SIDARTHa
European Emergency Data-based Syndromic Surveillance System

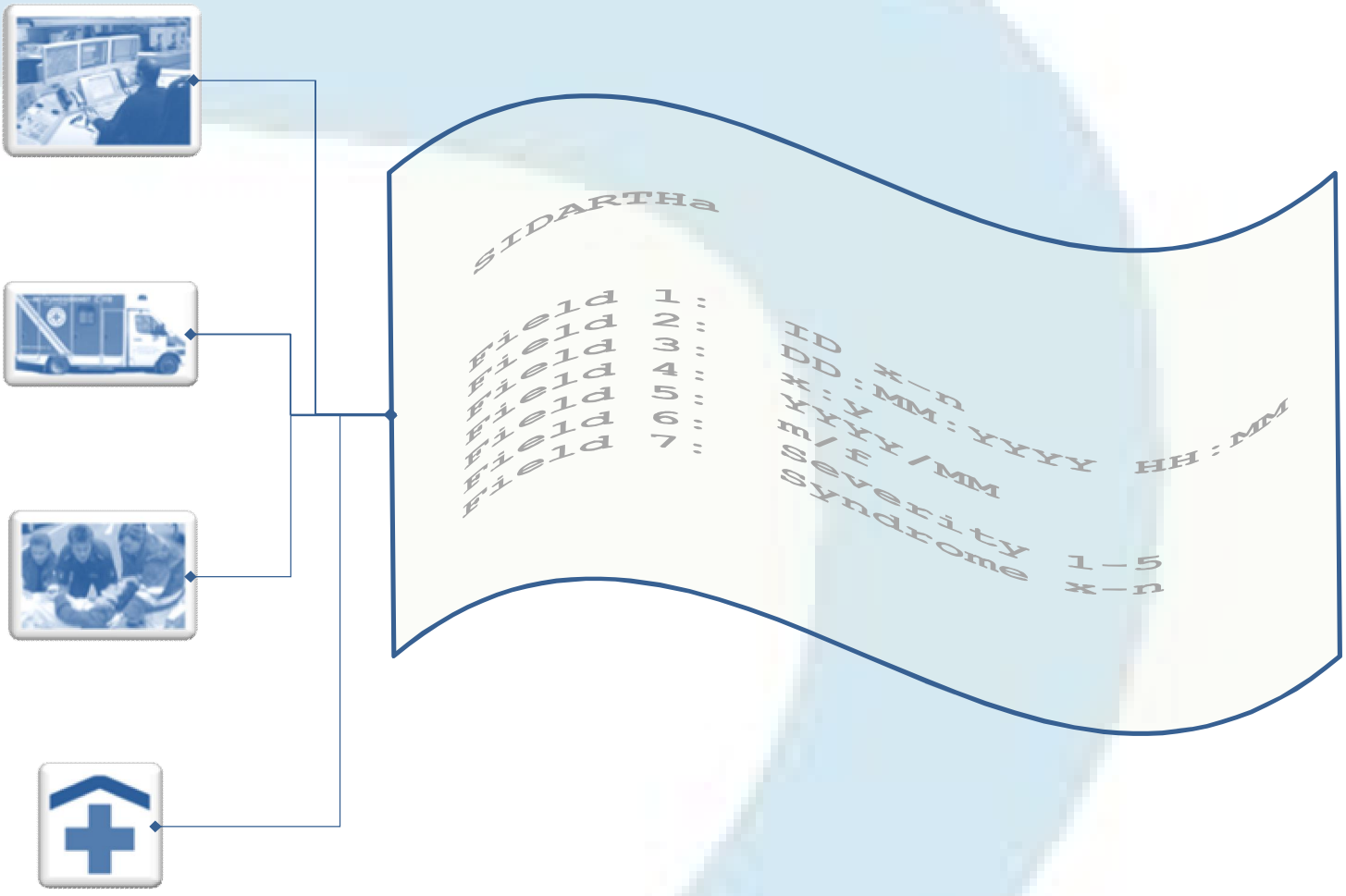
Executive Agency for Health and Consumers

Directorate-General for Health & Consumers

SIDARTHa
European Emergency Data-based Syndromic Surveillance System
Grant Agreement No. 2007208

SIDARTHa Coding Manual

Syndrome coding based on routinely collected emergency care data for the European syndromic surveillance system SIDARTHa



SIDARTHa
European Emergency Data-based Syndromic Surveillance System

SIDARTHa - European Emergency Data-based Syndromic Surveillance System

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The SIDARTHa Coding Manual –Syndrome coding based on routinely collected emergency care data for the European syndromic surveillance system SIDARTHa

This report summarises part of the results of work package 5 of the SIDARTHa project and forms deliverable D5 as defined in Annex I of the Grant Agreement.The report was updated at the end of the project time.

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Cover Figure

Generating the SIDARTHa Data Set from Routine Emergency Care Data Sources (own creation)

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Abbreviations

AICD	Automated implantable cardioverter-defibrillator
ACS	Acute coronary syndrome
14 - AKFAM – TR	SIDARTHa associated partner abbreviation for the University Hospital Antalya, Turkey
ALS	Advanced Life Support
AMI	acute myocardial infarction
AMPDS	Advanced Medical Priority Dispatch System
BLS	Basic Life Support
CAD	Computer Aided Dispatch
CAP	Community Acquired Pneumonia
CBD	Criteria Based Dispatch
CDC	Centers for Disease Control and Prevention
CNS	Central nervous system
COPD	Chronic Obstructive Pulmonary Disease
CPR	Cardiopulmonary resuscitation
CVA	Cerebrovascular accident
D5	Deliverable No. 5 of the SIDARTHa project
DD	Day (SIDARTHa data set format)
ECDC	European Centre for Disease Prevention and Control
ED	Emergency Department
EED	European Emergency Data
EMD	Emergency Medical Dispatch
EMS	Emergency Medical Service (pre-hospital emergency care given by paramedics or emergency physicians at the scene)
EP	Emergency physician
EU	European Union
8 – FOD Health DG 1 – BE	SIDARTHa associated partner abbreviation for the federal public service health, food chain safety and environment, Belgium
2 - GEOMED – DE	SIDARTHa associated partner abbreviation for the GEOMED Research Forschungsgesellschaft mbH, Germany
GI	Gastrointestinal
GPS	Global Positioning System
16 – HSanMartino – IT	SIDARTHa associated partner abbreviation for the San Martino University Hospital Genoa, Italy
17 – HUS – NO	SIDARTHa associated partner abbreviation for the Haukeland University Hospital Bergen, Norway
ICB	intracranial/intracerebral bleeding
ICD	International Classification of Diseases
ILI	Influenza-Like-Illness
7 – KAE – DE	SIDARTHa associated partner abbreviation for the Klinik am Eichert (Clinics of the County of Goeppingen), Germany
9 – KUH – FI	SIDARTHa associated partner abbreviation for the University Hospital Kuopio, Finland
4 – LST Tirol – AU	SIDARTHa associated partner abbreviation for the Dispatch Centre Tyrol, Austria
M	Month of the SIDARTHa project

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MIND	Minimal Data Set for Emergency Physicians
MM	Months (SIDARTHa data set format)
NLP	Natural Language Processing
NSTEMI	non-ST elevation myocardial infarction
5 – OMSZ – HU	SIDARTHa associated partner abbreviation for the National Emergency Medical Service Hungary
RAS-CHEM	European Union Rapid Alert System on incidents including chemical agents
3 – RegH – DK	SIDARTHa associated partner abbreviation for the Capital Region Denmark
RTI	Respiratory Tract Infection
6 – SAMU – FR	SIDARTHa associated partner abbreviation for the System of Emergency Medical Assistance Garches, France
SARI	Severe Acute Respiratory Infection
SIDARTHa	European Emergency Data-based System for Information on, Detection and Analysis of Risks and Threats to Health
SQL	Structured Query Language
STEMI	ST elevation myocardial infarction
TIA	transient ischemic attack
15 – UNIBI – DE	SIDARTHa associated partner abbreviation for the University of Bielefeld, Germany
1 – UNICAN – ES	SIDARTHa associated partner abbreviation for the University of Cantabria, Spain
USA	United States of America
UTI	urinary tract infection
VAS	Visual Analogue Scale
WP	Work Package of the SIDARTHa project
WHO	World Health Organization
X	X-coordinate (geographic) (SIDARTHa data set format)
Y	Y-coordinate (geographic) (SIDARTHa data set format)
YYY	years (age) (SIDARTHa data set format)
YYYY	year (date) (SIDARTHa data set format)
13 – ZZSHMP – USZS – CZ	SIDARTHa associated partner abbreviation for the Emergency Medical Service Prague, Czech Republic

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1 Introduction: The SIDARTHa Project

Syndromic surveillance can detect public health threats earlier than traditional surveillance and reporting systems. Pre-hospital emergency medical services (EMS) and emergency medical dispatch centres (EMD), and in-hospital emergency departments (ED) across Europe routinely collect electronic data that provides the opportunity to be used for near real time syndromic surveillance of communicable and non-communicable health threats such as heat-related diseases or Influenza-Like-Illness (ILI). The European Commission co-funded project SIDARTHa (Grant Agreement No. 2007208) for the first time systematically explores the use of emergency data to provide a basis for syndromic surveillance in Europe. The project runs from June 2008 until December 2010. It is an initiative of emergency medical professionals organised in the *European Emergency Data (EED) – Research Network*[1].

Objectives

The objective of the European project SIDARTHa is to conceptualise, develop, implement/test and evaluate the European Emergency Data-based System for Information on, Detection and Analysis of Risks and Threats to Health (SIDARTHa).

