicator expressed as a number of cases, the indicators expressed as incidence and proportional morbidity do not show any significant departure from the levels expected because of the parallel increase in population and attendance. ECDC has developed a tool to calculate the thresholds for number of cases, incidence and proportional morbidity according to this methodology for each particular setting and situation (http://ecdc.europa.eu/en/publications/Documents/syndromic-surveillance-migrant-centres-handbook.xls).

Therefore, in situations where population denominators are unstable, a change in the epidemiological pattern of diseases is best detected by indicators expressed as incidence or proportional morbidity (if incidence is not available) rather than on indicators based on absolute numbers. Yet, looking at the trend in absolute numbers still provides important information about the burden of specific syndromes in a particular setting, which is useful for scaling health services and resources.

Figure 3. Distribution of observed values, expected values and the 95% CI of the expected values for a syndrome by day in a setting with population, attendance and syndrome increasing in the same proportion



2.5. Set-up of data collection and standard operating procedures

Data collection

Data collection is crucial to the efficient functioning of syndromic surveillance. It is suggested that the syndromes to be recorded and the data collection forms be discussed in detail with the reporting healthcare workers in advance of implementing the system. A site visit and training session are important means for ensuring that data are collected consistently and accurately.

It is important to stress that data on all syndromes are meant to be reported daily, including zero-reporting.

An example data sheet for the daily reporting of the aggregate number of cases for each syndrome and denominators (population or number of visits) by age group is available in Annex 3 of this handbook.

Ideally, data reporting would be web-based to a central database, so that data are available in real time to subnational and national health authorities.

The web-based database should be password-protected and comply with data protection requirements. In each setting, a person responsible for data entry should be identified.

Data validation

Data should be checked for quality and cleaned before analysis.

The quality of data collected on paper may be checked during entry into the database (e.g. at the national level). Some data anomalies might be noticed by the data entry officer directly: e.g. cases of extremely rare or severe conditions. Less evident anomalies should be detected by inbuilt automatic validation checks in the database (e.g. making sure the number of syndromes reported one day for an age group is not higher than the number of people in that age group present in the setting that day) and signal any implausibility to the data entry officer. In either instance, the data entry officer should contact the reporting reception centre for confirmation before running any data analysis.

If case data are entered directly into a web-based platform by the reporting health officer based in the setting concerned, inbuilt automatic validation checks should improve the quality of the data. Web-based tools may also issue alerts (e.g. on missing data) to the reporting health officer of the setting when he/she logs in. This can improve data completeness and timeliness.

Data analysis

Statistical analysis of syndromic surveillance data is usually performed by a coordination team (e.g. at national level) in charge of interpreting data and deciding on follow-up actions. The coordination team could, for example, comprise three epidemiologists, with at least one having a good statistical background and two having a medical background (in public health and/or infectious diseases).

An automatic statistical analysis of the data for each setting, and then at subnational or national level, should be conducted daily.

Standard operating procedures

Regardless of the approach chosen for data analysis and the definition of thresholds, standard operating procedures need to be in place to guide when, how and by whom the surveillance findings should be collected, reported, interpreted and acted upon.

Verification of findings

If an alarm is raised, the coordination team should inform the reporting health officer of the setting concerned and report any related alerts that have been observed. The team should also ask for feedback on the epidemiological situation faced in the field. The reporting health officer of the setting concerned will verify the information (excluding data entry errors, describing the clinical presentation and the likely diagnosis). Based on this feedback, the statistical alarm will be confirmed as an early signal of a potential health emergency among migrants hosted in the migrant centre, or not.

In addition to identifying when incidence data on a common syndrome in the population depart from what is expected, the system will also generate alerts when a rare syndrome is reported (and none were reported in the previous week). As shown in Table 1, some syndromes can be defined purposefully in this way. In case of rare conditions (defined by more specific syndrome definitions, e.g. suspected tuberculosis) or extremely severe

conditions (e.g. septic shock or sudden death), the coordination team will undertake further actions, e.g. make a telephone call to the setting for additional information.

Reporting potential health emergencies

If an early signal of a potential health emergency is confirmed, the coordination team should report their findings to the relevant health authorities in charge of supporting the migrant centre in managing the response.

