A public health enhanced surveillance system for a mass gathering event

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Abstract

Background: From June 7 to June 9, 2018, a G7 Summit was held in the Canadian province of Quebec. This international political mass gathering event posed a number of potential risks to public health.

Objective: To assess three additional monitoring strategies to detect public health threats during a mass gathering event.

Intervention: In addition to routine public health monitoring, a partnership was created and three monitoring strategies were put in place three days before, during and six days after the G7 event: the analysis of data on the presenting complaint and discharge diagnosis from 11 emergency departments in the area using the logiciel Early Aberration Reporting System; the daily polling of key health partners with an online questionnaire; and the analysis of calls to Info-Santé, a government-run telephone consultation service for the public regarding health and social issues.

Results: Emergency room data produced 78 alerts from the presenting complaints and 39 alerts from the discharge diagnoses. Of these 117 alerts, two were investigated (one in the respiratory and one in the neurological-muscular categories) and no other interventions were required. With a few exceptions, all of the health partners completed the online survey each day and no signal of concern was generated. Compared with historical data, no increase or differences in calls to Info-Santé were detected during the monitoring period.

Conclusion: The three additional monitoring strategies developed to detect events of public health importance during the 2018 G7 Summit in Quebec were successful in gathering timely data for analysis. Close collaboration and good participation from the different partners were essential to this project. However, because no public health event occurred, it was not possible to determine whether the enhanced surveillance system had sufficient speed and sensitivity for timely detection and response.

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Introduction

From June 7 to June 9, 2018, the prime minister of Canada hosted a G7 Summit in La Malbaie and Québec, Quebec (1). Seven internationally protected persons and their delegations (approximately 3,200 people), 3,200 journalists, thousands of demonstrators, 1,000 to 2,000 police officers, 1,000 service members from the Canadian Armed Forces and approximately 12,000 people from a number of non-G7 countries invited as part of the Outreach Program were expected to attend.

In preparation for this event, experts in emergency management were consulted, and the literature (2–9), including lessons learned from the Summit of the Americas in 2001 (10), was reviewed. A number of monitoring initiatives previously applied

during sporting (3,11–19), religious (5,20,21) and artistic events (22,23) have been described previously. However, there was less detailed information available about surveillance during political events, especially those that are at risk for violent demonstrations or acts of terrorism (24,25).

In advance of the event, a number of potential public health threats were identified and prioritized for monitoring: rapid spread of certain infectious diseases; violence associated with demonstrations and use of crowd-control agents; potential for chemical, biological, radiological, nuclear or explosive (CBRNE) terrorist threats; and presence of suspicious packages (26). Although the probability of these threats was considered low (11–16,27), an enhanced surveillance system was needed to quickly detect potential public health threats (28–31), as well as a rapid intervention plan for each of these threats.

Routine public health surveillance in Quebec relies on the mandatory reporting of notifiable diseases by physicians and laboratories, and on the passive reporting of perceived or real public health threats by various partners, including clinicians, government departments and local municipalities (32). However, these routine surveillance activities lacked the necessary sensitivity and timeliness to rapidly detect and respond to priority public health threats during the G7 Summit (33). To address this, the Direction de santé publique (DSPublique) of the Centre intégré universitaire de santé et de services sociaux de la Capitale-Nationale (Public Health Department of the Nationale Capital Integrated University Health and Social Services Centre) developed an enhanced surveillance system that included activities for the period from June 4 to June 15, 2018 (three days before, three days during and six days after the event). The goal of the enhanced surveillance system was to develop a surveillance capacity that met the goals of early detection and acceptability to all participating partners.

The purpose of this article is to describe the development and outcome of three monitoring strategies that were part of the enhanced surveillance system during the 2018 G7 Summit, and to consider the implications of these strategies for public health surveillance during future mass gathering events.

Establishing partnerships

Approximately six months before the event, a DSPublique project team began the development of an enhanced surveillance system. All of the region's emergency departments (ED) already had in place electronic records for both presenting complaints (those given by patients to the triage nurses when they came into the ED) and medical discharge diagnoses (those given by a physician when the patient left the ED). Not all these data are usually available to the DSPublique, and they had not been previously used for public health surveillance. The EDs of six university hospital centres and five regional hospital centres within the event perimeter or nearby were invited to collaborate for this event. To ensure access to these data, additional partners from other Integrated University Health and Social Services Centre departments collaborated with the DSPublique project team.