Methodology

During the conceptualisation phase, information on international state-of-the-art in the early detection of health threats and on the current practice of health surveillance and alert systems in Europe are brought together with the possibilities of emergency data for detection of health threats and specific public health authority and emergency professional desires for SIDARTHa's system features. On this basis the surveillance system SIDARTHa is tested and evaluated during the implementation phase in different regions[2] (cf. Figure 1).

The project group constitutes a high-level expert panel of emergency professionals, public health experts and health authority representatives under guidance of an interdisciplinary steering committee. A sequence of focused methods such as group discussions, Strengths - Weaknesses - Opportunities - Threats analysis of existing procedures, half-standardised surveys to seek input from potential futures users, statistical analyses and modelling, and geo-processing methods are applied.

Expected Results & Products

The SIDARTHa project provides a methodology and software application for syndromic surveillance at the regional level[3] in Europe based on routinely collected emergency data. The SIDARTHa syndromic surveillance system automatically analyses the actual demand for emergency services and detects temporal and spatial aberrations from the expected demand. The system will automatically alert decision makers in the emergency medical institution and the regional public health authority. Via the established reporting ways the regional public health authority can inform national or supranational authorities on an event (cf. Figure 2).

It is expected that SIDARTHa improves the timeliness and cost-effectiveness of European and national health surveillance by providing a basis for systematic syndromic surveillance that supplements the existing surveillance structures.

The main outputs of the project are a syndromic surveillance application (software) publicly available free-of-charge and guidelines for future users on how to use the application and how to transform emergency data into syndromes and into the common SIDARTHa data set that the application can analyse, including recommendations on technical infrastructure, reporting procedures and interpretation of the results. Furthermore, the guidelines cover the utilisation of the interactive user display and risk communication platform.

[1] www.eed-network.eu

[2] SIDARTHa Implementation sites: District of Kufstein, Austria; Capital Region, Denmark, County of Goeppingen, Germany, Autonomous Region Cantabria, Spain

[3] In the SIDARTHa project the term *regional* is used referring to the smallest administrative level at which a health authority responsible for surveillance and reporting is established in a European country depending on the national definition and rules. This level can be a community, city, county, district or state. The implementation of the SIDARTHa syndromic surveillance system can be based on data collected for the same administrative level or also for a part of this area or based on the catchment areas of one or more participating emergency institutions.

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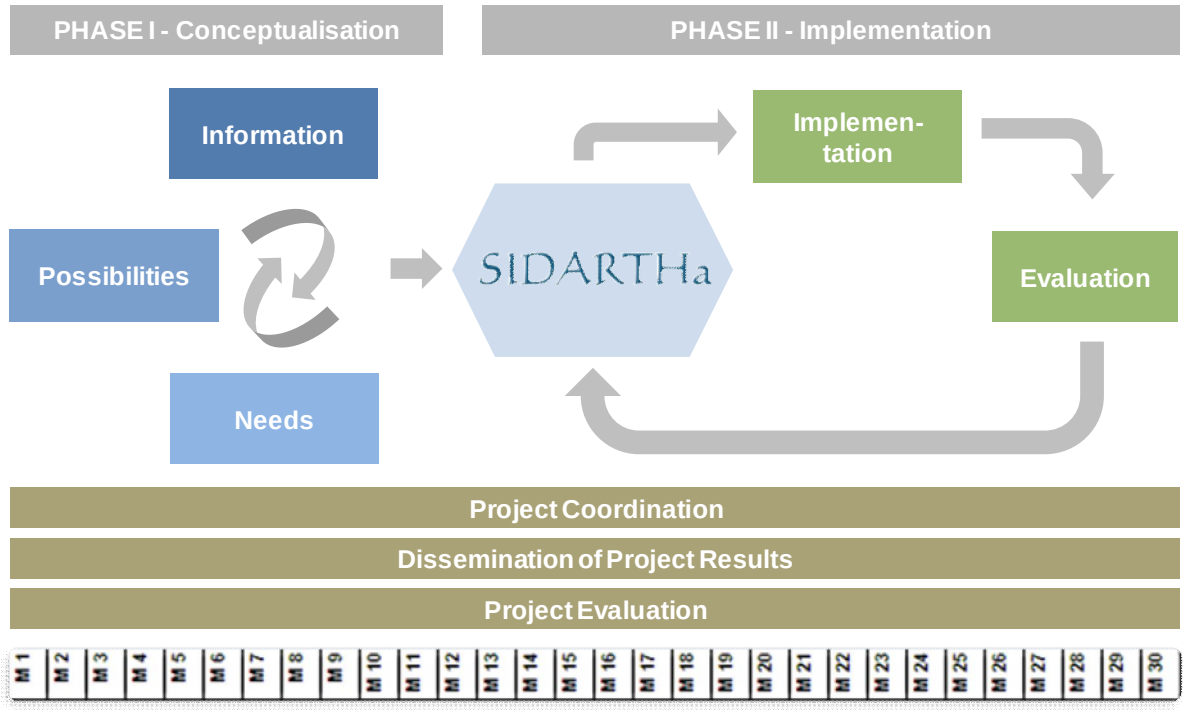

Figure 1: SIDARTHa Project Methodology

M = Month of the project time

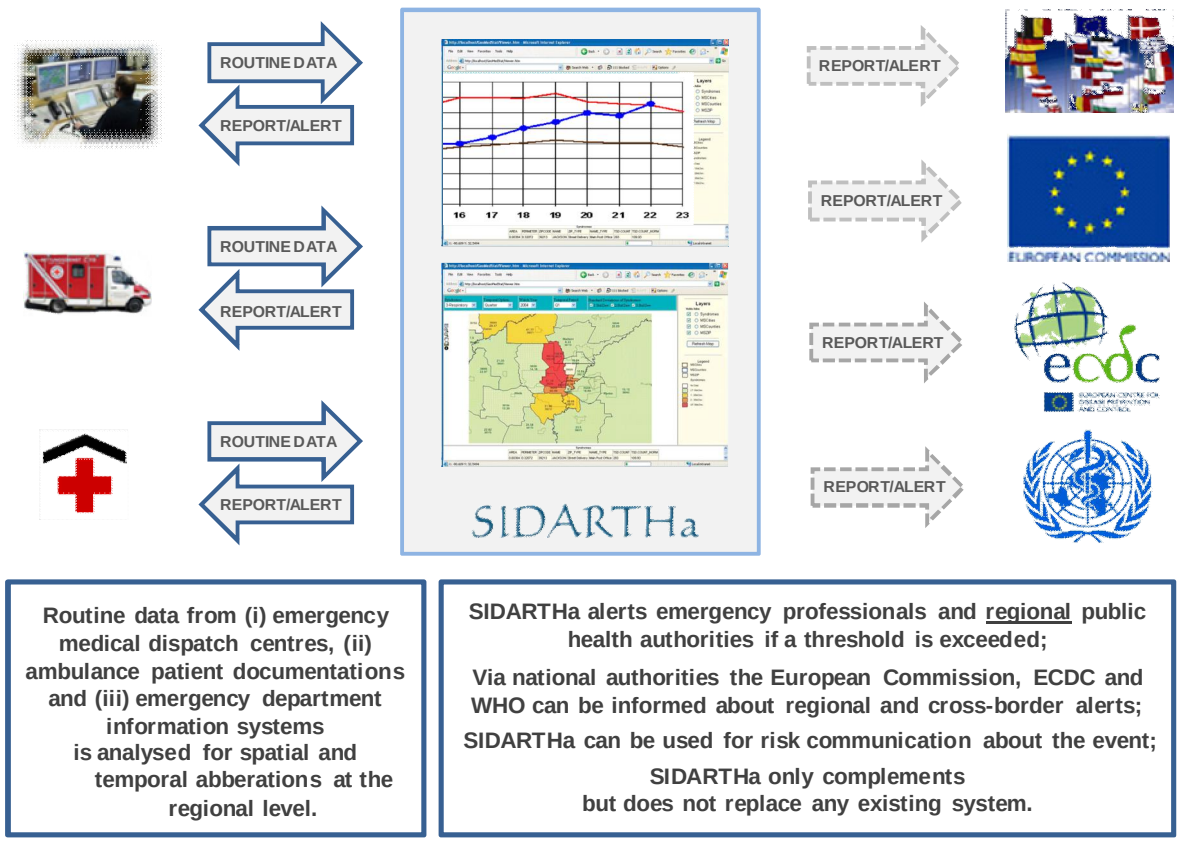

Figure 2: SIDARTHa Approach

ECDC = European Centre for Disease Prevention and Control, WHO = World Health Organization

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2 Background & Objectives: From Emergency Data to Syndromes

2.1 Background

Syndromic surveillance should continuously analyse information available in real-time and in electronic form. Routinely collected pre- and in-hospital emergency medical care services easily provide such data. Surveillance systems based on emergency medical care information have demonstrated their efficacy in identifying seasonal influenza waves, gastrointestinal outbreaks, and environment-related public health events (cf. literature review results of WP 4 in Ziemann et al. 2009 (1)).

In syndromic surveillance instead of case identifications a more generic strategy is used: patients are grouped using relevant symptoms to generate very broad categories called *syndromes*. This methodology fits with emergency medical services systems where chief complaints are the driver of the whole process of care.

Electronic records collected in a standardised way facilitate the generation of specific syndromes, even free text can be treated by Natural Language Processing (NLP) software (Ivanov et al. 2002 (2), Day et al. 2004 (3)).

In many EMD across Europe, some form of computer aided dispatch (CAD) systems based on standardised protocols such as Advanced Medical Priority Dispatch (AMPDS), or Criteria Based Dispatch (CBD) are common facilitating a standard generation of syndromes.