Syndromic surveillance has an alerting role that will not only be used to trigger public health actions. For example, if a suspected tuberculosis alert is detected, the health authority for the setting will be informed. However, if a case of tuberculosis is suspected, the responsible health providers should independently refer the case for care and follow-up and report him/her to the statutory surveillance system (which syndromic surveillance cannot substitute). Therefore, the public health interventions deemed necessary will be activated on the basis of a number of information sources, in addition to syndromic surveillance.

Keeping track of signals

It is important that the coordination team keeps track of the signals produced by the system and of the subsequent action taken, e.g. verification of the signal, decision about its public health significance, prevention and control action planned, prevention and control action taken, etc. This can be done using a simple database of signals which is updated regularly to include information on further action. Ideally, this database with initial information regarding the signals (e.g. date, site, syndrome, number of cases, etc.) is produced automatically by the analysis programme.

Data dissemination

In addition to validating syndrome alerts and alarms by communicating with health providers in the reporting units and rapidly communicating validated information to public health authorities, outputs of syndromic surveillance should also be disseminated to inform target audiences.

Target audiences should be identified by the implementing countries and may include health providers in the reporting units, regional and national health authorities, NGOs and other stakeholders involved in providing health services to migrants, as well as the media and the general public.

For each target audience identified, one or more dissemination tools (bulletins, newsletters, alert notes, reports) can be designed with specific distribution channels (emails, text message, websites, etc.) and publication frequency (daily, weekly, monthly).

A typical dissemination tool used in syndromic surveillance is a weekly national surveillance bulletin that presents aggregated data.

The bulletin may contain the following information:

1. The reporting period.
2. A summary paragraph indicating the main surveillance findings during the reporting period and public health actions taken, if any (e.g. three alerts and one alarm have been reported for the period. These concerned syndromes X, Y and Z in the settings A and B. Investigation ruled out any outbreak of public health significance for syndromes Y and Z. The third syndrome was confirmed as a case of X).
3. A section on the overall information collected during the reporting period. This may include the number of syndromes detected and a table on the distribution of cases reported by syndrome and reporting unit during the reporting period.
4. A section on syndrome incidence trends. This section may include graphs on the incidence of syndromes over time that may be stratified by place (e.g. administrative units/reporting setting), depending on the data available and the detail needed.
5. A section describing the alerts and alarms recorded during the reporting period and the potential public health emergencies identified (if any). This section may include the graphical outputs from the system and the alerts and alarms recorded. If available, this section may include data on any public health actions taken in response to the surveillance information.
6. A section on the system performance. This section should provide information on indicators of completeness and timeliness that might help readers to interpret the information provided. In addition, the migrant centre census data available may serve to assess the system's representativeness (for further information please refer to Section 3). Some examples of indicators are provided below:
   - Number of units reporting to the system/number of existing migrant centre identified in the census (to provide some information of the representativeness of the data provided)
   - Number of units reporting during the period/number of recruited reporting units in the surveillance system (to provide some indication of reporting completeness for the period)
   - The proportion of reporting units meeting the predefined timeliness target (to provide some indication of reporting timeliness).

3. Pilot phase

Once the surveillance system objectives have been defined, the proposed methodology adapted and the data collection tools set up (e.g. a web-based platform), it is advisable to pilot the system ahead of implementation in order to test its functions and performance (Figure 1).

The methodology used to pilot the system will depend on the situation in the implementing country. An example of elements to consider during the pilot phase is presented below.

The pilot phase may be divided into four steps:

1. Recruitment and training (on the system objectives, reporting requirements and syndrome definitions) of healthcare providers in the reporting units.
2. Technical testing of data collection, analysis, validation and alerting procedures (including the functioning of the tools). Acquisition of baseline data for each reporting unit for each syndrome.
3. Weekly monitoring of the system performance (timeliness, reporting completeness) and weekly outputs (e.g. bulletin) to be tested with a restricted audience (for clarity and completeness of information provided).
4. Evaluation of the pilot phase (by providing feedback on the overall performance to the reporting units and collecting feedback from them, e.g. through a questionnaire on acceptability, simplicity and sustainability).

Following this process, any gaps or ambiguities identified by front-line healthcare workers, data analysts and data users should be addressed leading to a consolidated syndromic surveillance system. This approach can also increase the sense of ownership of all stakeholders.

