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Maritime illness and death reporting and public health response, United States, 2010–2014

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Abstract

Background—Deaths and certain illnesses onboard ships arriving at US ports are required to be reported to the US Centers for Disease Control and Prevention (CDC), and notifications of certain illnesses are requested.

Methods—We performed a descriptive analysis of required maritime illness and death reports of presumptive diagnoses and requested notifications to CDC’s Division of Global Migration and Quarantine, which manages CDC’s Quarantine Stations, from January 2010 to December 2014.

Results—CDC Quarantine Stations received 2891 individual maritime case reports: 76.8% (2221/2891) illness reports, and 23.2% (670/2891) death reports. The most frequent individual illness reported was varicella (35.9%, 797/2221) and the most frequently reported causes of death were cardiovascular- or pulmonary-related conditions (79.6%, 533/670). There were 7695 cases of influenza-like illness received within aggregate notifications. CDC coordinated 63 contact investigations with partners to identify 972 contacts; 88.0% (855/972) were notified. There was documentation of 6.5% (19/293) receiving post-exposure prophylaxis. Three pertussis contacts were identified as secondary cases; and one tuberculosis contact was diagnosed with active tuberculosis.

Conclusion—These data provide a picture of US maritime illness and death reporting and response. Varicella reports are the most frequent individual disease reports received. Contact investigations identified few cases of disease transmission.

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Potential conflicts of interest

No reported conflicts.

Disclaimer

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Keywords

Surveillance; Infectious disease; Travel; Contact investigation; Public health response

1. Background

In 2014, 13.5 million passengers and 5.1 million crew members arrived at US seaports by cruise ship [unpublished data provided to the Centers for Disease Control and Prevention (CDC) by US Customs and Border Protection]. In addition, 35,000 passengers and 900,000 crew members arrived at US seaports by cargo ships in 2014. Many of these travelers, particularly crew members, were from countries that may have lower vaccine coverage and less availability to healthcare than the United States. Although cruise ships have medical facilities onboard, laboratory diagnostic capacity is limited; recommended onboard tests include rapid antigen tests for malaria, influenza, and *Legionella* [1].

Federal regulations require the master of a ship to immediately report to CDC any death or certain illnesses that occur within 15 days before entering or 15 days after leaving a US port [2]. Because a diagnosis cannot always be made aboard the ship, certain signs and symptoms are required to be reported. During the time frame of data collection for this analysis, reporting was required for the following signs and symptoms: fever lasting more than 48 h; fever of any duration plus rash, swelling of the lymph nodes, or jaundice; or diarrhea. CDC also requested notifications of fever plus any of the following: difficulty breathing or suspected/confirmed pneumonia, persistent or bloody cough, headache with neck stiffness, reduced level of consciousness, unexplained bleeding, or persistent vomiting. In addition to the regulatory requirement to report individual reports of deaths due to influenza-like illness (ILI) and ILI due to a potentially novel strain of influenza, CDC requests individual case reports for ILI when the patient requires hospitalization, and immediate aggregate notifications of outbreaks. Since 2010, CDC has requested that cruise ships send the total number of ILI cases among passengers and crew at the end of each voyage, even if the number of cases of ILI was zero. Aggregate ILI notification is not requested from cargo ships. Gastrointestinal illness cases on cruise ships are reported to the CDC Vessel Sanitation Program (VSP).

CDC Quarantine Stations, managed by the Division of Global Migration and Quarantine, receive reports and notifications of illness or death from ship personnel; the US Coast Guard; Customs and Border Protection; state, territorial and local health departments; and health care facilities ashore. When a report is received, quarantine public health officers assess the case, request follow-up information if needed, and may consult with quarantine medical officers to determine if additional action, such as a contact investigation, onboard response, or notification to the health department, is warranted. Since 2005, the illnesses and deaths reported to CDC Quarantine Stations and resulting actions taken are recorded in the Quarantine Activity Reporting System (QARS), a secure Web-based database.