In EMS in which care is provided as Basic Life Support (BLS) (emergency medical technicians) or Advanced Life Support (ALS) (paramedics, doctors), for every case a working diagnosis is provided. In some services also the International Classification of Disease coding is used (ICD9 or ICD10) which facilitates a standardised syndrome generation process.

ED registries usually include a broad description of reason for demanding care (accident, disease, violence, etc.) and triage is done immediately after arrival. Most triage systems like *eTRIAGE Manchester Triage*, *Emergency Severity Index*, *Sistema Español de Triage* use chief complaints as driving information for protocol application, resulting also in a certain level of severity (1-5) which is related to an accepted delay for assistance.

The following syndromes suitable for syndromic surveillance from the data routinely collected in emergency medical systems and with relevance to public health surveillance have been selected for the SIDARTHa Syndromic Surveillance System (cf. Baer et al. 2009 (4)):

1. **Unspecific Syndrome (increase in overall demand and/or severity of cases)**
2. **Influenza-Like-Illness**
3. **Gastrointestinal Syndrome**
4. **Respiratory Syndrome**
5. **Intoxication Syndrome**
6. **Environment-related Illness (heat/cold-related problems)**

These syndromes are considered to form the basis on which analyses for the SIDARTHa syndromic surveillance system are performed. Other syndromes can be considered in the future such as syndromes related to human behaviour (intentional, unintentional), e.g., domestic violence. Other syndromes could also be of interest only in a specific region/country or for specific threats (cf. SIDARTHa volcanic ash cloud rapid assessment: Rosenkötter et al. 2010 (5))

While there are common procedures in the emergency settings of EMD, EMS and ED across Europe providing the general potential for Europe-wide syndromic surveillance based on emergency data, the more detailed analysis of the

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variables availability at EMD, EMS and ED in the SIDARTHa project showed a large heterogeneity among the SIDARTHa country consortia (cf. Baer et al. 2009 (4)). The reasons for this lay in the data collection methodology (i.e., manual vs. electronic data collection) which was also changing during the course of the project in many of the emergency systems represented in the SIDARTHa project, and in a limited legal and technical accessibility of the data. The 12 SIDARTHa country consortia represent different organizational aspects of emergency services throughout Europe.

In order to best fit SIDARTHa to these circumstances, the coding manual needs to provide a framework for future users with guidelines how to translate the emergency data into syndromes that the SIDARTHa system can analyse. This calls for a minimum standardised data set open to as many emergency institutions routinely collecting electronic data across Europe as possible. Beyond that, syndromes should be defined rather as framework than by a fix case definition supporting portability and acceptance of the system.

2.2 Objectives

The primary objectives of the coding manual are:

- To help users to generate syndromes following the SIDARTHa approach.
- To establish definitions and formats for coding among SIDARTHa partners.

Please note:

The rationales and examples of codings presented in this Coding Manual are a framework and guideline and not an obligation. If not all codes are collected in an emergency system, i.e., because short lists are used or a special CAD, this does not mean that SIDARTHa is not applicable. In each region specific Local Health Surveillance Data Sets will have to be defined taking into account the local/regional circumstances and specifications.

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3 Methodology: Development of Syndrome Coding

The first draft **coding manual** developed by the task leader and the Steering Committee was discussed during Technical Workshop II, a second review round was done electronically among the Steering Committee Members/implementation site representatives and the members of the Technical Unit. Afterwards the coding manual was adjusted in accordance to the experiences made in the historical data analysis (WP6). If possible, existing case definitions and grouping suggestions for syndromes were used, e.g., from the Centers of Disease Control and Prevention (CDC) or from the literature (6-9). Coding examples from the literature which were based on ICD-9 were translated to ICD-10 codes by a list provided from the World Health Organization (WHO) and a website with lists of ICD-9 codes and their respective descriptions[4].

The **SIDARTHa Standard Data Set** was defined at Technical Workshop II taking into account the results of the standardised survey on emergency data availability (cf. Baer et al. 2009 (4)).

The **coding manual structure** is as follows:

Chapter 4: SIDARTHa Standard Data Set

Minimum standard format of data set to be uploaded into the syndromic surveillance application SIDARTHa;

Chapter 5.1: Syndrome Generation by Emergency Data Source

Potential sources of information for syndromes for data collected in emergency medical dispatch centres, emergency medical services including emergency physician services, and emergency departments

Chapter 5.2: Syndrome Definitions

- Rationale

  Background information on the syndrome and its relevance to public health

- Case definition

  Framework definition for the syndrome that should be applied by future users to classify a case into a syndrome category; if available, already existing definitions for syndromes are applied, e.g., from CDC

- Syndrome generation per emergency data source

  Special remarks on syndrome generation in addition to chapter 5.1

- Basic literature

  Scientific articles related to the syndrome providing further information

Chapter 6: Syndrome generation step-by-step

Step-by-step guide for syndrome coding including preparatory analyses

Appendices

Examples and recommendations for syndrome coding for different coding systems used in the different parts of emergency medical care (e.g., ICD)

[4] Accessed November 2010 : World Health Organization : http://whqlibdoc.who.int/icd/hq/1996/9_to_10.pdf, ICD-9 lists : http://www.icd9data.com

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4 SIDARTHa Standard Data Set

Emergency data across the different institutional settings (EMD, EMS, ED) and across countries can provide a set of common variables useful or necessary for syndromic surveillance although collected in different format or language. The automated SIDARTHa syndromic surveillance system can only process a standardised data set that needs to be produced in each setting where SIDARTHa is implemented before it enters the SIDARTHa system. These variables form **the SIDARTHa Standard Data Set**:

1. **Anonymous Case Identifying Number**
2. **Date**
3. **Geographic Reference**
4. **Syndrome**
5. **Modifier 1: Age**
6. **Modifier 2: Gender**
7. **Modifier 3: Severity**

The minimum data set for syndromic surveillance must contain enough information to produce the number of cases per day for temporal syndromic surveillance; a geographic reference can provide the third dimension for spatial-temporal surveillance while syndrome information increases specificity. Age, gender and severity can be seen as modifiers and can be of special relevance to certain syndromes, e.g., gastroenteritis in children, heat-related illness in elderly. From the coding point of view, date, age/gender and geographic reference are easier to classify than severity or any variable applicable for generating syndromes. Table 1 gives an overview on the SIDARTHa Standard Data Set including examples of variables for the three emergency data sources of EMD, EMS and ED.

The emergency data collected in one region or institution must be transferred/translated into the SIDARTHa Standard Data Set by the future users themselves, i.e., the emergency institution.

Table 2 lists the format of each of the variables of the SIDARTHa Standard Data Set into which the regionally specific emergency data needs to be translated.

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Variables of SIDARTHa Data Set	Emergency Medical Dispatch Centre	Emergency Medical Service	Emergency Department
Case Identification	Call identification code (Event, Case)	Response identification code (Event/Case)	Patient identification code
Date	Date	Date	Date
Geographic reference	Address, geographic coordinates (event)	Address (event, patient), GPS signal (event)	Address, postal code (patient)
Syndrome (based on reason for demanding care)	Dispatch coding	Working diagnosis	Triage chief complaint
Synddrome (based on diagnosis)	n.a.	Working diagnosis ICD9, ICD10	Working/Discharge Diagnosis ICD9, ICD10
Age (Modifier)	Age	Age	Age
Gender (Modifier)	Gender	Gender	Gender
Severity of the case (Modifier)	Priority of response	Priority of response	Triage code

Table 1: SIDARTHa Standard Data Set: Common Variables

Due to different characteristics of the emergency institutions EMD, EMS and ED variables are collected in a different way and following a different methodology. The white parts of the table indicate the essential variables for syndromic surveillance in SIDARTHa (no. of cases per time unit), the gray shaded parts of the table show the variables that are geographical variables for spatial surveillance, modifiers and relevant variables for generating syndromes.

GPS = Global Positioning System, ICD = International Classification of Diseases

Case Identification	Sequential code (number format)
Date	DD:MM:YYYY (date format)
Geographic reference	X:Y coordinates, health zone codes, post codes, community codes (number format)
Syndrome	New generated variable for each of the SIDARTHa syndromes (one column for each syndrome). These variables combine the information from the variable *reason for demanding care* and/or *diagnosis*: *0* = syndrome xy is not present; *1* = syndrome xy is present (numeric)
Age (Modifier)	Age YYY (number), for age less than 1 year, months will be transferred into decimals, following Age=months/12.
Gender (Modifier)	Male; Female (numeric *0,1*)
Severity of the case (Modifier)	Code *1-5* (*1-2* = more severe cases) (numeric)

Table 2: SIDARTHa Standard Data Set: Format of Variables

DD = Day, ICD = International Classification of Diseases, MM = Month, X = geographic x-coordinate, Y = geographic y-coordinate, YYY = age in years, YYYY = year

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5 SIDARTHa Syndrome Coding

5.1 Syndrome generation by emergency data source

A. **Emergency Medical Dispatch (EMD)**
Diagnostic information at this level of emergency medical care is based on the information from callers (patient, relative, bystander, etc.) given to the staff in the dispatch centre. This information can be documented using a CAD system which gives a standard code for a reported complaint. There can be different CAD systems from local/regional specific systems to broadly distributed systems such as Criteria-based dispatched or the AMPDS. The AMPDS system allows the generation of one complaint category (AMPDS code) for each patient (e.g. code *breathing problems – difficulty speaking between breaths*). A recommendation for syndrome generation based on AMPDS codes is given in Appendix 1 (AMPDS versions 11.3 and 12.0, Priority Dispatch Corp, USA). When diagnostic information at EMD level is coded with a different CAD system the coding has to be adjusted.