4. Monitoring and evaluation

The ongoing monitoring suggested is aimed at assessing whether the syndromic surveillance system meets the objective of rapidly detecting early signals of potential health emergencies among migrants hosted in migrant centres. To make the monitoring feasible and sustainable, particularly during a large influx of migrants when data flows are expected to peak, the proposed focus is only on two priority surveillance attributes: timeliness and completeness. This approach can be applied during the pilot phase as well as during the full implementation phase.

A full evaluation to assess all surveillance attributes might be considered by implementing countries. It should be adapted to the way syndromic surveillance has been implemented and to the other existing information sources (e.g. statutory surveillance to assess sensitivity, specificity and positive predictive value).

Completeness

The completeness of reporting should be assessed weekly: if a reporting unit is not reporting every day, the coordinating team should contact the healthcare provider in this reporting unit and request him/her to report the missing data as soon as possible.

Any reporting unit failing to report for one day will no longer have continuous baseline data to calculate the thresholds. A full week of data will be required to rebuild this threshold automatically. For this reason, it is recommended to aim for 100% completeness.

Timeliness

The timeliness of reporting should be assessed weekly (number of reports from each reporting unit sent within a predefined target). If a reporting unit repeatedly reports with excessive delay, the coordinating team should contact the healthcare provider in this reporting unit and request him/her to report daily as per the syndromic surveillance protocol.

Timeliness targets (e.g. 48 hours) should be defined by the implementing country, balancing the constraints faced in the field with the reporting requirements to meet the surveillance objectives.

Adaptation to changing circumstances

Once set up, the syndromic surveillance system should not be considered fixed once and for all. The influx of refugees and migrants in a country is a dynamic phenomenon, and in some instances their general profile may change substantially over time. Furthermore, the structure and organisation of the reception facilities may also change.

The coordination team should keep a critical eye on the general situation of refugees and migrants in the country, be prepared to carry out a new risk assessment if deemed necessary, and modify the surveillance protocol accordingly (including selection of syndromes, data collection process, indicators, report templates, etc; see Section 2), bearing in mind that changes should be kept to the minimum necessary in order to retain comparability as much as possible.

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Annex 1. Template for conducting census of migrant centres

* mandatory field

Section 1 – Details of the centre		
Field name	**Field type**	**Options / Format**
Date *	Date	dd/mm/yyyy
Region *	Text – Mutually exclusive options	List of Regions
County *	Text	
Name of the migrant centre*	Text	
Type of migrant centre*	Text – Mutually exclusive options	Close/detention, Holding Centre for Asylum seeker, Short-term at point of entry, unstructured spontaneous setting, Other
If other, specify	Text	
Type of the person/institution in charge of the centre *	Text – Mutually exclusive options	Institution, Company, Private
Name of the person/institution in charge of the centre *	Text	
Is the centre managed by persons/institutions contracted by a governmental body?	Yes/No	
If yes, with which governmental body? (e.g. Ministry of Interior)	Text	
If yes, indicate the contract expiry date	Date	dd/mm/yyyy
Name and Surname of the person responsible for the centre *	Text	
Phone Number of the person responsible for the centre *	Text	
E-mail of the person responsible for the centre *	Text	@
Centre active since	Date	dd/mm/yyyy
Is the centre active at the time of the survey?*	Yes/No	
Does the centre intend to participate in the syndromic surveillance? *	Yes/No	
Name and surname of the representative for the syndromic surveillance*	Text	
Phone number of the representative for the syndromic surveillance*	Text	
E-mail of the representative for the syndromic surveillance*	Text	@
Section 2 – Population hosted in the centre		
Field name	**Field type**	**Options / Format**
Maximum person capacity authorised	Number	
Number of migrants hosted at the time of the survey*	Number	
Mean length of stay in the centre *	Text – Mutually exclusive options	1-7 days, 2-3 weeks, 1 month, 2-6 months, 6 months-1 year; > 1 year
Maximum number of migrants staying in the centre in one day in the last year	Number	
Minimum number of migrants staying in the centre in one day in the last year	Number	
Did the centre host migrants aged < 18 years in the last year?	Yes/No	

