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Risk factors for hospitalisation and associated costs among patients with hepatitis A associated with imported pomegranate arils, United States, 2013

E.E. Epson[a,b,*], **A. Cronquist**[b], **K. Lamba**[c], **A.C. Kimura**[c], **R. Hassan**[d], **D. Selvage**[e], **C.S. McNeil**[a,e], **A.K. Varan**[f,g], **J.L. Silvaggio**[h,i], **L. Fan**[j], **X. Tong**[j], **P.R. Spradling**[j,**]

[a]Epidemic Intelligence Service, Centers for Disease Control and Prevention, Atlanta, GA, USA

[b]Colorado Department of Public Health and Environment, Denver, CO, USA

[c]California Department of Public Health, Richmond, CA, USA

[d]Arizona Department of Health Services, Phoenix, AZ, USA

[e]New Mexico Department of Health, Santa Fe, NM, USA

[f]County of San Diego Health and Human Services Agency, San Diego, CA, USA

[g]Division of Global Migration and Quarantine, Centers for Disease Control and Prevention, Atlanta, GA, USA

[h]CDC/CSTE Applied Epidemiology Fellowship Program, Atlanta, GA, USA

[i]Los Angeles County Department of Public Health, Acute Communicable Disease Control Program, Los Angeles, CA, USA

[j]Division of Viral Hepatitis, Centers for Disease Control and Prevention, Atlanta, GA, USA

Abstract

Objectives: To assess hospitalisation risk factors and economic effects associated with a multistate hepatitis A outbreak in 2013.

Study design: Retrospective case series.

[*]*Corresponding author*. Healthcare-Associated Infections Program, Center for Healthcare Quality, California Department of Public Health, 850 Marina Bay Parkway, Richmond, CA, 94804, USA. Erin.Epson@cdph.ca.gov (E.E. Epson). [**]*Corresponding author*. Division of Viral Hepatitis, National Center for HIV, Hepatitis, Sexually Transmitted Disease, and Tuberculosis Prevention, Centers for Disease Control and Prevention, 1600 Clifton Rd, NE, Atlanta, GA, 30333, USA. Tel.: +1 404 718 8566. pspradling@cdc.gov (P.R. Spradling).

Author's contributions

Conception and design: EE, AC, KL, AK, PS; Acquisition, analysis, or interpretation of the data: EE, AC, KL, AK, RH, DS, CM, AV, JS, LF, XT, PS; Drafting of the article or critical revision: EE, AC, KL, AK, RH, DS, CM, AV, JS, LF, XT, PS; Final approval of the version submitted for publication: EE, AC, KL, AK, RH, DS, CM, AV, JS, LF, XT, PS.

Ethical approval

This investigation underwent review by the CDC Scientific Education and Professional Development Program Office human subjects protection coordinator and was determined to be non-research, because the primary intent was to inform public health interventions.

Competing interests

None

Methods: Eligible outbreak-related cases confirmed by September 1, 2013, were defined as acute hepatitis symptoms and positive IgM anti-hepatitis A during March 15–August 12 among patients who consumed the food vehicle or had the outbreak genotype. We reviewed medical records, comparing demographic and clinical characteristics among hospitalized and non-hospitalized patients; we used logistic regression analysis to identify factors associated with hospitalization. We interviewed patients regarding symptom duration and healthcare usage and estimated per-patient and total costs. Health departments reported outbreak-related personnel hours.

Results: Medical records were reviewed for 147/159 (92%) eligible patients; median age was 48 (range: 1–84) years, and 64 (44%) patients were hospitalized. Having any chronic medical condition was independently associated with hospitalisation (odds ratio, 3.80; 95% confidence interval, 1.68–8.62). Interviews were completed for 114 (72%) eligible patients; estimated per-patient cost of healthcare and productivity loss was $13,467 for hospitalized and $2138 for non-hospitalized patients and $1,304,648 for all 165 outbreak-related cases. State and local public health personnel expenditures included 82 h and $3221/outbreak-related case.