Past publications on US maritime surveillance data have included all conveyance death reporting from 2005 to 2008 [3], an analysis of varicella on cruise ships [4], and case reports describing illness aboard a cruise ship [5–7]. International studies of maritime

communicable disease surveillance have described respiratory and gastrointestinal illness among passengers and crew on cruise ships [8] and trends in infectious disease mortality on merchant ships [9]. This is the first published comprehensive description of US maritime illness and death reporting and the resulting contact investigations.

2. Methods

Investigators queried the QARS database for maritime illness and death reports from January 1, 2010, to December 31, 2014. A case was defined as any illness or death reported to CDC on a ship with a presumptive diagnosis captured in QARS. A presumptive diagnosis is the diagnosis of potential public health concern when the case is initially reported to CDC. A final diagnosis is documented for a case based on information provided by healthcare facilities, health departments, medical examiners, or laboratories, when available, and review by a quarantine medical officer. These presumptive and final diagnoses represent surveillance categorizations and are based on the information available to CDC. Cardiovascular and pulmonary diseases are captured as a single category when considered not to be associated with infection. Public health actions (by the ship, health department, or CDC staff) may be recommended based on the presumptive diagnoses for onboard illnesses and deaths; thus, presumptive diagnoses were used in the analysis. Differences between numbers of presumptive and final diagnoses were quantified.

Reports of gastrointestinal illness on cargo ships to CDC Quarantine Stations are included in this analysis; however, reports of gastrointestinal illness on cruise ships are not included and are published by VSP [10]. Gastrointestinal illness is defined as diarrhea within a 24 h period, 3 or more episodes of loose stools or an occurrence of loose stools that is above the normal for the person, or vomiting and one or more of the following additional symptoms: one or more episodes of loose stools in a 24-h period, abdominal cramps, headache, muscle aches, or fever (temperature of 100.4 °F [38 °C] or greater) [11].

Descriptive analysis was used to characterize all individual illness and death reports. The presumptive diagnosis for all maritime reports during this time period was described for illnesses and deaths in both passengers and crew. Aggregate ILI were analyzed separately from individual ILI reports because the multiple differences between the reporting mechanisms limited their comparability. For example, unlike individual reports, aggregate ILI notifications had limited demographic detail collected (only differentiating passengers and crew), were submitted voluntarily at the end of each voyage, and were requested from cruise ships only. ILI cases that were submitted as individual reports, were included in the analysis with the other individual reports. Because the signs and symptoms of influenza are not specific and most persons who have a respiratory illness are not tested for influenza, ILI has been defined for surveillance purposes as an illness with fever plus either cough or sore throat in the absence of another diagnosis [11].

For the purposes of this analysis, presumptive or final diagnoses of public health concern included tuberculosis, measles, rubella, mumps, pertussis, and meningitis/meningococcal disease. Contact investigation was defined as an investigation due to a presumptive or final diagnosis of public health concern, with documentation identifying contacts and attempts

made to notify, evaluate, or provide post-exposure prophylaxis (PEP) to the contacts. Investigators reviewed all disease reports to ensure that CDC's criteria for cases of public health concern, contacts, and contact investigations were met as defined in Table 1. Public health responses for varicella and ILI outbreaks were defined as enhanced data collection rather than contact investigations because of differences in response protocols and lack of individual contact level information collected by CDC Quarantine Stations, and details of these responses are not included in this analysis. Contact investigations for communicable diseases of public health concern are described, including details of the number of contacts and secondary cases. Analyses were performed using SAS 9.3. This investigation was determined to be non-research by CDC's human subjects review process.

3. Results

3.1. Demographics

From 2010 through 2014, 2891 individual reports were received by CDC Quarantine Stations; there were 2221 (76.8%) illness cases and 670 (23.2%) death cases.

Of the 1142 illness and death cases with known gender, 1310 (73.5%) were male, and 472 (26.5%) were female (Table 2). Of 1656 reports with documented age, the mean age was 36.1 years (inter-quartile range [IQR] = 17) at illness and 65.8 years (IQR = 22) at death. Mean age at illness was similar on cruise ships (35.8 years, IQR = 16) and cargo ships (36.4 years, IQR = 18), while mean age at death was higher on cruise ships (67.2 years, IQR = 18.5) than cargo ships (49.0 years, IQR = 14). Illnesses were reported more often in crew members (68.3%, 1517/2,221, p value < 0.0001) and deaths were reported more often in passengers (89.0%, 596/670, p value < 0.0001).