To receive daily reports from key partners, five organizations likely to detect the targeted threats early were approached: the Centre antipoison du Québec (Quebéc Poison Control Centre); the region's ambulance services; the Laboratoire de santé publique du Québec (Quebec Public Health Laboratory); and the Bureau du coroner (Quebec Coroner's Office). Info-Santé (a public telephone consultation service for health and social issues) was a key partner that provided daily reports and contributed data for enhanced surveillance. Three temporary clinics were set up for the event and also submitted daily reports.

In addition to the partners who directly contributed to the enhanced surveillance system, the region's clinicians were informed of the project's progress stage-by-stage through the emergency management structure, which was put on alert for the event. The Public Health Agency of Canada provided support, deploying two field epidemiologists for planning, analyzing data and producing reports. All the enhanced monitoring activities were timed to allow for rapid analysis and dissemination of results, decision-making and response. A daily report summarizing the results was prepared and distributed to the DSPublique, partners and decision-makers. Two versions (short and detailed), adapted to the target audiences, were available.

Enhanced monitoring activities

To enhance the sensitivity and timeliness of the surveillance system, while ensuring it remained acceptable to all partners, the following three monitoring activities were added to Notifiable Disease reporting and passive reporting for the period from June 4 to June 15, 2018:

- Monitoring trends in presenting complaints and discharge diagnoses at ED
- Requesting daily reports from key partners
- Monitoring trends in calls to Info-Santé

Monitoring trends from emergency departments

For the ED electronic data, presenting complaints were recorded by the triage nurse following a patients' arrival, and medical discharge diagnoses were recorded when the patient was ready to leave the ED. All univserity hospital patients were identified with a unique identifier number. These data were available the day after the visit. Electronic record data from all ED visits in the area surrounding the G7 Summit were incorporated into the enhanced surveillance system. This approach was acceptable to clinical partners because these data were already available

for other purposes. However, it did create a slight increase in workload, as reminders were sent if there were entry delays.

The discharge diagnoses were identified according to the International Classification of Diseases, 10th revision (ICD-10) as per the Quebec guidelines (34). Selected presenting complaints and discharge diagnoses were sorted and analyzed by category (see **Appendices 1** and **2**). A few discharge diagnoses were also analyzed individually; these included either a notifiable disease or a diagnosis for which a public health response may be indicated for a single case, such as measles (see last column in Appendix 2). Two clinicians—one specializing in CBRNE emergencies and the other in clinical toxicology—validated the choices.

The number of cases in each category was analyzed using the Centers for Disease Control and Prevention's Early Aberration Reporting System (35) software, which detects alerts or aberrations in the number of cases based on short-term historical data (ten days). All the generated alerts were compared with historic data for the period of April to July 2013–2017. A daily analysis of the previous day's data was conducted, by emergency department and for all emergency departments combined. Age group, municipality of the cases and details on the presenting complaints and diagnoses were used when available. A team evaluation and decision were made regarding whether or not to further investigate each alert that was generated.

Daily reports from key partners

Key partners included Quebéc's Poison Control Centre, the region's ambulance services, the Quebec Public Health Laboratory, the Coroner's Office, Info-Santé and three temporary clinics. A short, three-question online questionnaire (Voxco Inc. platform) (36) was developed and sent to respondents from partner organizations on a daily basis (before, during and after the event) regarding infectious or environmental health threats. Questionnaires were completed by 10 am regarding information from the previous day.

Monitoring trends for calls to Info-Santé

Electronic data on the reasons for calling Info-Santé were already available to the DSPublique, but had not previously been used for surveillance. The most relevant reasons for calling were selected based on the priority threats (**Table 1**). These reasons were sorted into categories for enhanced surveillance. In each category, the number and percentage of calls were analyzed on a daily basis to detect any increase or change compared with historical data.