If yes, specify the age group	Text – Multiple options	0-11 months, 1-4 years, 5-14 years, 15-17 years
Did the centre host pregnant women in the last year?	Yes/No	
Is the daily number of migrants hosted in the centre regularly collected and available?	Yes/No	
Section 3 – Health services inside the centre		
Field name	**Field type**	**Options / Format**
Which type of healthcare staff provides the health services inside the centre?	Text – Multiple options	Nurses working during the day; 24 h nurses; nurses on request; medical staff working during the day; 24 h medical staff; medical staff on request
The health services offered inside the centre are managed by:	Text – Mutually exclusive options	Healthcare staff of the Institution/Company in charge of the centre; Public Local Health Unit healthcare staff; Other
If Other, specify:	Text	
Is the healthcare staff of the centre in charge of reporting any infectious disease suspected in the migrants who are examined inside the centre?	Yes/No	
In the last year did the centre report to national routine surveillance system any individual case of infectious disease among hosted migrants?	Yes/No	
If yes, how were cases reported?	Text – Mutually exclusive options	Individual standardised forms within the routine infectious diseases surveillance system; Informal communication (e.g. phone call); Other
If Other, specify:	Text	
Does the healthcare staff of the centre perform a clinical evaluation of each host arriving at the centre?	Yes/No	
Does the healthcare staff of the centre fill individual health records including health information regarding each host examined in the centre?	Yes/No	
Does the centre internally organise any ambulance transport of the hosted migrants, if necessary?	Yes/No	
Does the centre internally offer other services relevant to the health status of the hosted migrants?	Yes/No	
If Yes, specify:	Text	
Is health information of the migrants hosted in the centre regularly collected and archived in a database?	Yes/No	
Was the centre ever subjected to a health inspection?	Yes/No	
If yes, specify the date of the last inspection	Date	dd/mm/yyyy
If yes, specify which Health Authority performed the inspection	Text	
Section 4 – Health external structures collaborating with the centre		
Field name	**Field type**	**Options / Format**
Which are the reference health structures for diagnosis and treatment for moving sick migrants hosted in the centre (e.g. hospitals)?	Text	
Are standard procedures in place for moving the patients to the reference health structures?	Yes/No	
Which are the reference health structures for providing prevention services (e.g. vaccination) to the migrants hosted in the centre?	Text	
Are standard procedures in place for activating prevention services?	Yes/No	

Were formal agreements between the centre and private/public health structures signed to facilitate the access of the migrants hosted in the centre to the external health services?	Yes/No	
If Yes, specify:	Text	

Annex 2. Example of a set of syndromes for surveillance

Title	Definition	Targeted diseases and conditions	Public health actions	Indicator and threshold for public health action	Comments
Acute respiratory infection with fever	- Temperature ≥38.0°C And at least one of the following signs/symptoms: - Breathing difficulties - Cough - Sore throat - Chest rales - Increased respiratory rate	Pharyngitis, tracheitis, bronchitis, pneumonia, bronchopneumonia or bronchiolitis, including those caused by: - Viruses: e.g. adenovirus, rhinovirus, respiratory syncytial virus, influenza, parainfluenza… - Bacteria: e.g. *streptococcus*, pneumococcus, *mycoplasma*, *legionella*…	Outbreak investigation in case of clustering of cases Public health measures for specific aetiologies: - Legionnaires' disease: environmental investigation - Diphtheria: isolation and contact tracing	Statistical increase Observed above the upper limit of the confidence interval of the expected	This syndrome will capture common viral acute respiratory infections such as seasonal influenza, but can identify more rarely bacterial infections requiring public health measures, such as Legionnaire's disease or diphtheria.
Prolonged productive cough	- Productive cough lasting more than 3 weeks	Pulmonary tuberculosis	If confirmed tuberculosis: isolation, contract tracing, chemo-prophylaxis	One case, as every case should be investigated	Early detection of tuberculosis is important in migrant centres because of the conditions experienced by migrants during their journey, which can favour transmission.
Bloody diarrhoea	All of the following signs/symptoms: - 3 or more loose stools per 24 hours - Red blood in the stool	Any infection presenting as acute dysentery, including: - Amoebic dysentery - Bacillary dysentery (*Shigella*) - Entero-haemorrhagic *Escherichia coli* (EHEC)	Outbreak investigation for source and vehicle, and control in case of clustering of cases	Statistical increase Observed above the upper limit of the confidence interval of the expected	Shigellosis is very infectious in such settings
Non-bloody gastroenteritis	At least one of the following signs/symptoms: - 3 or more loose watery stools per 24 hours - Vomiting	Gastroenteritis caused by: - Viruses: norovirus, rotavirus, etc. - Bacterial toxins: staphylococcal, etc. - Bacteria: *Campylobacter*, *Salmonella* spp. (non-typhoid), typhoid fever, *E. coli*, *Yersinia*, Cholera, etc. - Parasites: *Cryptosporidium*, *Giardia*, *Cyclospora* Chemicals: e.g. mushroom toxins			Severe diarrhoea resulting in dehydration, in particular in an adult could be indicative of cholera.
Rash and fever	Temperature ≥38.0°C And A localised or generalised rash of any nature.	Diseases resenting with rash and fever and caused by: - Viruses: measles, rubella, chickenpox, smallpox, enteroviruses, Chikungunya, West Nile virus, Zika virus, dengue fever, fevers, Coxsackie virus etc. Bacteria: typhus fever, trench fever, louse-borne relapsing fever, leptospirosis, etc.	Outbreak confirmation and investigation, contact tracing, isolation, immunisation (measles, chickenpox …), prophylaxis.	One case	Measles is a public health emergency in migrant centres given its high contagiousness and severity for malnourished children. Measles and varicella can be seen among adults in migrants from countries where infection in childhood has been prevented by immunisation [56].