Conclusions: Hospitalisations in this outbreak were associated with chronic medical conditions and resulted in substantial healthcare usage and lost productivity. These data can be used to inform future evaluation of expansion of hepatitis A vaccination recommendations to include adults with chronic medical conditions.

Keywords

Hepatitis A; Disease outbreaks; Health economics and organizations

Introduction

Hepatitis A virus (HAV) infection is an acute illness, characterised by fever, abdominal pain, elevated aminotransferase enzymes, and jaundice. Illness is typically self-limited and complications are uncommon; however, symptomatic infection, jaundice, hospitalisation, and other complications are more frequent among adults.[1–3] Fulminant hepatic failure from hepatitis A has been associated with pre-existing chronic liver disease, especially among persons with hepatitis C virus (HCV) coinfection.[4] Among patients identified through national surveillance data, death attributed to hepatitis A occurs among 0.8%, but increases to 2.6% among persons aged ≥60 years.[3]

Effective hepatitis A vaccines were licensed during the mid-1990s and recommended for persons at increased risk for hepatitis A exposure (e.g., international travellers) and for persons at greater risk for complications (e.g., persons with chronic liver disease)[5]; in 2006, hepatitis A vaccine was recommended for all children aged one year.[6] Although hepatitis A vaccine coverage is low (53% among U.S. children during 2012),[7] the overall incidence of hepatitis A among persons in all age groups in the United States has declined substantially after the vaccine became available,[3] which has been attributed to herd immunity.[8] Meanwhile, because fewer opportunities for exposure to hepatitis A exist, a growing susceptible adult population has emerged. Protective anti-HAV seroprevalence has decreased among persons aged ≥30 years, from 55% during 1990–2000 to 37% during 2010–2011 [Centers for Disease Control and Prevention (CDC), unpublished data, 2013].

Despite low overall hepatitis A incidence, sporadic foodborne outbreaks of hepatitis A continue to occur in the United States.[9–11] These outbreaks can result in substantial morbidity as well as costs associated with medical care, productivity losses, and public health expenditures related to case investigations and implementation of control measures; however, contemporary data are lacking.[12–14] During May–September 2013, a total of 165 persons from 10 states were reported with hepatitis A in the largest outbreak in the United States in 10 years. Epidemiologic investigation identified a frozen berry-pomegranate mix containing pomegranate arils imported from Turkey as the likely food vehicle, and HAV genotype 1B, uncommon in the United States[15] but endemic in the Middle East and North Africa,[16] was isolated from the majority of clinical specimens.[17] In this outbreak, 69 (42%) persons were hospitalised as a result of their illness, compared with previous U.S. hepatitis A outbreaks in which proportions hospitalized ranged from 15% in 154 outbreaks during 1973–1992 (CDC, unpublished data, 2001) to 26% and 33% in foodborne outbreaks associated with green onions during 2003[9] and 1998,[10] respectively. To assess this substantial proportion of hospitalized persons in this foodborne HAV outbreak after substantial shifts in the hepatitis A epidemiology in the United States, we expanded our outbreak investigation to identify factors associated with hospitalisation. In addition, we estimated costs of medical care and lost productivity among affected persons, as well as the state and local public health personnel hours spent during the outbreak investigation and control efforts, with the expectation that such information could inform future discussion regarding expansion of current hepatitis A vaccination guidelines.

Methods

Outbreak case-patients

Confirmed outbreak-related cases were defined as onset of acute hepatitis symptoms and positive anti-HAV IgM reported during March 15–August 12, 2013, in a patient who had either consumed the suspect food vehicle or had the outbreak HAV genotype. All outbreak-related cases confirmed by public health authorities in nine participating states (Arizona, California, Colorado, Hawaii, Nevada, New Jersey, New Mexico, Utah, and Wisconsin) as of September 1, 2013, were eligible for this investigation.