Table 1: Monitored reasons for calling Info-Santé by category

Category	Reasons for calling
Cardiovascular	Cardiovascular system manifestations or symptoms
CBRNE/physical/ environmental	Extreme heat
	Intoxications
	Large events
	Environmental health
Cutaneous/lymphatic	Skin and tissue manifestations or symptoms
Extreme	Avian influenza (bird flu)
	Ebola virus
Gastrointestinal	Gastrointestinal system manifestations or symptoms
Infectious	Infectious and parasitic diseases
	Thermoregulation
Neurological/muscular	Nervous system manifestations or symptoms
Ophthalmological/ otorhinolaryngological	Ophthalmic manifestations or symptoms
Respiratory	Influenza-like illness
	Respiratory problems excluding the flu

Abbreviation: CBRNE, chemical, biological, radiological, nuclear or explosive

Results

Emergency department data

During the monitoring period, data were available for both the presenting complaints and the discharge diagnoses. No presenting complaint data were missing. Overall, 27% of diagnosis data were missing during the entire monitoring period, which extended from June 4 to 15. During the G7 Summit (June 7 to 9), however, only 23% of diagnosis data were missing. These missing data were due to patients leaving the ED before a diagnosis was made and delays in the entry of diagnoses into the electronic record.

Emergency department data produced 78 alerts for the presenting complaint categories and generated 39 alerts in the various diagnosis categories. Among these 117 alerts, two were investigated (one for respiratory category and one for neurological-muscular category). No other intervention was required. **Table 2** summarizes the number of alerts per category.

Daily reports and Info-Santé

With a few exceptions, all of the partners completed the survey every day and few reminders were required. One of the three temporary clinics reported two cases of gastroenteritis. Ambulance services reported one case of opioid intoxication. Given that these reports did not exceed the expected frequency and there were no related health threats, none of these reports was investigated.

Table 2: Number of alerts by presenting complaint and discharge diagnosis category from 11 emergency departments in the La Malbaie/Québec region, June 4–15, 2018

Category	Number of alerts	
	Presenting complaints	Discharge diagnosis
Cardiovascular	5	3
CBRNE/physical/environmental	6	4
Cutaneous/lymphatic	6	4
Fever	9	n/a
Gastrointestinal	9	0
Hemorrhagic	8	6
Infectious	n/a	5
Opioid intoxication	n/a	0
Neurological/muscular	8	8
Ophthalmic/Otorhinolaryngological	9	4
Respiratory	5	2
Systemic/dehydration	13	3
TOTAL	78	39

Abbreviations: CBRNE, chemical, biological, radiological, nuclear or explosive; n/a; not applicable

In analyzing the reasons for calls to Info-Santé, neither increases nor differences were detected during the monitoring period in comparison with historical data.

Discussion

A three-pronged enhanced surveillance system, developed to detect events of public health importance during the 2018 G7 Summit in Quebec, was successful in gathering timely data for analysis. Most alerts were generated from the analysis of ED data. The use of historical data made it possible to limit the number of alerts for which an investigation was needed. The use of these data appeared to result in high sensitivity but low specificity.

A strength of this enhanced surveillance system was the close collaboration with a number of different partners. This collaboration was essential to the development of this enhanced surveillance system. The three additional monitoring strategies exhibited a high level of participation by the partners. This was likely because partners understood the importance of the additional monitoring and because only minimal additional time was required by participants. Thus, most data requested from the partners were received in a timely manner.

This work identified the feasibility of our enhanced surveillance system and could inform future public health preparedness for mass gathering events. However, because no public health event occurred, it was not possible to determine whether the enhanced surveillance system had sufficient speed and sensitivity for timely detection and response.

Conclusion

Three additional monitoring strategies developed to detect events of public health importance during the 2018 G7 Summit in Quebec were successful in gathering timely data for analysis. However, further assessment of speed and sensitivity is needed if applied to a future public health surveillance strategy of a mass gathering event.

Authors' statement

HC — Conceptualization, methodology, intervention, analysis and interpretation of data, article writing
AP — Conceptualization, methodology, intervention, analysis and interpretation of data, article review
KHC — Intervention, analysis and interpretation of data, article review
MAB — Analysis and interpretation of data, article review
JV — Conceptualization, methodology, article review
NB — Intervention, analysis and interpretation of data, article review
IGS —Conceptualization, resources, article review
JR — Intervention, analysis and interpretation of data, article review

Conflict of interest

None.