Meningitis, encephalitis	Temperature ≥38.0°C And at least one of the following signs/symptoms: - Severe, persistent headache - Neck stiffness - Altered consciousness - Altered mental status - Confusion - Delirium - Disorientation	Bacterial/viral/fungal/other infectious meningitis or encephalitis. This could be caused by: - Bacteria: meningococcal, Hib, pneumococcal, listeriosis, leptospirosis, TB, syphilis - Viruses (aseptic): enteroviruses, polio, measles, mumps, rubella, influenza, West Nile virus, other arboviruses… Fungi (aseptic): Cryptococci…	Outbreak confirmation and investigation, contact tracing, isolation, immunisation, prophylaxis.	One case	This syndrome targets infections caused by a wide range of pathogens and transmitted by different routes. One case of meningococcal meningitis should trigger consideration for prophylaxis among contacts.
				Statistical increase Observed above the upper limit of the confidence interval of the expected	Meningococcal meningitis can cause severe, large outbreaks in institutional settings. Aseptic meningitis/encephalitis that can be transmitted in a community, e.g. due to enteroviruses or by vectors, require public health action in a contained setting.
Lymphadenitis with fever	Lymphadenitis with fever All of the following signs/symptoms: - Temperature ≥38.0°C Enlarged lymph nodes with or without pain	Several conditions could present with fever and swollen lymph nodes as a prominent symptoms. These could include: infectious mononucleosis, plague, tularaemia, diphtheria	Outbreak confirmation and investigation, contact tracing, isolation/containment, immunisation (diphtheria), prophylaxis.	One case	Plague and diphtheria are the two epidemic-prone diseases of public health priority that can present with lymphadenitis and fever. The circulation of *C. diphtheriae* has been documented among migrants in the EU/EEA [57,58].
Acute paralysis	At least recent onset of one of the following symptoms: - Ptosis - Blurred vision - Double vision (diplopia) - Speech impediments (dysarthria) - Eating impediments (dysphagia) - Acute onset of flaccid paralysis	Acute flaccid paralysis/paralytic poliomyelitis Botulism	Outbreak confirmation and investigation (e.g. source/vehicle for botulism), contact tracing, immunisation (poliomyelitis).	One case	This syndrome captures acute flaccid paralysis both of cranial nerves, typical symptom of botulism intoxications, and of the peripheral nervous system, that is a typical symptom of paralytic poliomyelitis.
Sepsis or unexplained shock	More sensitive alternative All of the following: - Tachypnoea (in adults: ≥22/min) - Altered mental status - Systolic hypotension (in adults: ≤100 mmHg) More specific alternative At least two of the following signs/symptoms of a systemic inflammatory response syndrome: - Tachypnoea - Tachycardia - Temperature ≥38°C or <36°C	Includes all infections causing sepsis, severe sepsis or septic shock. This could include dengue shock syndrome and invasive meningococcal disease.	Outbreak investigation if clustering of cases	One case	
Fever and bleeding	Temperature ≥ 38.0°C And at least one of the following signs/symptoms: - Petechial rash with any purpuric areas - Haemorrhagic exanthema - Haematuria - Conjunctival haemorrhage - Gingival bleeding - Epistaxis - Bloody diarrhoea - Unexplained bleeding from other sites Or clinical suspicion of a viral haemorrhagic illness	Haemorrhagic fevers due to infectious disease agents. These could include: - Yellow fever - Dengue - Crimean-Congo haemorrhagic fever and other arboviral diseases Ebola and other viral haemorrhagic fevers.	Outbreak investigation if clustering of cases Control measures, including contact tracing, isolation, immunisation	Number of cases One case	This syndrome could be adopted by health authorities having assessed a risk for viral haemorrhagic fever (VHF) introduction and spread in migrant centres.