Medical records reviews

For each eligible confirmed outbreak-related case, hereafter referred to as a case, patient medical records from hospitals and outpatient healthcare facilities were requested by public health staff, and all available records were reviewed by using a standardised data collection instrument. Investigators recorded the presence of documented pre-existing chronic medical conditions at the time of hepatitis A diagnosis. Whether a patient was pregnant at the time of hepatitis A diagnosis was also collected. Patients were categorized as having any chronic medical condition if ≥1 serious ongoing chronic medical condition was documented in the medical record as being present at the time of hepatitis A diagnosis; conditions included chronic liver disease, excessive alcohol use or abuse, respiratory conditions (e.g., asthma), cardiovascular or cerebrovascular disease, neurologic disease (e.g., multiple sclerosis), diabetes, obesity, inflammatory bowel disease, immunosuppressive conditions or receipt of immunosuppressive therapies and cancer treatment. Isolated hypertension, dyslipidemia,

hypothyroidism, and history of previously treated cancer not receiving chemotherapy at the time of hepatitis A diagnosis were excluded.

Laboratory test results obtained at the time of hepatitis A diagnosis were recorded, including serologic tests for hepatitis B virus and HCV, aminotransferase enzyme (aspartate aminotransferase and alanine aminotransferase), and total bilirubin levels and international normalized ratio. For patients hospitalised as a result of hepatitis A, admission diagnoses and dates of admission and discharge were recorded; length of hospitalisation was calculated by subtracting date of discharge from date of admission. We ascertained complications, including fulminant hepatic failure, liver transplantation, and death, by using the latest medical documentation or date of patient interview.

Patient interviews

Patients were interviewed by public health staff members using a standardised form regarding the types and numbers of outpatient medical provider visits, and were asked whether they had medical insurance at the time of their hepatitis A diagnosis and to estimate the amount of out-of-pocket expenses incurred for direct medical expenses not covered by health insurance.

Patients were queried about the number of weeks they had hepatitis symptoms, whether they were still symptomatic at the time of interview, and the amount of time that they had been completely unable to perform normal activities. Patients were asked their occupation, and if employed, whether they received paid leave or disability benefits during hepatitis A illness. We also asked if household members missed work to care for patients and about any additional unexpected expenses incurred to perform patients' household responsibilities.

Analysis of risk factors for hospitalization

Differences in the distribution of clinical and demographic features among hospitalised and non-hospitalised patients with hepatitis A were compared by using Fisher's exact test for categorical variables and Wilcoxon rank-sum test for continuous variables. Multivariate logistic regression analyses were used to assess factors associated with hospitalisation; $P < .05$ was considered to be significant, and all statistical analyses were performed by using the statistical software package SAS® 9.3 (SAS Institute Inc., Cary, North Carolina).

Costs of medical care and lost productivity

Mean payments for hospitalisations, emergency department (ED), and other outpatient visits with hepatitis A as the principal diagnosis code during 2011 were obtained from the Truven Health Analytics MarketScan® databases (Truven Health Analytics, Ann Arbor, Michigan); these payments are inclusive of facility and provider fees, imaging studies, procedures, and laboratory testing. Per-patient costs were estimated separately for interviewed hospitalised patients and non-hospitalised patients, by multiplying the mean payment per hepatitis A-related hospitalisation reported in MarketScan® ($10,108.00) by the number of patients hospitalised, and the mean payment per hepatitis A-related outpatient visit reported in MarketScan® ($153.00) by the number of outpatient visits reported by hospitalised and non-hospitalised patients. The payment for hospitalisation for liver transplantation was also

obtained from MarketScan® ($183,680.00) and was included in the total estimated cost of healthcare usage.

Median hourly wages were obtained from the U.S. Department of Labor (DOL), Bureau of Labor Statistics, May 2013 National Occupational Employment and Wage Estimates.[18] Per-patient costs for lost productivity were estimated separately for hospitalised and non-hospitalised patients. For patients working for an employer for a wage or salary or who were self-employed, the national median hourly wage ($16.87) was multiplied by the number of work hours represented by the total number of days these patients reportedbeing completely unable to carry out their usual activities, assuming a five-day, 40-hour working week; for patients working at home without a wage (e.g., caregiver for a child or dependent adult), their potential foregone earnings if performing similar work outside the home were estimated[19] by using the national median hourly wage for personal care and service workers ($10.00). Totaland per-patient estimated costs were summed for healthcare usage and lost productivity for interviewed hospitalised and non-hospitalised patients, and total costs for healthcare and lost productivity for all outbreak patients were estimated by including imputed per-patient costs for hospitalised and non-hospitalised patients who were not interviewed.