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Appendix 1: Monitored presenting complaints from emergency departments, by category

Category	Presenting complaint
Cardiovascular	Cardiac arrest (non-traumatic)
	Chest pain—cardiac features
CBRNE/physical/environmental	Noxious inhalation
	Chemical exposure
	Intoxication
	Exposure to communicable disease
Cutaneous/lymphatic	Reddened hot limb
	Neck swelling/pain
	Groin pain/mass
	Pruritus
	Rash
	Localized swelling/redness
	Other skin conditions
	Lumps, bumps, calluses
	Burn
Fever	Fever
Gastrointestinal	Diarrhea
	Nausea/vomiting
	Blood in stool/melena
	Jaundice
	Abdominal pain
	Diarrhea and fever
Hemorrhagic	Epistaxis
	Vomiting blood
	Hematuria
	Spontaneous bruising
Neurological/muscular	Difficulty swallowing/dysphagia
	Altered level of consciousness
	Confusion
	Seizure
	Gait disturbance/ataxia
	Extremity weakness/symptoms of cerebrovascular accident
	Headache
	Diplopia
Ophthalmological/ Otorhinolaryngological	Sore throat
	Chemical exposure, eye
	Visual disturbance
	Red eye, discharge
	Photophobia
	Eye pain
	Eye trauma

Appendix 1: Monitored presenting complaints from emergency departments, by category (*continued*)

Category	Presenting complaint
Respiratory	Symptoms of upper respiratory tract infection
	Chest pain—non-cardiac features
	Dyspnea
	Respiratory arrest
	Cough/congestion
	Hemoptysis
	Stridor
	Wheezing—no other complaints
	Cough and fever/Influenza-like illness
Systemic/dehydration	General weakness
	Syncope/pre-syncope
	Oliguria
	Cyanosis

Abbreviation: CBRNE, chemical, biological, radiological, nuclear or explosive

Appendix 2: Monitored discharge diagnoses with ICD-10 code from emergency departments, by category[a]

Category	ICD-10 code	ICD-10 diagnosis	Individual analysis done (Y/N)
Cardiovascular	I20.0	Unstable angina	N
	I20.9	Angina pectoris	N
	I21.9	Acute myocardial infarction	N
	I24.9	Acute ischemic heart disease, acute coronary syndrome (ACS)	N
	I46.9	Cardiac arrest	N
	I95.9	Hypotension	N
	R00.1	Bradycardia	N
	R07.2	Chest pain of unknown cause	N
	R07.3	Anterior chest-wall pain	N
	R07.4	Chest pain	N
	R57.0	Cardiogenic shock	N
CBRNE/physical/ environmental	J68.9	Inhalation of toxic products	**Y**
	T59.9	Toxic effect: gases, fumes and vapours	**Y**
	T62.9	Noxious substance eaten as food	**Y**
	T67.0	Heatstroke and sunstroke	**Y**
	T52.9	Toxic effect: organic solvent	N
	T54.9	Toxic effect: corrosive substance	N
	T58	Toxic effect of carbon monoxide	N
	T60.9	Toxic effect: pesticide	N
	T65.9	Toxic effect: unspecified substance	N
	T66	Effects of radiation	N
	T67.9	Effect of heat and light	N
	T71	Asphyxiation	N
	Y14	Poisoning by and exposure to other and unspecified drugs, medicaments and biological substances, undetermined intent	N
	Y17	Poisoning by and exposure to other gases and vapours, undetermined intent	N
	Y25	Contact with explosive material, undetermined intent	N
	Z20.9	Contact with and exposure to unspecified communicable disease	N
	Z29.9	Prophylactic measure	N
Cutaneous/lymphatic	B05.9	Measles	**Y**
	B09	Viral exanthema	**Y**
	L02.9	Cutaneous abscess, furuncle and carbuncle	**Y**
	I88.9	Nonspecific lymphadenitis	N
	I89.1	Lymphangitis	N
	L03.9	Cellulitis	N
	L13.9	Bullous disorder	N
	L25.9	Unspecified contact dermatitis	N
	L29.9	Pruritus	N
	L50.9	Urticaria	N
	L51.9	Erythema multiforme	N
	L72.9	Cyst of skin	N
	L97	Ulcer of lower limb, diabetic foot ulcer	N
	L98.9	Disorder of skin and subcutaneous tissue	N
	M72.69	Necrotizing fasciitis	N

Appendix 2: Monitored discharge diagnoses with ICD-10 code from emergency departments, by category[a] (*continued*)