	Pay attention not to include cases of acute leukaemia or bleeding of traumatic of pharmacological origin (e.g. anticoagulants).					
Acute jaundice	Acute onset of jaundice And at least one of the following signs/symptoms: - Temperature ≥38.0°C - Malaise - Hepatomegaly		Acute viral hepatitis A and E Other hepatitis	Confirmation of aetiology Outbreak investigation if clustering of cases, for source and vehicle Control measures, including immunisation	Statistical increase Observed above the upper limit of the confidence interval of the expected.	In contained settings such as migrant centres, overcrowding and unsanitary conditions can favour the transmission of infections due to HAV and HEV.
Skin parasites	More sensitive alternative - Presence of visible ectopatasites in any body part Or all of the following signs/symptoms: - Skin lesions caused by scratching - Papules, vesicles or small linear burrow tracks	More specific alternative - Skin lesions caused by pruritus/scratching And - Papules, vesicles or small linear burrow tracks	Infestation by ectopatasites: mites, scabies, lice pediculosis and pthiriasis. Body lice (pediculous corporis) can transmit: - Epidemic typhus (*Rickettsia prowazekii*) - Trench fever (*Bartonella Quintana*) - Relapsing fever (*Borrelia recurrentis*) Bites from mites and fleas can become infected (Staphylococcal skin infection) Fleas can transmit - Flea-borne typhus (*R. typhi*) or murine typhus, *(R. mooseri*, *R. felis*) - Plague Mites - Mite-borne typhus - Scrub typhus Tsutsugamushi disease (*Orientia tsutsugamushi*)	Household contact tracing Hygiene measures	Statistical increase Observed above the upper limit of the confidence interval of the expected.	Two definition alternatives are provided, one more sensitive and one more specific. The former enables the more general monitoring of parasites that are transmitted from person to person through direct contact/bedding/clothes. This could be used as an early proxy of poor hygiene conditions that might be conducive to an easier transmission not only of scabies but also of louse-borne fever. The latter more specifically targets scabies. The rationale of targeting a wider range of infestations is that louse-borne relapsing fever has been documented among migrants in the EU/EEA [59].
Unexplained deaths	Any death of unknown cause		Deaths of unknown cause		Number of cases One case	

Annex 3. Generic reporting form for data collection in migrant centres

Country:		Date:	
Migrant centre:		Name of healthcare worker:	

	Number new cases			
Syndromes under surveillance	0–4 years	5–17 years	18+ years	Total
[1] Acute respiratory infection with fever				
[2] Prolonged productive cough				
[3] Bloody diarrhoea				
[4] Non-bloody gastroenteritis				
[5] Rash and fever				
[6] Meningitis, encephalitis				
[7] Lymphadenitis with fever				
[8] Acute paralysis				
[9] Sepsis or unexplained shock				
[10] Fever and bleeding				
[11] Acute jaundice				
[12] Skin parasites				
[13] Unexplained deaths				

Denominators	0–4 years	5–17 years	18+ years	Total
Total number of persons in the centre				
Total number of clinic visits (for all causes)				

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