Illnesses and deaths were most commonly reported during travel, as opposed to before the voyage began or after the voyage was complete, for both cruise ships (71.9%, 1858/2586) and cargo ships (74.8%, 184/246).

3.2. Diagnoses

Of the 2221 illness reports, the most frequent diagnoses reported to CDC Quarantine Stations (Table 3) were varicella (797/2,221, 35.9%), ILI (702, 31.6%), respiratory tract infections other than ILI (174, 7.8%), and tuberculosis (120, 5.4%). The most common illness case-reports from cruise ships were varicella (740, 37.6%), ILI (675, 34.3%), and respiratory tract infections other than ILI (168, 8.5%), while varicella (53, 26.4%), gastroenteritis (45, 22.4%), and tuberculosis (30, 14.9%) were most commonly reported in passengers and crew aboard cargo ships. Of the 702 individual ILI reports received, one hundred thirty-nine cases (19.8%) were characterized as novel/pandemic influenza; all were reported in 2010 and were classified as influenza A(H1N1)pdm. Cardiovascular/pulmonary-related conditions (79.6%, 533/670) were the most frequently reported cause of death. The most commonly reported illness diagnoses that were more frequent in passengers than crew were ILI (40.9% vs. 27.3%, p -value < 0.0001), other respiratory tract infections (17.1% vs. 3.6%, p -value < 0.0001), and Legionnaires' disease (5.1% vs. 0.1%, p -value < 0.0001). The most commonly reported illness diagnoses that were more frequent in crew members than

passengers were varicella (44.5% vs. 17.3%, p-value < 0.0001), tuberculosis (7.0% vs. 2.0%, p-value < 0.0001), and gastroenteritis (3.2% vs. 0.7%, p-value = 0.0004). Of cases with both a presumptive diagnosis and a final diagnosis not categorized as “other”, 262 (10.4%) received a different final diagnosis than the presumptive diagnosis.

3.3. Aggregate ILI reports

From 2010 through 2014, there were 7695 aggregate notifications of cases of ILI onboard cruise vessels arriving into the United States: 4782 (62.1%) were ill passengers.

3.4. Contact investigations

From 2010 through 2014, CDC Quarantine Stations coordinated 63 contact investigations for communicable diseases of public health concern aboard cruise and cargo vessels (Table 4). The largest number of contact investigations recorded occurred in 2014 (36.5%, n = 23). The number of contact investigations prior to 2014 ranged from 6 (9.5%) in 2010 to 15 (23.8%) in 2013. Most (55, 87.3%) contact investigations were conducted on cruise ships; contact investigations were conducted on 8 cargo ships (for one measles case and 7 tuberculosis cases).

Of the 63 index cases, 45 were crew members (71.4%), 48 (76.2%) were male; the mean age was 34.7 years. Illnesses were reported to CDC Quarantine Stations during travel for 36 of the index cases (57.1%), and after travel was completed for 27 index cases (42.8%). Six infected travelers (one with pertussis, one with rubella, one with meningococcal disease, and 3 with tuberculosis) also traveled by commercial airline while infectious, resulting in additional airline contact investigations. All index cases were subsequently confirmed positive for their respective presumptive diagnosis with the exception of one measles and one tuberculosis index case; both were confirmed negative after initiation of a contact investigation. A diagnostic confirmation was not obtained for one traveler with a presumptive diagnosis of meningococcal meningitis who was treated with antibiotics and later tested negative. Of the 972 contacts identified, assessment, interview, or outcome information was available for 855 (88%) contacts. Crew members accounted for 697 (71.7%) of the contacts, and passengers accounted for 275 (28.3%). Included in this count are 18 contacts of the tuberculosis index case whose diagnosis was later ruled out and 2 contacts of the index case who later tested negative for measles. During 5 meningococcal disease contact investigations, there was documentation of post-exposure prophylaxis (PEP) provided by the ship medical crew to 7 passenger contacts and 9 crew contacts. During one pertussis contact investigation, a health department administered antimicrobial prophylaxis to 3 passenger contacts of the index case; secondary transmission was not detected. Distribution of PEP as recommended by CDC staff was not documented for 5 contact investigations.