Public health personnel hours and costs

One investigator in each of five participating state public health agencies (Arizona, California, Colorado, Nevada, and New Mexico) identified state and local public health personnel involved in the outbreak response, determined each person's job category, and tallied the number of hours each person spent during outbreak investigation and disease control activities during May 14–September 1, 2013. Total personnel costs were estimated by multiplying the hours reported in each job category by the corresponding national median hourly wage in the DOL Bureau of Labor Statistics, May 2013 National Occupational Employment and Wage Estimates.[18]

Results

Case-patients included in the investigation

As displayed in Fig. 1, of the 165 confirmed outbreak-related cases, five were confirmed after September 1, 2013, and ineligible for this investigation, and one was from a non-participating state; therefore, 159 cases from nine participating states were eligible for this investigation. Medical records were obtained and reviewed for 147 (92%) eligible cases and included in the analysis of risk factors for hospitalization. Interviews were completed for 114 (72%) eligible patients (including 109 [96%] for whom medical records were reviewed), and interview data were included in the analysis of healthcare usage and expenses, symptoms duration, and lost productivity; 34 (21%) of the 159 eligible patients were lost to follow-up or did not respond to interview attempts, and 11 (7%) refused interview.

Patient characteristics and outcomes

Demographic characteristics of the 147 patients with completed medical records reviews are listed in Table 1. The median age was 48 (range: 1–84) years. Sixty-four (44%) of the 147

patients with completed medical records reviews were hospitalized for a median duration of 2.5 (range: 1–11) days. No deaths occurred; 2 (1%) patients had fulminant hepatitis, including 1 (0.7%) who required liver transplantation, and 1(0.7%) had documentation of relapsing hepatitis A. Two (1%) patients underwent cholecystectomy during their hepatitis A hospitalization. Any chronic medical condition was present in 37 (25%) patients; chronic liver disease was present in 1 (0.7%) patient with non-alcoholic fatty liver disease, and other individual chronic comorbid conditions were uncommon among patients.

Factors associated with hospitalization

In univariate analysis, a greater but not statistically significant proportion of patients aged ≥40 years were hospitalized: 49/100 (49%), vs 15/47 (32%) for patients aged 0–39 years (odds ratio, 2.05; 95% confidence interval, 0.99–4.24). There were no significant associations with hospitalisation and female sex (odds ratio, 1.35; 0.7–2.62), or non-white race (odds ratio, 0.39; 0.14–1.08). Twenty-five of 37 (68%) patients with any chronic medical condition were hospitalised, vs 39/110 (35%) of patients without chronic medical conditions (odds ratio, 3.79; 95% confidence interval, 1.72–8.37); certain individual comorbid conditions were each significantly associated with hospitalisation, including excessive alcohol use or abuse (odds ratio undefined), inflammatory bowel disease (odds ratio undefined), and heart disease (odds ratio, 5.79; 95% confidence interval, 1.18–28.27). In multivariate analysis (Table 2), having any chronic medical condition was independently associated with hospitalisation (odds ratio, 3.80; 95% confidence interval, 1.68–8.62).

Healthcare usage, lost productivity, and estimated costs

The demographic characteristics of the 114 patients who were interviewed were similar to those of all outbreak cases and to the 147 patients whose medical records were reviewed (data not displayed); however, a greater proportion of persons interviewed had been hospitalised, compared with those of all outbreak cases (54/114 [47%] vs 69/165 [42%]; $P < .05$). Patients reported a median of 7 (range: 1.3–27.6) weeks of symptoms associated with their hepatitis A illness, including 8 (range: 1.5–27.6) weeks for hospitalised patients and 6 (range: 1.3–25.4) weeks for non-hospitalized patients ($P = .018$).