Category	ICD-10 code	CD-10 diagnosis	Individual analysis done (Y/N)
Cutaneous/lymphatic (*continued*)	R21	Rash	N
	R22.9	Localized swelling, mass and lump	N
	R59.9	Enlarged lymph nodes	N
	R60.0	Localized edema	N
	T29.0	Burns of multiple regions	N
	T30.1	Burn of first degree	N
	T30.2	Burn of second degree	N
	T30.3	Burn of third degree	N
Gastrointestinal	A05.9	Bacterial foodborne intoxication	**Y**
	A09.9	Gastroenteritis	**Y**
	B19.9	Viral hepatitis	**Y**
	K29.7	Gastritis	N
	K29.9	Gastroduodenitis	N
	K51.9	Ulcerative colitis	N
	K56.7	Ileus	N
	K65.0	Acute peritonitis	N
	K72.9	Hepatic failure	N
	K92.9	Disease of digestive system	N
	R10.4	Abdominal pain	N
	R11.1	Isolated nausea	N
	R11.3	Nausea with vomiting	N
	R17	Jaundice	N
Hemorrhagic	D65	Disseminated intravascular coagulation (DIC)	N
	D68.9	Coagulation defect	N
	D69.6	Thrombocytopenia	N
	D75.9	Blood disease	N
	I62.9	Intracranial hemorrhage (nontraumatic)	N
	K92.0	Hematemesis	N
	K92.2	Gastrointestinal hemorrhage	N
	R04.0	Epistaxis	N
	R31.8	Hematuria	N
	R58	Hemorrhage	N
Infectious	A39.2	Acute meningococcaemia	**Y**
	A21.2	Pulmonary tularaemia	**Y**
	A00.0	Cholera due to *Vibrio cholerae* 01, *biovar cholerae*	N
	A00.1	Cholera due to *Vibrio cholerae* 01, *biovar eltor*	N
	A00.9	Cholera, unspecified	N
	A01.0	Typhoid fever	N
	A01.1	Paratyphoid fever A	N
	A01.2	Paratyphoid fever B	N
	A01.3	Paratyphoid fever C	N
	A01.4	Paratyphoid fever, unspecified	N
	A02.0	Salmonella enteritis	N

Appendix 2: Monitored discharge diagnoses with ICD-10 code from emergency departments, by category[a] (*continued*)

Category	ICD-10 code	ICD-10 diagnosis	Individual analysis done (Y/N)
Infectious (continued)	A02.1	Salmonella sepsis	N
	A02.2	Localized salmonella infections	N
	A02.8	Other specified salmonella infections	N
	A02.9	Salmonella infection, unspecified	N
	A03.0	Shigellosis due to *Shigella dysenteriae*	N
	A03.1	Shigellosis due to *Shigella flexneri*	N
	A03.2	Shigellosis due to *Shigella boydii*	N
	A03.3	Shigellosis due to *Shigella sonnei*	N
	A03.8	Other shigellosis	N
	A03.9	Shigellosis, unspecified	N
	A15.0	Tuberculosis of lung, confirmed by sputum microscopy with or without culture	N
	A15.1	Tuberculosis of lung, confirmed by culture only	N
	A15.2	Tuberculosis of lung, confirmed histologically	N
	A15.3	Tuberculosis of lung, confirmed by unspecified means	N
	A15.4	Tuberculosis of intrathoracic lymph nodes, confirmed bacteriologically and histologically	N
	A15.5	Tuberculosis of larynx, trachea and bronchus, confirmed bacteriologically and histologically	N
	A15.6	Tuberculous pleurisy, confirmed bacteriologically and histologically	N
	A15.7	Primary respiratory tuberculosis, confirmed bacteriologically and histologically	N
	A15.8	Other respiratory tuberculosis, confirmed bacteriologically and histologically	N
	A15.9	Respiratory tuberculosis unspecified, confirmed bacteriologically and histologically	N
	A20.2	Pneumonic plague	N
	A36.0	Pharyngeal diphtheria	N
	A36.1	Nasopharyngeal diphtheria	N
	A36.2	Laryngeal diphtheria	N
	A36.3	Cutaneous diphtheria	N
	A36.8	Other diphtheria	N
	A36.9	Diphtheria, unspecified	N
	A40.9	Streptococcal infection	N
	A41.9	Septicemia	N
	A48.3	Toxic shock syndrome	N
	A49.9	Bacteremia	N
	A80.0	Acute paralytic poliomyelitis, vaccine-associated	N
	A80.1	Acute paralytic poliomyelitis, wild virus, imported	N
	A80.2	Acute paralytic poliomyelitis, wild virus, indigenous	N
	A80.3	Acute paralytic poliomyelitis, other and unspecified	N
	A80.4	Acute nonparalytic poliomyelitis	N
	A80.9	Acute poliomyelitis, unspecified	N
	A96.2	Lassa fever	N
	A98.0	Crimean-Congo hemorrhagic fever	N
	A98.3	Marburg virus disease	N
	A98.4	Ebola virus disease	N
	B03	Smallpox	N