Three secondary cases of pertussis were identified in travelers following onboard exposure. The secondary cases were family members and shared a cabin with the index case. Forty three tuberculosis contact investigations identified 547 contacts. Documentation of evaluation results were available for 472 (86.3%) contacts, 66 were diagnosed with latent

tuberculosis infection and one with active disease. It is unclear if these 67 contacts were infected during exposure to the index case onboard or from prior exposures.

3.5. In-person responses

Although most contact investigations involved communications with ships' medical staff by phone or e-mail, CDC Quarantine Stations conducted 8 in-person responses (on 5 cruise ships, 2 fishing vessels, and an oil tanker) for 39 illnesses and a single death report. In-person response was initiated because of the presence of onboard transmission or a request for assistance by ship personnel. The reported presumptive diagnoses of these cases were ILI (1 response, 17 cases), gastroenteritis (3 responses, 18 cases), rubella (2 responses, 2 cases), mumps (1 response, 1 case), and varicella (1 response, 2 cases). For 6 on-board responses that resulted in contact investigations, 52 contacts were identified. When on board, CDC staff interviewed contacts, collected specimens to be taken ashore for testing, were present for a medical examination, measured temperatures, and provided recommendations to captains and physicians.

4. Discussion

The reports and notifications of illnesses and deaths and resulting contact investigations described in this manuscript provide insight into the public health issues that are reported to CDC Quarantine Stations and how they are managed. However, it is important to note that illnesses and deaths onboard cruise and cargo ships are underreported, based on specific reporting requirements and requests, and that the magnitude of disease experienced by passengers and crew at sea is largely unknown [12].

As recognized in the maritime literature, our findings confirm that varicella [4] and ILI [7] remain among the most frequently reported illnesses from maritime conveyance and underscores the importance of being up-to-date on routine vaccinations before travel.

Given the lack of laboratory capacity in remote clinical environments, such as ship infirmaries, much of the laboratory testing for diseases of public health concern must occur on land. This may delay testing of specimen for disease confirmation and creates a significant challenge in the initiation of contact investigations in a timely manner. Occasionally, contact investigations were initiated and actions taken before laboratory confirmation occurred. This analysis identified only two index cases, for which contact investigations were initiated, who subsequently tested negative for their presumptive diagnoses. In both cases the need for timely action was considered appropriate in the absence of test results. The frequency of contact investigations increased from 2010 to 2014, perhaps due to broader contact investigation criteria, stricter reporting standards, or greater awareness of reporting standards, emphasizing the importance of the need for timely action.

In addition to testing capabilities, delays in ships' ability to obtain some forms of post exposure prophylaxis at sea is a challenge. Although antimicrobial prophylaxis for meningococcal disease and pertussis is typically readily available, large quantities of MMR vaccine or immune globulin, for example, are not typically available on board. After measles exposure, vaccine is an effective form of prophylaxis for approximately 72 h, or immune

globulin can be given within 6 days of exposure. This short timeline makes it clear that the challenges created by testing and PEP acquisition delays, make it unlikely that prophylaxis can be effectively distributed if a measles exposure occurs on board. This point further stresses the importance of both passengers and crew being fully immune to vaccine-preventable diseases such as measles, prior to embarkation.

Considerations by cruise and cargo lines to implement policies regarding immunization for crew, and recommendations for passengers to ensure they are up-to-date on routine immunizations before travel, will likely reduce the burden of certain illness aboard maritime conveyance. In addition, prevention measures for respiratory and gastrointestinal infections such as pre-travel advice, hand hygiene, strict reporting and isolation requirements, food safety measures have been found to be effective in the mitigation of disease transmission on ships [8,10].

During contact investigations, lack of prior exposure information for tuberculosis contact diagnosed with tuberculosis disease or those with latent tuberculosis infection provides an unclear picture of tuberculosis transmission on maritime vessels. Many crew members are from countries with high burden of tuberculosis, and previous exposure or infection status cannot be assessed from the information collected in QARS. While information about transmission on maritime conveyances is limited, prolonged time spent working and living in close, crowded spaces to individuals with infectious tuberculosis likely contributes to onboard transmission of tuberculosis in crew [13].