Estimated per-patient costs associated with healthcare and lost productivity were $13,467 for hospitalised patients (not including the hospitalisation for liver transplantation) and $2138 for non-hospitalised patients (Table 3). Including the cost of the liver transplant-related hospitalisation and imputing per-patient costs to hospitalised and non-hospitalised patients who were not interviewed for this investigation, estimated total cost for healthcare and lost productivity for all 165 confirmed outbreak-related cases was $1,304,648.

In addition to costs listed in Table 3, the 83 (73%) of 114 interviewed persons who were employed for a wage or salary reported a median of 7 (range: 0–60) days of paid leave. Fifty (44%) interviewed patients reported out-of-pocket expenditures >$1000.00 for direct medical expenses not covered by healthcare insurance; 51 (45%) reported expenditures of $1e$1000.00; a total of 9 (8%) reported no expenditure; and 4 (4%) did not know or answer. In addition, 46 (40%) patients reported that another household member had to miss work to

care for them, and 28 (25%) reported additional expenses incurred for help conducting usual activities during their illness.

Public health personnel hours and costs

Personnel hours reported by participating state and local public health agencies in five states that had reported 127/165 (77%) cases are listed by job category in Table 4. The estimated total number of public health personnel hours was 10,413, or 82 h/case reported in those states. State and local public health response costs for the outbreak (including cost of administration of postexposure prophylaxis [PEP], but not actual vaccine or immune globulin [IG] doses) in these states was $409,106 ($3221/case).

Discussion

During the largest common-source foodborne hepatitis A outbreak in the United States since 2003, 44% of case-patients were hospitalised, a substantially greater proportion compared with U.S. hepatitis A outbreaks during the preceding 40 years (CDC, unpublished data, 2001).[9,10] We report that having any chronic medical condition was associated with being hospitalised during this outbreak, although the majority of hospitalisations (61%) occurred among persons without known or documented medical conditions. In addition, we estimated >$1.3 million in healthcare and lost productivity costs among outbreak patients and documented substantial public health resources expended to investigate and implement control measures.

The chronic medical conditions reported to be associated with hospitalisation among outbreak patients were predominantly conditions that are not listed as indications for hepatitis A vaccination in the current recommendations.[5] The chronic medical conditions found to be associated with hospitalisation in our investigation might have the potential to increase the severity of hepatitis associated with HAV infection (e.g., excessive alcohol use or immunosuppression). In addition, other chronic diseases that might not have a direct influence on the severity of hepatitis (e.g., cardiovascular disease) were also associated with hospitalisation. The reasons for this association are unclear but might include actual or perceived (by the admitting provider) risk for more severe hepatitis manifestations among persons with decreased ability to manage physiologic stress and decompensation of chronic medical conditions during hepatitis A infection. In the majority of cases, we were unable to determine the actual reasons for hospitalisation other than typical symptoms or signs of hepatitis; chronic medical conditions were not associated with more prolonged hospitalisations or other adverse outcomes, although the latter were rare. We were also unable to assess medical provider-related factors in decisions involving hospitalisation.

Among patients without known or documented chronic medical conditions, a higher but not statistically significant proportion of patients aged ≥40 years were hospitalised, compared with younger patients, consistent with the association between increasing age and hospitalisation among all patients with hepatitis A cases reported through routine surveillance.[3] Shifts in seroprevalence of protective anti-HAV among the U.S. population might explain the higher median age of patients with this outbreak (48 years), compared with the median age of 34 years among patients involved in common-source outbreaks in the

United States that occurred in the late 1990s and early 2000s.[9,10] It might also help to explain the proportion of hospitalised patients not attributable to chronic illness in this outbreak.

Because the presence of chronic medical conditions has not been systematically documented in previous outbreak reports, we cannot assess how the factors we identified compare with other outbreaks; the older age of case-patients in this outbreak and presence of chronic medical conditions might reflect the demographics of persons likely to consume an organic berry-pomegranate aril product or the shoppers of the retailer that sold the product. We are also unable to directly assess whether the relatively high proportion hospitalised during this outbreak was because of the potential for increased severity of clinical manifestations associated with genotype 1B HAV, compared with the predominant genotype 1A in the United States.[15] HAV strain-specific variation in the severity of clinical manifestations has been indicated by differences in multiple regions of the HAV genome that were reported to be associated with fulminant hepatic failure.[20] However, infection with the same viral strain has been reported to produce varying disease courses among different persons,[21] and therefore, host factors are believed to play an important role in determining severity of illness.