B. **Emergency Medical Services (EMS)**
EMS data contains diagnostic information collected at the scene by emergency physicians (EP) or paramedics. Information can be available as free-text or as ICD code or local/regional/national specific coding systems. To simplify the use of ICD, ICD short lists are frequently used in EP services. To be able to generate syndromes out of this information ICD lists in Appendix 2 (ICD-9 and ICD-10) or the lists with free text terms in Appendix 5 can be a useful information source for syndrome generation at this level. Especially the ICD syndrome codes are rather broad and it is possible that short lists do not cover all of the mentioned ICD codes.

As example for national or regional specific coding systems, the Minimal Data Set for Emergency Physicians (MIND-2 (cf. Messelken and Schlechtriemen (10)) is presented here. The MIND-2 coding system is used in German speaking countries. The diagnostic categories of this coding system can be used alone but also in combination with ICD codes when collected in addition (cf. Appendix 3). This can be an example how different coding systems can be combined for syndrome generation.

C. **E mergency Department (ED)**
Data from emergency departments contain a wide range of medical information which can be used for syndrome generation. Syndromes can be established on the basis of chief complaints from the triage system. Appendix 4 presents as an example syndromes based on Manchester Triage. Further, working diagnoses coded in ICD-10 or ICD-9 (cf. Appendix 2) or free-text chief complaints/working diagnosis (cf. Appendix 5) can be used for syndrome generation.

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5.2 Syndrome definitions

5.2.1 Unspecific Syndrome

Rationale

One reason for developing syndromic surveillance is the detection of new or undefined health threats for which no case definition applies or still must be developed (during an outbreak). These can be reflected by simply analysing aberrations from the overall demand for health services. As unspecific syndrome the daily total number of emergency calls, EMS responses, or patients visiting the ED is defined irrespective of any diagnostic information.

Demand in emergency services and emergency departments clearly reflect population health, mainly in those systems with no access restrictions. Emergency services function as point of entry for acutely ill patients, therefore they can be the first institution which comes to know about a public health threat

Modifiers such as severity, age, gender and geographic information allow for identification of an aberration in a specific group of patients providing more detailed information.

Case Definition

Aberrations in the overall volume and pattern of daily demand from expected demand for emergency medical care

Syndrome Generation

Total number of cases can be analysed in all three data sources.

EMD
At the EMD level it is important that only emergency medical calls are taken into account. Service drives, standby activities or simple patient transportation to a dialysis centre or relocation of patients to another hospital should not be included.

EMS
no specific information

ED
no specific information

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5.2.2 Influenza-Like Illness

Rationale

Seasonal influenza or other types of pandemic influenza cause a great workload on health systems although it is usually a mild health problem that can be self-treated, or treated by general practitioners. But due to destabilisation of chronic patients and the tendency to use emergency services and emergency departments as preferred point of access to health care in some regions, a clear increase in demand can be noticed during waves of influenza (Silka et al. 2003 (11)).

Influenza surveillance is usually based on sentinel doctors and notifiable disease reporting systems. These traditional surveillance systems can be operose which leads to a delay in detection. International health organisations encourage detecting influenza outbreaks as early as possible to prepare for a possible increase in health care demand and to be able to place preventive interventions as early as possible. Other resources such as emergency department data have demonstrated similar accuracy detecting influenza outbreaks as traditional surveillance systems but with an increased timeliness. Actually, seasonal influenza surveillance became a common extension to syndromic surveillance during the last years (Buehler et al. 2009 (12)).

Case definition

For definitions of influenza a great variation can be found not only in the general diagnoses in any setting, but also in sentinel doctor systems that specifically deal with influenza surveillance.

To facilitate the coding process two definitions have been established to identify cases: *Influenza-Like-Illness* (ILI) and *Severe Acute Respiratory Infections* (SARI):

1. ILI as used by sentinel doctors is defined according to the CDC:

- Sudden onset of a fever over 38°C, AND
- Cough or sore throat, AND
- Absence of other diagnosis.[5]

2. SARI is used by sentinel hospitals and as part of nationwide surveillance. The definition for SARI is adapted from the World Health Organization protocol on rapid response.

For persons ≥5 years old:

- Sudden onset of fever over 38°C, AND
- Cough or sore throat, AND
- Shortness of breath or difficulty in breathing, AND
- Requiring hospital admission.

Sydromic surveillance has used more simple definitions based on presence of fever and respiratory problems or based on ICD 9 codes (Marsden-Haug et al. 2007 (6)).

For the SIDARTHa syndromic system the following case definition of the CDC's BIOSENSE syndromic surveillance system influenza module will be used as a best practice case definition:

Chief complaints: (Fever AND (Cough OR Upper Respiratory Infection)) OR ILI

Syndrome Generation

Identification of ILI cases is possible in EMS and ED data sources. In EMD data respiratory syndrome can be monitored as the information given by callers might not be specific enough to differentiate ILI from respiratory cases.

EMD
CAD systems based on AMPDS coding (Priority Dispatch Corp, USA) allow in the versions 11.3 and 12.0 not to differentiate between respiratory syndrome and ILI. It can be expected that it is possible in the future to identify ILI cases among emergency calls coded with AMPDS since the topic influenza is pre-announced for the AMPDS version 12.

EMS
No specific information

ED
No specific information

[5] http://www.acha.org/ILI_case_definition_CDC.pdf

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Basic Literature

Marsden-Haug et al. 2007 (6), Muscatello et al. 2005 (7), Metzger et al. 2004 (13), Heffernan et al. 2004 (14), South et al. 2008 (15), Zheng et al. 2007 (16), Josseran et al. (2006) (17), Lemay et al. 2008 (18), Dailey et al. 2007 (19), Cooper et al. 2008 (20)

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5.2.3 Gastrointestinal Syndrome

Rationale

Acute gastrointestinal (GI) diseases are basically produced by toxins or infectious agents. A quick identification of the problem is crucial to mitigate the effect of the disease and to reduce the number of new cases.

Salmonellosis is one GI pathogen of great interest in Europe and detection of cases is crucial in the control of disease. Enteroviruses (coxsackieviruses, echoviruses) are another pathogen having caused several outbreaks. For some GI outbreaks, syndromic surveillance has demonstrated its utility for detecting cases. Some of these infections are more frequent in patients who are less than 14 years so a focused surveillance of this segment of the population is recommended (Marx et al. 2003 (21)).

In an acute state most of the patients are going to demand emergency care, basically in ED. Due to a wide spectrum of symptomatic admissions to hospitals only a minority of the cases will be identified, those of highest severity. GI syndrome has also been of interest in bioterrorist attacks (Das et al. 2003 (22)).

Case Definition

The CDC proposes to include the following criteria for a GI syndrome definition:

- ACUTE infection of the upper and/ or lower GI tract:
- SPECIFIC diagnosis of acute GI distress such as Salmonella gastroenteritis:
- ACUTE non-specific symptoms of GI distress such as nausea, vomiting, or diarrhoea;
- EXCLUDES any chronic conditions such as inflammatory bowel syndrome.

Syndrome Generation

EMD
no specific information

EMS
no specific information

ED
no specific information

Basic literature

Ivanov et al. 2002 (2), Muscatello et al. 2005 (7), Marx et al. 2006 (21), Balter et al. 2005 (23), Payne et al. 2008 (24), Wu et al. 2008 (25), Betancourt et al. 2007 (26)

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5.2.4 Respiratory Syndrome

Rationale

Respiratory syndrome can appear in an acute form. Therefore, emergency services are the natural point of access to care for these conditions such as severe dyspnoea and respiratory distress while other mild problems like upper respiratory infections can access through primary care services or as out-patients in emergency departments. Outbreaks of respiratory infections caused by influenza as primary virus, pneumonia, secondary infections or legionella pneumonias frequently are of great interest to public health services.

Other respiratory problems caused by exposition to a chemical or biological agent can cause severe respiratory problems (e.g., terrorist attacks using anthrax). But not only biological terrorist attacks can provoke clusters of patients with respiratory distress, but also allergenic substances or irritant gases due to accidents or industrial manipulations.

Case Definition

- ACUTE infection of the upper and/or lower respiratory tract (from the oropharynx to the lungs, includes otitis media)
- SPECIFIC diagnosis of acute respiratory tract infection (RTI) such as pneumonia, community acquired pneumonia (CAP)
- ACUTE non-specific diagnosis of RTI such as sinusitis, pharyngitis, laryngitis
- ACUTE non-specific symptoms of RTI such as cough, stridor, shortness of breath, throat pain
- EXCLUDES chronic conditions such as chronic bronchitis, asthma without acute exacerbation, chronic sinusitis, allergic conditions (Note: INCLUDES *acute exacerbation* of chronic illnesses, COPD, Asthma) (Mikoszk et al. 2004 (26))

Syndrome Generation

EMD
no specific information

EMS
no specific information

ED
no specific information

Basic literature

Muscatello et al. 2005 (7), Hope et al. 2008 (27), Townes et al. 2004 (28), Beitel et al. 2004 (29)

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5.2.5 Intoxication Syndrome

Rationale

Unintentional or intentional intoxication events usually develop into acute and severe situations. Emergency services will be the first point of access to health care in this situation. Terrorist attacks releasing toxic agents or biologic weapons are a real threat since the 1995 sarin gas release and the 2001 anthrax letters. These events were of tremendous impact on the society and a driving force for implementing sydromic surveillance systems. Actually, interest has been raised not only for intentional but also for unintentional accidents in which toxic substances are involved. Although other European alerting systems are in place such as RAS-CHEM, an earlier warning is needed in order to take preventive actions to reduce the impact of an event.