Confirmed cases of secondary transmission for most diseases of public health concern were relatively few and might have been prevented by prompt isolation or by high vaccination rates in the passenger population. It is also possible that secondary cases may not have been reported to public health, particularly if onset occurred after disembarkation. Often, CDC staff recommended PEP be administered to contacts by the ship medical staff and health departments conducting monitoring; however, in some reports, PEP provision was not documented in QARS. It is possible that administration of PEP to maritime contacts was higher than indicated in this analysis, because it is not required that this activity be reported to CDC.

This analysis has several limitations. These data are taken from a passive reporting system and may not represent the true burden of maritime morbidity and mortality; however, much of the reporting is required under federal regulations and may be more complete than if this information were merely requested. Reporting requirements are syndromic and during this timeframe most syndromes were reported by request. Aggregate ILI notifications were implemented during the 2009 H1N1 pandemic and were designed to monitor trends, detect outbreaks, and decrease the burden of individual case reporting. The notifications were not intended to provide the same surveillance information gained from individual illness reports and are therefore not comparable to individual illness reports because of differing methodologies. Limited confirmatory diagnostics are a challenge on maritime conveyance and public health response is often dependent on the presumptive diagnosis; however we found only a 10% difference in presumptive and final diagnoses. Reporting on cargo ships is typically performed by nonmedical personnel and may result in misclassification, and under

reporting of illness. Case definitions for conducting contact investigations and defining contacts underwent minor changes throughout the reporting timeframe. To address this, reports of diseases of public health concern were reviewed and categorized based on standard definitions for the purpose of this investigation.

5. Conclusions

Findings from this analysis emphasize the importance of up to date pre-travel vaccination for passengers and crew, prevention measures such as hand-hygiene, reporting, isolation, and food safety measures, and understanding the limitations of medical interventions on ships so that preparations can be made accordingly. This analysis is the first complete analysis of US maritime illness and death reporting, response, and follow-up. It provides vital public health information about diseases of public health concern, deaths on ships, how these events are being reported, outcomes, and patterns. These data will be used to inform maritime public health protocols and guidance, resource allocation, and research and evaluation projects. In 2017, CDC updated its regulatory reporting requirements and definitions of “ill person” [11]. By ensuring cases meet the revised ill person definition, more accurate public health surveillance information is anticipated, providing the opportunity to better document and respond to illnesses at sea.

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Table 1

Centers for Disease Control and Prevention criteria for initiating maritime contact investigations and contact definitions, by disease.

Criteria to initiate contact investigation	Definition of a contact
Measles	
Any probable or confirmed measles case ^a determined to be contagious during travel	<ul style="list-style-type: none"> • Direct face-to-face contact of an unvaccinated person with a case during the period of infectivity (4 days before to 4 days after onset of rash) • Shared confined space in close proximity for a prolonged period, such as 1 h, with infectious case
Rubella	
Any probable or confirmed rubella case ^a determined to be contagious during travel	<ul style="list-style-type: none"> • Direct face-to-face contact of an unvaccinated person with a case during the period of infectivity (7 days before to 7 days after onset of rash) • Shared confined space in close proximity for a prolonged period, such as 1 h, with infectious case
Tuberculosis	
Infectious tuberculosis confirmed by positive sputum nucleic acid amplification test or culture AND at least one of the following: <ul style="list-style-type: none"> • Sputum smear positive or cavitory disease on chest X-ray • Multidrug-resistant or Extensively drug-resistant-tuberculosis <p>Consider starting contact investigation if high suspicion for TB but not confirmed: sputum smear positive, no or negative nucleic Acid Amplification test, results of culture pending, cavitory disease seen by CXR, responding to medications</p>	<ul style="list-style-type: none"> • <i>Cargo ship crew member contact</i>—all other crew members on board within the 3 months before onset of symptoms that ultimately led to the tuberculosis diagnosis • <i>Cruise ship crew member contact</i>—cabinmates, dining mates, bathroom mates, workmates, intimate partners, and friends. If index patient was a passenger, includes crew members with whom index patient had repeated and prolonged contact (i.e., interacted with ill passenger daily, e.g., waiter, cabin crew, steward, day care provider) within the 3 months before onset of symptoms that ultimately led to the tuberculosis diagnosis • <i>Cruise ship passenger contact</i>—cabinmates, dining mates, intimate partners, friends, others in traveling party. If index patient was a crew member, includes passengers with whom index patient had repeated and prolonged contact (i.e., interacted with ill crew member daily, e.g., in dining room, cabin, or day care) within the 3 months before onset of symptoms that ultimately led to a diagnosis
Pertussis	
Any probable or confirmed pertussis case ^a determined to be contagious during travel	<ul style="list-style-type: none"> • Direct face-to-face contact of an unvaccinated person with a case who is symptomatic • Shared confined space in close proximity for a prolonged period, such as 1 h, with a symptomatic case
Mumps	
Any probable or confirmed mumps case ^a determined to be contagious during travel	<ul style="list-style-type: none"> • Direct face-to-face contact with of an unvaccinated person with a case during the period of infectivity (two days before to 5 days after onset of parotitis) • Shared confined space in close proximity for a prolonged period of time, such as 1 h, with infectious case
Meningococcal disease	
Any suspected, probable or confirmed meningococcal case ^a determined to be contagious during travel	<ul style="list-style-type: none"> • Direct contact with oral secretions during period of infectivity (7 days prior to symptom onset until 24 h after initiation of effective antimicrobial therapy) • Cabin mates • Daycare contacts