The majority of the estimated >$1.3 million in healthcare usage and lost productivity costs was related to hospitalised patients who incurred both inpatient medical costs as well as greater numbers of ED visits, other outpatient medical visits, and longer periods of lost productivity, compared with non-hospitalised patients. This cost is a conservative estimate; healthcare costs were estimated by using mean insurance reimbursement payments and do not include out-of-pocket expenses reported by the majority of outbreak patients. We also observed that the majority of patients' household members incurred additional expense or productivity loss as a result of the outbreak.

Public health expenditures documented in excess of 10,000 personnel hours and $400,000 in personnel costs represented substantial time and resources diverted from other public health activities. These expenditures were also conservative estimates because they do not include five additional states with outbreak cases, multiple states that did not have reported cases but were involved with the outbreak response (including provision of PEP to persons who had consumed the implicated food vehicle), or the response efforts of federal agencies, including CDC and the Food and Drug Administration. In addition, the public health cost estimate does not include the costs of PEP doses (either vaccine or IG) administered by public health agencies, which we were unable to determine in this analysis, although public health personnel hours for administering PEP doses were included in our estimate.

Given the relatively high proportion of hospitalised patients during this outbreak, we sought to characterise factors associated with hospitalisation and estimate costs of medical care, lost productivity, and public health expenditures to assist public health agencies in targeting public health prevention efforts for hepatitis A judiciously. Because protective anti-HAV seroprevalence has decreased among adults aged ≥30 years during the era of widespread vaccination of children, susceptible older persons might become an increasingly larger proportion of outbreak cases, resulting in higher overall proportions of hospitalised cases

and increased outbreak costs. Unlike the majority of foodborne pathogens, hepatitis A is preventable by vaccination, and our findings can inform future considerations for expansion of hepatitis A vaccination recommendations to include adults with chronic medical conditions, in addition to persons with chronic liver disease.

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Abbreviations:

HAV	hepatitis A virus
HCV	hepatitis C virus
CDC	Centers for Disease Control and Prevention
ED	emergency department
DOL	US Department of Labor
PEP	postexposure prophylaxis
IG	immune globulin