Intoxication can have a clear or complex pattern sometimes of great severity such as patients affected by neurotoxins. This complexity in manifestations makes the identification of cases difficult especially if caused by new or uncommon agents. Furthermore, outbreaks with a low number of cases can be difficult to detect.

Case Definition

Intoxication patients of accidental release of toxic agents as well as of intentional release are included. Bioterrorist attacks (antrax, salmonella, etc) produce similar patterns as infectious diseases which makes a case definition complex.

CDC proposes to include the following criteria:

1) An unusual increase in the number of patients seeking care for potential chemical-release-related illness;

2) Unexplained deaths among young or healthy persons;

3) Emission of unexplained odours by patients;

4) Clusters of illness in persons who have common characteristics, such as drinking water from the same source;

5) Rapid onset of symptoms after an exposure to a potentially contaminated medium (e.g., paresthesia and vomiting within minutes of eating a meal);

6) Unexplained death of plants, fish, or animals (domestic or wild); and

7) A syndrome (i.e., a constellation of clinical signs and symptoms in patients) suggesting a disease associated commonly with a known chemical exposure (e.g., neurologic signs or pinpoint pupils in eyes of patients with a GI-like syndrome or acidosis in patients with altered mental status).

For pragmatic reasons we suggest to define the intoxication syndrome for the SIDARTHa syndromic surveillance system as: **Chief complaint classified as poisoning or intoxication, bizarre neurologic symptoms** (Barthell et al. 2004 (30)). Alcohol as well as illicit drug consumption is not included in this syndrome.

Syndrome Generation

EMD
no specific information

EMS
no specific information

ED
no specific information

Basic literature

Muscatello et al. 2005 (7), Townes et al. 2004 (28), Yih et al. 2004 (31), Wolkin et al. 2006 (32), Parsell et al. 2008 (33), Meyer et al. 2008 (34)

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5.2.6 Environment-Related Illness (heat-related)

Rationale

Extreme climate conditions, heat waves and cold spells affect mortality as has been clearly seen in recent events, e.g., during the 2003 heat wave in Europe resulting into 35.000 to 53.000 excess deaths. The next few decades will be marked by the convergence of three developments that will transform the exceptional circumstances of 2003 into a recurrent risk that must be considered as a priority in our health policies:

- Demographic change: a higher proportion of vulnerable elderly most markedly in industrialised countries, particularly in Europe
- Air pollution: the increase in ozone is connected to excess deaths and morbidity.
- Climate change: more extreme events such as heat waves, storms or floods are very likely to occur in Europe in the near future.

Heat and cold stress can worsen many pre-existing conditions and in doing so provoke excess mortality in those parts of the population with chronic health problems, mainly in patients with cardiovascular and respiratory problems. This pattern has been clearly seen during the heat waves in Europe. The increase in mortality and severe cases mainly in the elderly population has been related to heat stress and surveillance during extreme heat events helps health authorities to implement adequate response measures.

Early identification of risk situations is crucial. Health authorities are implementing Heat Health Watch Warning Systems in many EU countries focusing on weather forecasts. A small-area geographical analysis is useful because many local variations can modify heat and cold stress for humans, and the analysis of the spatial distributions of demand for health care services can help to understand the problem. Emergency services are in right place for motoring variations in care demand for acute or chronic disease decompensations. Information generated in EMD or ED has been used successfully for surveillance of heat-related illnesses with increased timeliness.

Case Definition

Based on the paper of Josseran et al. (2009 (9)) different syndromes should be monitored separately as well as in a group. Hypoglycemia, dehydration, hyponatremia, circulatory syndrome, cerebrovascular syndrome, respiratory syndrome, asthma, urinary infections, renal failure, renal colic, malaise, and hypothermia were monitored during a heat wave. We recommend the monitoring of this broad number of diagnoses which can be adjusted according to the experiences made when the SIDARTHa system is running.

Heat waves have been defined by the EU funded EUROHeat project as (35):

(1) periods of at least two days with day temperature exceeding the 90th percentile of the monthly distribution (day temperature is measured in as a discomfort index combining air and dew point temperature (Tappmax)), or

(2) periods of at least two days in which daily minimum temperature (during the night) exceeds the 90th percentile and the day temperature (Tappmax) exceed the median monthly value.

Cold Spells have been defined as periods of at least 3 consecutive days with daily air temperature maxima (TMAX) < -3.5°C, although definition need local adjustment.

Patients > 65 demanding care for cardiovascular or respiratory problems or specific heat related problems could be analysed separately.

Syndrome Generation

The ability to display relevant diagnostic conditions differs according to the respective setting. However, differences depending on the setting are also an opportunity to provide different perspectives of the real picture.

EMD

With EMD data based on the AMPDS coding system it is not possible to monitor dehydration, hyponatremia, urinary infections, renal failure and renal colic. The other syndrome sub-groups can be monitored.

EMS

no specification

ED

no specification

Basic Literature

Bassil et al. 2009 (36), Josseran et al. 2009 (9)

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6 Syndrome Generation Step-by-Step

In the chapters before it is shown how syndrome generation can be performed with different emergency medical care data sources. Especially in the appendices examples are given how routine diagnostic codes and their combination can be applied for syndrome generation.

However, the coding manual is following a flexible approach providing a framework rather than a standardised, detailed plan. Code or free text combinations given in the appendices are rather examples than strict rules for syndrome generation. They shall support the users in finding the most suitable approach to their specific circumstances related to data availability, data quality, infrastructure, thematic foci and requirements.

Here, the necessary steps are explained how to generate the SIDARTHa Standard Data Set and especially syndromes with the locally/regionally available data:

1. **Identifiy variables** (data information) in the original emergency data set which provide information for the SIDARTHa standard data set:
   a. Case identifier
   b. Date
   c. Geographic reference
   d. Syndrome
   e. Gender
   f. Severity of the case
2. **Indentify regional coding systems** (e.g. CAD codes, ICD or categorised text short lists, codes of the triage system, etc.) that can be an additional or better source of syndrome information compared to internationally used coding systems.
3. **Check data quality and frequency of terms and codes** used for the potential variables for the SIDARTHa Standard Data Set by generating frequency tables. Use only those variables for generating syndromes that are frequently collected without many missing or wrong values to ensure the validity of SIDARTHa.
4. **Decide for variables to be grouped to syndromes** using the framework case definitions in this Coding Manual including the appendices.

   Combine for each syndrome all codes (if not decided in a different way) with the Boolean operator *or.*

   If patients can have more than one code on reasons for demanding care or diagnosis, decide if combinations of codes with the Boolean operator *and* or *not* are helpful. E.g. for influenza fever (> 38˚C) *AND* respective ICD codes for influenza-like illness.
5. **Generate a new variable for each syndrome** (i.e., all cases are coded with *1* (syndrome definition fulfilled) or *0* (syndrome definition not fulfilled).

Variations based on changes of seasonal and weekly changing demand must be taken into consideration when analysing emergency data. Not every syndrome can be generated based on data collected in the different emergency medical services and not every algorithm works with every syndrome or data source or variation in time. It is recommended to read also the SIDARTHa report by Rosenkoetter et al. (2010 (37)) that tested different algorithms for different emergency data sets and different syndromes.

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Appendix

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Appendix 1 Syndromic Surveillance in Emergency Medical Dispatch Centres (AMPDS Codes)

Respiratory syndrome

AMPDS 11.3

6		Breathing problems	
Level		Determinant Descriptors	Possible suffix
C	1	Abnormal breathing	A. Asthma
C	2	Known heart disease	A. Asthma
D	1	Difficulty breathing	A. Asthma
D	2	Not alerting	A. Asthma
D	3	Sweating	A. Asthma
26		**Sick person (specific diagnosis)**	
Level		Determinant Descriptors	
A	25	Sore throat (without difficulty breathing or swallowing)	

AMPDS 12.0

6		Breathing problems	
Level		Determinant Descriptors	Possible suffix
C	1	Abnormal breathing	A. Asthma
D	1	Not alerting	A. Asthma
D	2	Difficulty speaking between breaths	A. Asthma
D	3	changing colour	A. Asthma
D	4	clammy	A. Asthma
26		**Sick person (specific diagnosis)**	
Level		Determinant Descriptors	
A	4	Fever/chills	
O	26	Sore throat (without difficulty breathing or swallowing)	

Gastrointestinal Syndrome

AMPDS 11.3 and 12.0

1		Abdominal Pain
Level		Determinant Descriptors
A	1	Abdominal Pain

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Intoxication syndrome

AMPDS 11.3

8		Carbon Monoxide/Inhalation	
Level		Determinant Descriptors	
O	1	Carbon monoxide detector alarm	
B	1	Alert without difficulty breathing	
C	1	Alert with difficulty breathing	
D	1	Unconscious or arrest	
D	2	Heavy breathing problems	
D	3	Accident with toxic substances	
D	4	Difficulty breathing	
D	5	Multiple victims	
D	6	unknown status	

23		Overdose/Poisoning (ingestion)	
Level		Determinant Descriptors	Possible suffix
O	1	Poisoning without priority symptoms	A. Accidental, V. Intentional
C	1	Violent or combative (police not alerted yet)	A. Accidental, V. Intentional
C	2	Not alert	A. Accidental, V. Intentional
C	3	Abnormal breathing	A. Accidental, V. Intentional
C	4	Antidepressives (tricyclic)	A. Accidental, V. Intentional
C	5	Cocaine, methamphetamine	A. Accidental, V. Intentional
C	6	Narcotics (heroin)	A. Accidental, V. Intentional
C	7	Acid or alkali	A. Accidental, V. Intentional
C	8	Unknown status	A. Accidental, V. Intentional
C	9	Request at poison control center (VIZ) for response	A. Accidental, V. Intentional
D	1	Unconscious	A. Accidental, V. Intentional
D	2	Overdose - heavy breathing problems	A. Accidental, V. Intentional