^aConfirmed and probable cases defined according to Council of State and Territorial Epidemiologists position statements [14].

Table 2

Maritime illness and death cases reported to the Centers for Disease Control and Prevention, 2010–2014, characterized by gender, age, year, type of traveler and vessel.

	Illness Cases (n = 2221)	Death-Cases (n = 670)
	n (%)	n (%)
Gender		
Male	868 (39.1)	442 (66)
Female	274 (12.3)	198 (29.6)
Unknown	1079 (48.6)	30 (4.5)
Age		
< 10	61 (2.7)	4 (0.6)
10–19	38 (1.7)	4 (0.6)
20–29	302 (13.6)	14 (2.1)
30–39	316 (14.2)	24 (3.6)
40–49	137 (6.2)	56 (8.4)
50–59	54 (2.4)	84 (12.5)
60–69	54 (2.4)	148 (22.1)
70	74 (3.3)	286 (42.7)
Unknown	1185 (53.4)	50 (7.5)
Year		
2010	535 (24.1)	131 (19.6)
2011	439 (19.8)	143 (21.3)
2012	302 (34.3)	132 (19.7)
2013	499 (22.5)	113 (16.9)
2014	446 (20.1)	151 (22.5)
Traveler Type		
Passenger	704 (31.7)	596 (89)
Crew	1517 (68.3)	74 (11)
Vessel Type		
Cruise	1970 (88.7)	616 (92.0)
Cargo	201 (9.1)	45 (6.7)
Other ^a	39 (1.7)	8 (1.2)
Unknown	11 (0.5)	1 (0.1)

^aOther vessel types include: fishing vessels, US military/Coast Guard ships, private/pleasure vessels, and research vessels.

Table 3

Presumptive diagnoses of maritime illnesses and deaths reported to the Centers for Disease Control and Prevention 2010–2014, characterized by type of traveler.