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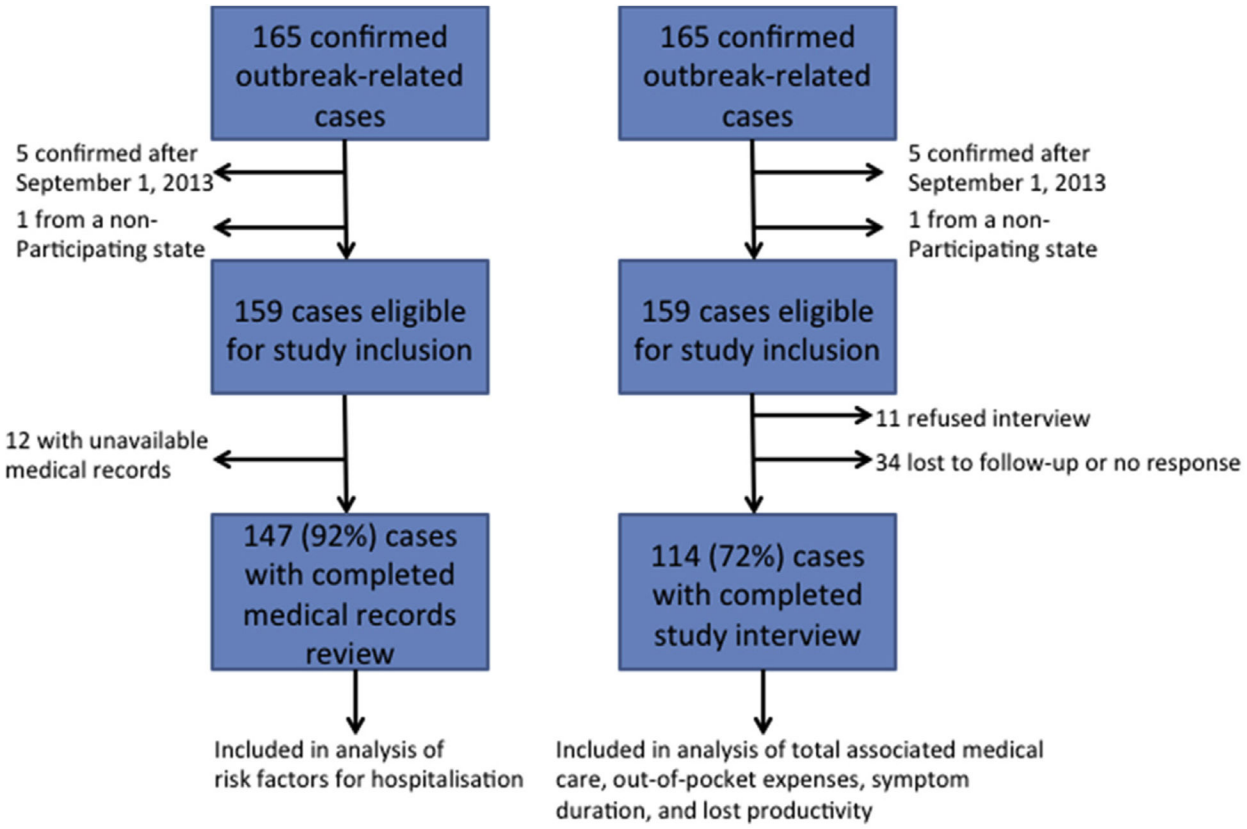

Fig. 1 –.

Study inclusion of patients with hepatitis A illness associated with consumption of imported pomegranate arils in multiple states during 2013.

Table 1 –

Patient characteristics and outcomes among 147 patients with Hepatitis A illness associated with consumption of imported pomegranate arils – multiple states, 2013.

Characteristic	No. (%)
Female	83 (56)
Race/ethnicity	
White, non-Hispanic	107 (73)
Hispanic	12 (8)
Asian	6 (4)
Black	2 (1)
Other	3 (2)
Unknown	17 (11)
Age groups (yrs)	
<5	3 (2)
5–14	5 (3)
15–39	39 (27)
40–64	84 (57)
≥65	16 (11)
Health insurance status	
Yes	116 (79)
No	6 (4)
Unknown	25 (17)
Comorbid conditions[a]	
Any chronic medical condition	37 (25)
Chronic liver disease	1 (0.7)[b]
Excessive alcohol use or abuse[c]	4 (3)
Immunosuppressive therapy	4 (3)
Inflammatory bowel disease[d]	4 (3)
Diabetes	4 (3)
Obesity[e]	13 (9)
Cardiovascular disease	10 (7)
Other chronic medical condition(s)	13 (9)
Pregnancy at time of hepatitis A diagnosis	0 (0)
HBsAg reactive (N = 116 persons with record of HBsAg testing)	0 (0)
Anti-HCV reactive (N = 112 persons with record of HCV antibody testing)	1 (0.9)[f]
Previously vaccinated against hepatitis A	0 (0)
Received hepatitis A vaccine for postexposure prophylaxis	12 (8)[g]
Hospitalized	64 (44)
Outcomes	
Death	0 (0)

Characteristic	No. (%)
Fulminant hepatitis[h]	2 (1)
Liver transplant	1 (0.7)
Relapsing hepatitis[i]	1 (0.7)
>1 hospitalization	5 (3)
Other outcomes not typically associated with hepatitis	
Cholecystectomy	2 (1)

[a]Categories of comorbid conditions are not mutually exclusive.

[b]Non-alcoholic fatty liver disease.

[c]Defined as any documentation by a medical provider of alcohol abuse or excessive alcohol use, or alcohol use constituting heavy drinking defined as consuming ≥15 drinks/week for men or ≥8 drinks/week for women.