AMPDS 12.0

8		Carbon Monoxide/Inhalation	
Level		Determinant Descriptors	
O	1	Carbon monoxide detector alarm	
B	1	Alert without difficulty breathing	
C	1	Alert with difficulty breathing	
D	1	Unconscious or arrest	
D	2	Not alert	
D	3	Difficulty in speaking between breaths	
D	4	Multiple victims	
D	5	unknown status/Other codes not applicable	

23		Overdose/Poisoning (ingestion)	
Level		Determinant Descriptors	Possible suffix
O	1	Poisoning without priority symptoms	A. Accidental, I. Intentional, V. violent or combative
C	1	Not alert	A. Accidental, I. Intentional, V. violent or combative
C	2	Abnormal breathing	A. Accidental, I. Intentional, V. violent or combative
C	3	Antidepressives (tricyclic)	A. Accidental, I. Intentional, V. violent or combative
C	4	Cocaine, methamphetamine (or derivatives)	A. Accidental, I. Intentional, V. violent or combative
C	5	Narcotics (heroin)	A. Accidental, I. Intentional, V. violent or combative
C	6	Acid or alkali (lye)	A. Accidental, I. Intentional, V. violent or combative
C	7	Unknown status	A. Accidental, I. Intentional, V. violent or combative
C	8	Poison Control request for response	A. Accidental, I. Intentional, V. violent or combative
D	1	Unconscious	A. Accidental, I. Intentional, V. violent or combative
D	2	Changing colour	A. Accidental, I. Intentional, V. violent or combative

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Environment-related illness

AMPDS 11.3 and 12.0		
13		**Diabetic problems**
Level		Determinant Descriptors
A	1	Alert and behaving normally
C	1	not alert
C	2	abnormal behaviour
C	3	abnormal breathing
D	1	unconcious

AMPDS 11.3		
10		**Chest pain (not traumatic)**
Level		Determinant Descriptors
D	1	chest pain, severe breathing problem
D	2	chest pain - not alert
D	3	chest pain - clammy
C	1	abnormal breathing
C	2	heart attack or angina history
C	4	breathing normally >= 35
A	1	breathing normally < 35
19		**Heart problems / A.I.C.D. (Automated implantable cardioverter-defibrillator)**
Level		Determinant Descriptors
D	1	severe breathing problem
D	2	changing colour
D	3	clammy
C	1	firing of AICD
C	2	abnormal breathing
C	3	chest pain >=35
C	4	cardiac history
C	6	heart rate <50bpm, or >=130 bpm (without priority symptoms)
C	7	unknown status/other codes not applicable
A	1	heart rate >=50 bpm and <130 bpm (without priority symptoms)
A	2	chest pain <35 (without priority symptoms)

AMPDs 12.0		
10		**Chest pain (not traumatic)**
Level		Determinant Descriptors
D	1	not alert
D	2	difficulty speaking between breaths
D	3	changing colour
D	4	clammy
C	1	abnormal breathing
C	2	heart attack or angina history
C	4	breathing normally >= 35
A	1	breathing normally < 35

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19		Heart problems / A.I.C.D. (Automated implantable cardioverter-defibrillator)
Level		Determinant Descriptors
D	1	not alert
D	2	difficulty speaking between breaths
D	3	changing colour
D	4	clammy
D	5	just resusciated and/or defibrillated (external)
C	1	firing of AICD
C	2	abnormal breathing
C	3	chest pain >=35
C	4	cardiac history
C	6	heart rate <50bp, or >=130 bpm (without priority symptoms)
C	7	unknown status/other codes not applicable
A	1	heart rate >=50 bpm and <130 bpm (without priority symptoms)
A	2	chest pain <35 (without priority symptoms)

AMPDS 11.3 and 12.0

28		Stroke
Level		Determinant Descriptors
C	1	not alert
C	2	abnormal breathing
C	3	speech problems
C	4	numbness, paralysis or movement problems
C	5	vision problems
C	6	sudden onset of severe headache
C	7	stroke history
C	8	breathing normally >=35
B	1	unknown status
A	1	breathing normally <35

AMPDS 11.3

6		Breathing problems
Level		Determinant Descriptors
C	1	Abnormal breathing
C	2	Known heart disease
D	1	Difficulty breathing
D	2	Not alerting
D	3	Sweating
26		**Sick person (specific diagnosis)**
Level		Determinant Descriptors
A	25	Sore throat (without difficulty breathing or swallowing)
6		**Breathing problems**
Level		Determinant Descriptors
C	1	Abnormal breathing
D	1	Not alerting
D	2	Difficulty in speaking between breaths
D	3	changing colour
D	4	clammy
26		**Sick person (specific diagnosis)**
Level		Determinant Descriptors
A	4	Fever/chills
O	26	Sore throat (without difficulty breathing or swallowing)

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AMPDS 11.3		
6		**Breathing problems**
Level		Determinant Descriptors
C	1	Abnormal breathing
C	2	Known heart disease
D	1	Difficulty breathing
D	2	Not alerting
D	3	Sweating
26		**Sick person (specific diagnosis)**
A	25	Sore throat (without difficulty breathing or swallowing)

AMPDs 12.0		
6		**Breathing problems**
Level		Determinant Descriptors
C	1	Abnormal breathing
D	1	Not alerting
D	2	Difficulty in speaking between breaths
D	3	changing colour
D	4	clammy
26		**Sick person (specific diagnosis)**
Level		Determinant Descriptors
A	4	Fever/chills
O	26	Sore throat (without difficulty breathing or swallowing)

only AMPDS 12.0		
26		**Sick Person**
Level		Determinant Descriptors
A	3	dizziness/vertigo

only AMPDS 12.0		
26		**Sick Person**
Level		Determinant Descriptors
A	10	unwell/ill

AMPDS 11.3 and 12.0		
26		**Sick Person**
Level		Determinant Descriptors
D	1	not alert

AMPDS 11.3		
20		**heat/cold exposure**
Level		Determinant Descriptors
A	1	Alert
B	1	Change of skin color
B	2	Unknown status
C	1	Hart attack or angina history (known hart disease)
D	1	Not alert

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AMPDS 12.0		
20		**heat/cold exposure**
Level		Determinant Descriptors
A	1	Alert
B	1	Change of skin color
B	2	Unknown status
C	1	Hart attack or angina history (known hart disease)
D	1	Not alert
D	2	Multiple victims

United Kingdom Department of Health - AMPDS Call Categorisation Version 11. Her Majesty's Stationery Office. April 2005

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Appendix 2 Syndromic Surveillance using International Classification of Disease (ICD) codes

The following ICD lists were established for the emergency medical care sector, either diagnostic information which is gathered at the scene or in the emergency department. In the lists a rather broad range of ICD cods is given, which can be narrowed down in case that emergency physicians work with locally developed ICD short lists.

The listing of three-digit ICD-10 or ICD-9 codes denotes that the whole ICD group with all sub-groups should be included for syndrome generation.

Appendix 2.1 Influenza-like Illness

ICD-10	
J00	Acute nasopharyngitis [common cold]
J02	Acute pharyngitis (includes sore throat)
J04	Acute laryngitis and tracheitis
J06	Acute upper respiratory infections of multiple and unspecified sites
J09	Avian Influenza
J10	Influenza due to other identified influenza virus
J11	Influenza, virus not identified
J16	Pneumonia due to other infectious organisms, not elsewhere classified
J18	Pneumonia, organism unspecified
R05	Cough
R50	Fever of other and unknown origin

ICD-9	
460	Acute nasopharyngitis [common cold]
462	Pharyngitis, acute
464	Acute laryngitis and tracheitis
464.0	Acute laryngitis
464.1	Acute tracheitis
464.2	Acute laryngotracheitis
465	Acute upper respiratory infections of multiple or unspecified sites
465.0	Acute laryngopharyngitis
465.8	Acute upper respiratory infections of other multiple sites
465.9	Acute upper respiratory infections of unspecified site
480.9	Viral pneumonia unspecified
488	Influenza due to certain identified influenza viruses
488.0	Influenza due to identified avian influenza virus
488.1	Influenza due to identified novel h1n1 influenza virus
487	Influenza
487.0	Influenza with pneumonia
487.1	Influenza with other respiratory manifestations
487.8	Influenza with other manifestations
486	Pneumonia organism unspecified
786.2	Cough
780.6	Fever and other physiologic disturbances of temperature regulation

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Appendix 2.2 Gastrointestinal Syndrome

ICD-10	
A00	Cholera
A01	Typhoid and parathyphoid fevers
A02	other salmonella infections
A03	Shigellosis
A04	other bacterial intestinal infections
A05	Other bacterial foodborne intoxications, not elsewhere classified
A08	Viral and other specified intestinal infections
A09	Diarrhea and gastroenteritis of presumed infectious origin
R11	Nausea and vomiting
K52	Other non-infective gastroenteritis and colitis
K52.9	Non-infective gastroenteritis and colitis, unspecified
T62.9	Noxious substance eaten as food, unspecified

ICD-9	
001	Cholera
002	Typhoid and paratyphoid fevers
003	Other salmonella infections
004	Shigellosis
008.5	Bacterial enteritis unspecified
005	Other food poisoning (bacterial)
005.9	Food poisoning unspecified
008.6	Enteritis due to specified virus
008.69	Enteritis due to other viral enteritis
009.2	Infectious diarrhea
009.3	Diarrhea of presumed infectious origin
787.0	Nausea and vomiting
787.01	Nausea with vomiting
787.02	Nausea alone
787.03	Vomiting alone
787.81	Diarrhea
558.9	Other and unspecified noninfectious gastroenteritis and colitis
535.5	Unspecified gastritis and gastroduodenitis