Appendix 2: Monitored discharge diagnoses with ICD-10 code from emergency departments, by category[a] (*continued*)

Category	ICD-10 code	ICD-10 diagnosis	Individual analysis done (Y/N)
Infectious (continued)	B34.9	Viral infection	N
	R50.9	Fever	N
	R57.2	Septic shock	N
Opiod poisoning	T40.1	Poisoning: heroin	N
	T40.6	Poisoning: narcotics	N
	F11.9	Mental and behavioural disorders due to use of opioids	N
Neurological/muscular	A05.1	Botulism	**Y**
	A39.0	Meningococcal meningitis	**Y**
	A86	Viral encephalitis	N
	A87.9	Viral meningitis	N
	F05.9	Delirium	N
	G00.9	Bacterial meningitis	N
	G03.9	Meningitis, unspecified	N
	G04.9	Encephalomyelitis	N
	G24.9	Dystonia	N
	G41.9	Status epilepticus	N
	G44.8	Headache, other	N
	G51.0	Bell palsy	N
	G52.9	Cranial nerve disorder	N
	G61.0	Guillain-Barré syndrome	N
	G62.9	Polyneuropathy	N
	G72.9	Myopathy	N
	G83.4	Cauda equina syndrome	N
	G83.9	Paralytic syndrome	N
	G93.4	Encephalopathy	N
	G95.9	Myelopathy	N
	G96.9	Disorder of central nervous system, unspecified	N
	H53.2	Diplopia	N
	M62.99	Myopathy	N
	R13.8	Dysphagia	N
	R26.88	Abnormalities of gait and mobility	N
	R29.8	Symptoms and signs involving the nervous and musculoskeletal systems	N
	R40.0	Altered state of consciousness	N
	R40.29	Coma	N
	R41.0	Disorientation	N
	R51	Headache	N
	R56.88	Convulsions	N

Appendix 2: Monitored discharge diagnoses with ICD-10 code from emergency departments, by category[a] (*continued*)

Category	ICD-10 code	ICD-10 diagnosis	Individual analysis done (Y/N)
Ophthalmological/ otorhinolaryngological	H16.0	Corneal ulcer	N
	H10.9	Conjunctivitis	N
	H16.9	Keratitis, unspecified	N
	H18.9	Disorder of cornea	N
	H53.9	Visual disturbance	N
	H57.1	Eye pain	N
	H57.9	Disorder of eye and adnexa	N
	J02.9	Acute pharyngitis	N
	J03.9	Acute tonsillitis	N
	J04.0	Acute laryngitis	N
	J05.0	Acute obstructive laryngitis (croup)	N
	J05.1	Acute epiglottitis	N
	R07.0	Pain in throat	N
	S05.9	Injury of eye and orbit	N
Respiratory	J06.9	Acute upper respiratory infection	**Y**
	U04.90	Severe acute respiratory syndrome (SARS) – suspected	**Y**
	J04.1	Acute tracheitis	N
	J04.2	Acute laryngotracheitis	N
	J11.8	Flu/influenza	N
	J18.9	Pneumonia	N
	J20.9	Acute bronchitis	N
	J45.90	Asthma	N
	J69.0	Aspiration pneumonia	N
	J80	Adult respiratory distress syndrome- ARDS	N
	J96.0	Acute respiratory failure	N
	J98.0	Bronchospasm	N
	J98.9	Respiratory disorder, unspecified	N
	R04.2	Hemoptysis	N
	R05	Cough	N
	R06.0	Dyspnoea	N
	R06.1	Stridor	N
	R09.2	Respiratory arrest	N
Systemic/dehydration	E86.0	Dehydration	N
	E87.0	Hypernatraemia	N
	E87.1	Hyponatremia	N
	E87.6	Hypokalemia	N
	E87.8	Disorders of electrolyte and fluid balance	N
	N17.9	Acute renal failure	N
	R23.0	Cyanosis	N
	R53	Malaise and fatigue	N
	R55	Syncope and collapse	N
	R57.1	Hypovolemic shock	N
	R57.9	Shock	N

Abbreviations: ICD-10, International Classification of Diseases, 10th revision; N, No; Y, Yes

[a] Identified ICD-10 diagnoses were subject to a separate analysis