[d]Defined as receipt of ≥1 of the following: high-dose steroids (>2 mg/kg prednisone daily for children or >40 mg prednisone daily for adults, or steroid dose equivalent); chemotherapy administered <3 months of hepatitis A diagnosis; concurrent receipt of immunomodulator or other immune suppressive medications.

[e]Defined as body mass index ≥30.

[f]Person with reactive anti-hepatitis C virus (HCV) had a negative HCV RNA polymerase chain reaction.

[g]Postexposure prophylaxis was administered during incubation period or after symptom onset.

[h]Defined as rapid onset of encephalopathy <8 weeks of hepatitis A documented by a medical provider and coagulopathy with international normalized ratio >1.3.

[i]Defined as documented recurrence of clinical and biochemical manifestations of hepatitis A after partial or complete resolution.

Table 2 –

Multivariate analysis of factors associated with hospitalization among 147 patients with hepatitis A illness associated with consumption of imported pomegranate arils – multiple states, 2013.

Characteristic	No. hospitalized/No. with characteristic (%)	Adjusted odds ratio	95%CI[b]		*P* value
Female	39/83 (47)	1.64	0.8	3.35	0.18
Male	25/64 (39)	Reference			
Non-white[a]	6/23 (26)	0.47	0.21	1.08	0.08
White	51/107 (48)	Reference			
Age groups (yrs)					
Age ≤39	15/47 (32)	Reference			
≥40	49/100 (49)	1.88	0.87	4.05	0.11
Comorbid conditions[c]					
Any chronic medical condition	25/37 (68)	3.8	1.68	8.62	0.001
Known pre-existing liver disease	0/1 (0)				
Excessive alcohol use or abuse	4/4 (100)				
Immunosuppressive therapy	2/4 (50)				
Inflammatory bowel disease	4/4 (100)				
Diabetes	1/3 (33)				

[a] Among 130 persons with known race/ethnicity.

[b] Confidence interval.

[c] Categories of comorbid conditions are not mutually exclusive.

Table 3 –

Healthcare use, lost productivity, and estimated associated costs among 114 patients with hepatitis A illness associated with consumption of imported pomegranate arils and completed interviews – multiple states, 2013.

	Hospitalized (n = 54)			Non-hospitalized (n = 60)		
Variable	**Value**	**Total**	**Estimated cost**	**Value**	**Total**	**Estimated cost**
Hospitalization length of stay, days; median (range)	2 (1–12)	159	$535,724		N/A	
Outpatient visits, number; median (range)						
Regular healthcare provider	3 (0–30)	175	$26,775	3 (0–9)	178	$27,234
Urgent care	0 (0–3)	30	$4590	0 (0–2)	20	$3060
Emergency department	1 (0–4)	74	$11,322	0 (0–2)	23	$3519
Subspecialist	1 (0–12)	89	$13,617	0 (0–9)	42	$6426
Time completely unable to carry out usual activities, days; median (range)	28 (0–193)	1814		14 (0–75)	1346	
Persons working for employer for wage or salary (n = 54), or self-employed (n = 29)	28 (0–112)	1264	$121,850	14 (0–67)	870	$83,868
Persons working at home without a wage (n = 8)	30 (21–109)	233	$13,314	21 (21–30)	73	$4171
Total cost			**$727,192**			**$128,278**
Cost per-patient (excluding one liver transplantation hospitalization)			**$13,467**			**$2138**

Table 4 –

Public health personnel hours expended in response to outbreak of hepatitis A illness associated with imported pomegranate arils — multiple states, 2013

Job category	**Hours**	**Estimated cost**
Epidemiologists and environmental health specialists	3277	$104,497
Executive, director, or manager	2169	$94,831
Public health nursing	2752	$87,616
Physician	1147	$103,203
Laboratory	70	$2275
Administrative support	752	$11,570
Communications or media	246	$5114
Totals	**10,413**	**$409,106**
Per case (for 127 cases in five states[a] reporting personnel hours)	**82**	**$3221**

[a]States reporting public health agency personnel hours included: New Mexico, Colorado, Arizona, Nevada, and California (10 of 21 local agencies with outbreak cases).