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Appendix 2.3 Respiratory Syndrome

ICD-10	
J00	Acute nasopharyngitis [common cold]
J02	Acute pharyngitis (includes sore throat)
J04	Acute laryngitis and tracheitis
J06	Acute upper respiratory infections of multiple and unspecified sites
J09	Avian Influenza
J10	Influenza due to other identified influenza virus
J11	Influenza, virus not identified
J12	Viral pneumonia, not elsewhere classified
J13	Pneumonia due to Streptococcus pneumoniae
J14	Pneumonia due to Haemophilus influenzae
J15	Bacterial pneumonia, not elsewhere classified
J16	Pneumonia due to other infectious organisms, not elsewhere classified
J17	Pneumonia in diseases classified elsewhere
J18	Pneumonia, organism unspecified
J20	Acute bronchitis
J21	Acute bronchiolitis
J22	Unspecified acute lower respiratory infection
J44.0	Chronic obstructive pulmonary disease with acute lower respiratory infection
J44.1	Chronic obstructive pulmonary disease with acute exacerbation, unspecified
J46	Status asthmaticus (acute exacerbation of asthma)
J68.2	Upper respiratory inflammation due to chemicals, gases, fumes and vapours, not elsewhere classified
R05	Cough
R06.0	Dyspnoea (Orthopnoea, Shortness of breath)
R06.2	Wheezing
A15	Respiratory tuberculosis, bacteriological and histological confirmed
A16	Respiratory tuberculosis, not confirmed bacteriological or histological
A20.2	Pneumonic plague
A21.2	Pulmonary tularaemia
A22.1	Pulmonary anthrax
A48.1	Legionnaires' disease
B05.2	Measles complicated by pneumonia
J40	Bronchitis, not specified as acute or chronic
J41.1	Mucopurulent chronic bronchitis
J41.8	Mixed simple and mucopurulent chronic bronchitis
J42	Unspecified chronic bronchitis
J45	Asthma
J67	Hypersensitivity pneumonitis due to organic dust
J68	Respiratory conditions due to inhalation of chemicals, gases, fumes and vapours
J69	Pneumonitis due to solids and liquids
J70	Respiratory conditions due to other external agents
J80	Adult respiratory distress syndrome
J81	Pulmonary oedema
R06.8	Other and unspecified abnormalities of breathing

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ICD-9	
460	Acute nasopharyngitis [common cold]
462	Pharyngitis, acute
464	Acute laryngitis and tracheitis
464.0	Acute laryngitis
464.1	Acute tracheitis
464.2	Acute laryngotracheitis
465	Acute upper respiratory infections of multiple or unspecified sites
465.0	Acute laryngopharyngitis
465.8	Acute upper respiratory infections of other multiple sites
465.9	Acute upper respiratory infections of unspecified site
488	Influenza due to certain identified influenza viruses
488.0	Influenza due to identified avian influenza virus
488.1	Influenza due to identified novel h1n1 influenza virus
487	Influenza
487.0	Influenza with pneumonia
487.1	Influenza with other respiratory manifestations
487.8	Influenza with other manifestations
481	Pneumococcal pneumonia [streptococcus pneumoniae pneumonia]
482.2	Pneumonia due to hemophilus influenzae [h. influenzae]
482.9	Bacterial pneumonia unspecified
483	Pneumonia due to other specified organism
486	Pneumonia organism unspecified
466	Acute bronchitis and bronchiolitis
466.0	Acute bronchitis
466.1	Acute bronchiolitis
490	Bronchitis not specified as acute or chronic
493.91	Asthma unspecified type with status asthmaticus
493.01	Extrinsic asthma with status asthmaticus
496	COPD
506.2	Upper respiratory inflammation due to fumes and vapors
786.2	Cough
786.0	Dyspnea and respiratory abnormalities
011.01	Tuberculosis of lung infiltrative bacteriological or histological examination not done
011.02	Tuberculosis of lung infiltrative bacteriological or histological examination results unknown (at present)
011	Pulmonary tuberculosis
020.5	Pneumonic plague unspecified
021.2	Tularemia
022.1	Anthrax
482.84	Pneumonia due to legionnaires' disease
484.8	Pneumonia in other infectious diseases classified elsewhere
490	Bronchitis not specified as acute or chronic
491.1	Mucopurulent chronic bronchitis
491.9	Unspecified chronic bronchitis
493	Asthma
506.2	Other acute and subacute respiratory conditions due to fumes and vapors
507	Pneumonitis due to solids and liquids
508	Respiratory conditions due to other and unspecified external agents
786.0	Dyspnea and respiratory abnormalities
518.5	Pulmonary insufficiency following trauma and surgery
514	Pulmonary congestion and hypostasis
518.4	Acute edema of lung unspecified

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Appendix 2.4 Intoxication Syndrome

ICD-10	
T36	Poisoning by systemic antibiotics
T37	Poisoning by other systemic anti-invectives and anti-parasitics
T38	Poisoning by hormones and their synthetic substitutes and antagonists, not elsewhere classified
T39	Poisoning by non-opioid analgesics, antipyretics and anti-rheumatics
T40	Poisoning by narcotics and psychodysleptics [hallucinogens]
T41	Poisoning by anaesthetics and therapeutic gases
T42	Poisoning by antiepileptic, sedative-hypnotic and antiparkinsonism drugs
T43	Poisoning by psychotropic drugs, not elsewhere classified
T44	Poisoning by drugs primarily affecting the autonomic nervous system
T45	Poisoning by primarily systemic and haematological agents, not elsewhere classified
T46	Poisoning by agents primarily affecting the cardiovascular system
T47	Poisoning by agents primarily affecting the gastrointestinal system
T48	Poisoning by agents primarily acting on smooth and skeletal muscles and the respiratory system
T49	Poisoning by topical agents primarily affecting skin and mucous membrane and by ophthalmological, otorhinolaryngological and dental drugs
T50	Poisoning by diuretics and other and unspecified drugs, medicaments and biological substances
T51.1	Toxic effect of alcohol - methanol
T51.2	Toxic effect of alcohol - 2-propanol
T51.3	Toxic effect of alcohol - fusel oil
T51.8	Toxic effect of alcohol - other alcohols
T51.9	Toxic effect of alcohol - alcohol unspecified
T52	Toxic effect of organic solvents
T53	Toxic effect of halogen derivatives of aliphatic and aromatic hydrocarbons
T54	Toxic effect of corrosive substances
T55	Toxic effect of soaps and detergents
T56	Toxic effect of metals
T57	Toxic effect of other inorganic substances
T58	Toxic effect of carbon monoxide
T59	Toxic effect of other gases, fumes and vapours
T60	Toxic effect of pesticides
T61	Toxic effect of noxious substances eaten as seafood
T62	Toxic effect of other noxious substances eaten as food
T64	Toxic effect of aflatoxin and other mycotoxin food contaminants
T65	Toxic effect of other and unspecified substances
T96	Sequelae of poisoning by drugs, medicaments and biological substances
T97	Sequelae of toxic effects of substances chiefly non-medicinal as to source

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ICD-9*	
909.0	Late effect of poisoning due to drug medicinal or biological substance
909.1	Late effect of toxic effects of nonmedical substances
960	Poisoning by antibiotics
961	Poisoning by other anti-infectives
962	Poisoning by hormones and synthetic substitutes
965	Poisoning by analgesics anti-pyretics and anti-rheumatics
966	Poisoning by anti-convulsants and anti-parkinsonism drugs
969	Poisoning by psychotropic agents
971	Poisoning by drugs primarily affecting the autonomic nervous system
963	Poisoning by primarily systemic agents
964	Poisoning by agents primarily affecting blood constituents
972	Poisoning by agents primarily affecting the cardiovascular system
973	Poisoning by agents primarily affecting the gastrointestinal system
975	Poisoning by agents primarily acting on the smooth and skeletal muscles and respiratory system
976	Poisoning by agents primarily affecting skin and mucous membrane ophthalmological otorhinolaryngological and dental drugs
977	Poisoning by other and unspecified drugs and medicinal substances
980	Toxic effect of alcohol
980.1-980.3	
980.8-980.9	
982	Toxic effect of solvents other than petroleum-based
983	Toxic effect of corrosive aromatics acids and caustic alkalis
984	Toxic effect of lead and its compounds (including fumes)
985	Toxic effect of other metals
986	Toxic effect of carbon monoxide
987	Toxic effect of other gases fumes or vapors
988	Toxic effect of noxious substances eaten as food
989	Toxic effect of other substances chiefly non-medicinal as to source

* due to the large amount of codes only main groups are described, sub-groups or ranges of sub-groups are given without detailed description

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Appendix 2.5 Environment-Related Problems (heat-related)

ICD-10	
E16.2	**Hypoglycemia**
E86	**Dehydration**
E87.1	**Hyponatremia**
	Cardiovascular syndrome
I00-I99	
	Cerebrovascular syndrome
I60-I69	
	Respiratory syndrome (cf. appendix 3.3)
	Asthma
J45	Asthma
J46	Status asthmaticus
	Urinary infections
N10	Acute tubulo-interstitial nephritis
N30	Cystitis
N34	Urethritis and urethral syndrome
N15.1	Renal and perinephric abscess
N39.0	Urinary tract infection. site not specified
N41.0	Acute prostatitis
	Renal faillure
N17	Acute renal failure
N18	Chronic renal failure
N19	Unspecified renal failure
	Renal colic
N20	Calculus of kidney and ureter
N21	Calculus of lower urinary tract
N22	Calculus of urinary tract in diseases classified elsewhere
N23	Unspecified renal colic
	Malaise
R42	Dizziness and giddiness
R53	Malaise and fatigue
R55	Syncope and collapse
	Hypothermia
T67	Effects of heat and light
X30	Exposure to excessive natural heat