Illness diagnoses ^a	Traveler type		Total (n = 2221)
	Passenger (n = 704)	Crew (n = 1517)	
	n (%)	n (%)	n (%)
Varicella	122 (17.3)	675 (44.5)	797 (35.9)
Influenza-like illness	288 (40.9)	414 (27.3)	702 (31.6)
Upper/lower respiratory tract infection	120 (17.1)	54 (3.6)	174 (7.8)
Tuberculosis	14 (2)	106 (7)	120 (5.4)
Gastroenteritis ^b	5 (0.7)	48 (3.2)	53 (2.4)
Legionnaires' Disease	36 (5.1)	2 (0.1)	38 (1.7)
Mumps	13 (1.9)	22 (1.5)	35 (1.6)
Malaria	1 (0.1)	24 (1.6)	25 (1.1)
Meningitis/meningococcal disease	16 (2.3)	9 (0.6)	25 (1.1)
Rash	13 (1.9)	11 (0.7)	24 (1.1)
Hepatitis A	3 (0.4)	19 (1.3)	22 (1)
Measles	11 (1.6)	10 (0.7)	21 (1)
Fever	5 (0.7)	12 (0.8)	17 (0.8)
Dengue	1 (0.1)	9 (0.6)	10 (0.5)
Rubella	6 (0.9)	4 (0.3)	10 (0.5)
Pertussis	9 (1.3)	0 (0)	9 (0.4)
Chikungunya	2 (0.3)	6 (0.4)	8 (0.4)
Typhoid fever	0 (0)	5 (0.3)	5 (0.2)
Rabies	0 (0)	1 (0.1)	1 (0.1)
SARS	0 (0)	1 (0.1)	1 (0.1)
Other ^c	34 (4.8)	77 (5.1)	111 (5)
Unknown	5 (0.7)	8 (0.5)	13 (0.6)

Presumptive cause of death	Traveler type		Total (n=670)
	Passenger (n=596)	Crew (n=74)	
	n (%)	n (%)	n (%)
Cardiovascular/pulmonary related condition	494 (82.9)	39 (52.7)	533 (79.6)
Influenza-like illness	4 (0.7)	2 (2.7)	6 (0.9)
Meningitis/meningococcal disease	3(0.5)	2 (2.7)	5 (0.8)
Other ^d	73 (12.3)	10 (13.5)	83 (12.4)
Unknown	16 (2.7)	20 (27)	36 (5.4)
Upper/lower respiratory tract infection	6 (1)	1 (1.4)	7 (1)

^aThis table does not include aggregate influenza/ILI reports.

^bGastrointestinal illness cases on cruise ships are reported to the CDC Vessel Sanitation Program and are not included.

^cOther illness reports include sexually transmitted infections/human immunodeficiency virus, suspected Ebola, vector-borne disease, allergy/allergic reaction, miscarriage or abortion, trauma, seizure disorder, viral/bacterial/unspecified infection, acute abdomen, cancer, pancreatic infection, jaundice/hepatitis disorder, and encephalitis.

^dOther death reports include: cancer, trauma/accident, suicide, stroke, drug overdose, natural causes, allergic reaction, hepatic disorder, gastrointestinal hemorrhage, and diabetes.

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Table 4

Description of maritime contact investigations and contact outcomes of diseases of public health concern, United States 2010–2014.

Type of Illness	Index cases (n = 63)		Contacts identified (n = 972)		Contacts contacted ^a (n = 855)		Prophylaxis provided ^{b,c} (n = 19)		Secondary cases ^b (n = 4)	
	Passenger n	Crew n	Passenger n	Crew n	Passenger n (% of identified)	Crew n (% of identified)	Passenger n (% of contacted)	Crew n (% of contacted)	Passenger n (% of contacted)	Crew n (% of contacted)
Measles	1	3	82	167	82 (100)	167 (100)	0 (0)	0 (0)	0 (0)	0 (0)
Meningococcal disease	7	0	11	20	11 (100)	19 (95.0)	7 (63.6)	9 (47.4)	0 (0)	0 (0)
Mumps	1	2	0	5	n/a	5 (100)	n/a	n/a	0 (0)	0 (0)
Pertussis	4	0	114	0	14 (12.3)	n/a	3 (21.4)	n/a	3 (21.4)	n/a
Rubella	1	1	2	24	2 (100)	24 (100)	n/a	n/a	0 (0)	0 (0)
Tuberculosis	4	39	66	481	58 (87.9)	473 (98.3)	n/a	n/a	0 (0)	1 (1.7) ^d

^aPassenger contacts were considered to have been contacted if any assessment, interview, or outcome information was reported.

^bCenters for Disease Control and Prevention Quarantine Stations receive final disposition of crew members remaining aboard directly from the ship medical officer for each contact investigation. For passenger contacts, health departments notify CDC of findings.

^cImmune status was unknown for many of the contacts. It is unclear how many were not provided prophylaxis because of immunity.

^dSixty-six contacts among passengers and crew were found to have latent tuberculosis infection, which could not be confirmed to be attributed to onboard exposure.