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Appendix 3 Syndromic Surveillance using a combination of International Classification of Disease (ICD) codes and codes generated with the Minimum Data Set for Emergency Physicians (MIND-2)

Influenza-Like Illness

Variable	Value	Boolean opperator
Airway disorders (3)	Pneumonia/bronchitis (4)	OR
Airway disorders (3)	Other respiratory diseases (7)	OR
ICD-10 (main diagnostic information)	cf. appendix 3.1	
		AND
Breathing (ATM1)	dyspnoea (2)	OR
Breathing (ATM1)	cyanosis (3)	
Breathing (ATM1)	spastic (4)	
Breathing (ATM1)	rales (5)	
Pulse oxymetry oxygen saturation (SAOZ)	<90	OR
Respiratory rate (AF1)	>20	
		AND
Injury	no	
		NOT
Heart/circulation disorder (2, sub-codes 1-11)		OR
Psychatric disorders (5, sub-codes 1-8)		

Gastrointestinal Syndrome

Variable	Value	Boolean operator
Abdominal disorders (4)	Acute abdomen (1)	OR
Abdominal disorders (4)	Gastrointestinal Bleeding (2)	OR
Abdominal disorders (4)	Colic (3)	OR
Abdominal disorders (4)	other disease abdomen (4)	OR
Metabolic disease (6)	dehydrated (2)	OR
ICD-10 (main diagnostic information)	cf. appendix 3.2	
		AND
Pain (KSCHMER1)	VAS >3 (2, 3)	

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Respiratory Syndrome

Variable	Value	Boolean operator
Airway disorders (3)	Asthma (1)	OR
Airway disorders (3)	COPD exacerbations (2)	OR
Airway disorders (3)	Aspiration (3)	OR
Airway disorders (3)	Pneumonia / bronchitis (4)	OR
Airway disorders (3)	Hyperventilation tetany (5)	OR
Airway disorders (3)	Croup / Epiglottises (6)	OR
Airway disorders (3)	other respiratory disease (7)	OR
ICD-10 (main diagnostic information)	cf. appendix 3.3	
		OR
Breathing (ATM1)	dyspnoea (2)	OR
Breathing (ATM1)	cyanosis (3)	OR
Breathing (ATM1)	spastic (4)	OR
Breathing (ATM1)	rales (5)	OR
SAOZ	<90	OR
AF1	>20	
		AND
Injury	no	
		NOT
Heart/circulation disorder (2)	whole group, subfroup 1-11	OR
Psychatric disorders (5)	psychosis / depression / mania (1)	OR
Psychatric disorders (5)	increased emotion (2)	

Intoxication Syndrome

Variable	Value	Boolean operator
CNS disorders (1)	seizure (3)	OR
CNS disorders (1)	other CNS disorder (4)	OR
Psychatric disorders (4)	intoxication medical drugs (5)	OR
ICD-10 (main diagnostic information)	cf. appendix 3.4	

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Appendix 4 Syndromic Surveillance in Emergency Departments (Manchester Triage System)

Chief Complaints	Syndromes			
Manchester Triage	ILI	Gastrointestinal Syndrome	Respiratory Syndrome	Intoxication Syndrome
Abdominal pain adults		✓		
Abdominal pain in children		✓		
Aggression				
Asthma			✓	
Baby who cries				
Back pain				
Bites and stings				
Burns				
Catastrophe – primary classification				
Catastrophe – secondary classification				
Cephalalgia				✓
Convulsions				
Dental problems				
Diabetes				
Diarrhoea		✓		
Dyspnoea adults	✓		✓	
Dyspnoea in children	✓		✓	
Ear problems				
Exanthema				
Exposition to chemical substances				✓
Eye problems				

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Chief Complaints	Syndromes			
Manchester Triage	ILI	Gastrointestinal Syndrome	Respiratory Syndrome	Intoxication Syndrome
Falls				
Gastrointestinal haemorrhage				
Haematological disease				
Thoracic pain				
Injuries				
Irritable child				
Limping child				
Local infections and abscesses				
Mental disease				
Nasal problems				
Neck pain				
Overdoses and poisoning				✓
Polytraumatism				
Pregnancy				
Problems in the extremities				
Self injury				
Sexually transmitted disease				
Sore throat	✓		✓	
Strange behaviour				✓
Strange body				
Syncope or blackout				
Testicular pain				
Traumatic brain injury				
Trunk injury				
Urinary problems				
Vaginal haemorrhage				
Vomits		✓		✓
Worried parents				

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Appendix 5 Syndromic surveillance using free text information (emergency department)

Explanatory information: For syndrome generation it was searched for the below mentioned terms in the fee text information given on the chief complaint and/or the working diagnosis. All terms were combined with the Boolean operator "OR". The information was also extracted if it was part from longer free text elements. The syndromes were generated by the use of SQL queries (SAP BusinessObjects).

Influenza-like illness
chief complaint
cough
muscle pain
flu
H1N1
sore throat
influenza
fever

Respiratory syndrome
chief complaint or working diagnosis
airway disorder
laryngitis
earache, otalgia
bronchitis
pharyngitis
sinusitis
pneumonia
working diagnose
exacerbated COPD
exacerbated Asthma
Otitis media
chief complaint
cough
breathing problems
dyspnoea
sore throat

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Environment-related syndrome

Renal colic
working diagnose
urolithiasis
nephrolithiasis
renal colic
renal crisis

Renal faillure
working diagnose
renal failure
renal insufficiency

Urinary infections
working diagnose
urinary infection
urinary tract infection or UTI
urinary infection, dizziness
urinary infection, fistula
urinary infection, obstipation
urinary infection, not febrile neutropenia
urinary infection with suspivcion urosepsis
urinary infection, sepsis
urinary infection after ureterorenoscopy for lithiasis identification

Asthma
chief complaint or working diagnosis
asthma

Hyponatremia
chief complaint or working diagnosis
Hyponatremia

Dehydration
chief complaint
dehydration
working diagnosis
exsiccosis

Hypothermia
chief complaint or working diagnosis
hypothermia

Hypoglycemia
chief complaint or working diagnosis
hypoglycemia

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Cerebrovascular
working diagnose
intracerebral bleeding (hemorrhage)
intracranial bleeding (hemorrhage)
intracranial haematoma
intracerebral bleeding (hemorrhage) with ventricular perforation of the internal capsule
increased intracranial pressure
intracranial hypertension
intracranial bleeding (hemorrhage) with constrictions
intracerebral bleeding (hemorrhage) and status epilepticus
intracranial bleeding (hemorrhage) occipital left
intracerebral bleeding (hemorrhage) thalamus with ventricular perforation
intracerebral bleeding (hemorrhage) and syncope
increased intracranial pressure, third ventriculostomy
intracerebral bleeding (hemorrhage) right frontal lobe
intracranial bleeding (hemorrhage), resuscitation
intracerebral bleeding (hemorrhage) left temporal due to an aneurysm
intracerebral bleeding (hemorrhage) occipital
intracerebral bleeding (hemorrhage) basal ganglia
intracranial bleeding (hemorrhage), suarachnoid hemorrhage
intracerebral bleeding (hemorrhage) left skull fracture
intracerebral bleeding (hemorrhage) with starting trepidation
intracranial bleeding (hemorrhage), hypokalaemia, infection, liver metastases
ICB left basal ganglia
IC bleeding
ICB left parietal
ICB right
ICB epileptic seizure
ICB right parietal
ICB epidural haematoma right temporal lobe
cerebral hemorrhage
cerebral hemorrhage temporal lobe left with ventricular perforation
cerebral oedema, right cerebral hemisphere with subarachnoid hemorrhage
brain stem injury
brainstem hemorrhage pontomesencephalic with ventrikel perforation
cerebral hemorrhage subarachnoidal
brain stem suffering
cerebral oedema, subarachnoid hemorrhage
cerebral hemorrhage left frontal lobe
cerebellar ischemia
cerebrovascular insufficience
cerebellar infarct (old) and general malaise
cerebral bleeding and oedema
cerebral bleeding left temporal lobe
CVA (cerebrovascular accident)
TIA (transient ischaemic attack)

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Circulatory
working diagnose
cardiac decompensation
heart failure
AMI
acute myocardial infarction/acute pulmonary oedema
acute myocardial infarction/anterior
acute myocardial infarction/STEMI inferior
acute myocardial infarction/inferior
acute myocardial infarction/hypokalaemia/metabolic acidosis
acute myocardial infarction/lateral
acute myocardial infarction-fever
acute myocardial infarction/pulmonary oedema
acute myocardial infarction/hyperkalemia/detoriation of the global condition
acute myocardial infarction after catherization e 910
acute myocardial infarction with complete atrioventricular block and syncope
acute myocardial infarction, pulmonary oedema, asystole
Acute myocardial infarction/hyper/atrial fibbrilation
acute myocardial infarction, clavicular fracture
Acute myocardial infarction, CPR, dens fracture
acute myocardial infarction, urosepsis
acute myocardial infarction, STEMI
STEMI
Heartdecompensation
heartinfarction
ACS
acute coronary syndrome
acute coronary syndrome (NSTEMI)
acute coronary syndrome (STEMI)
arterial hypertension
chronic renal insufficience
acute coronary syndrome
syncope
myocardinfarction

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