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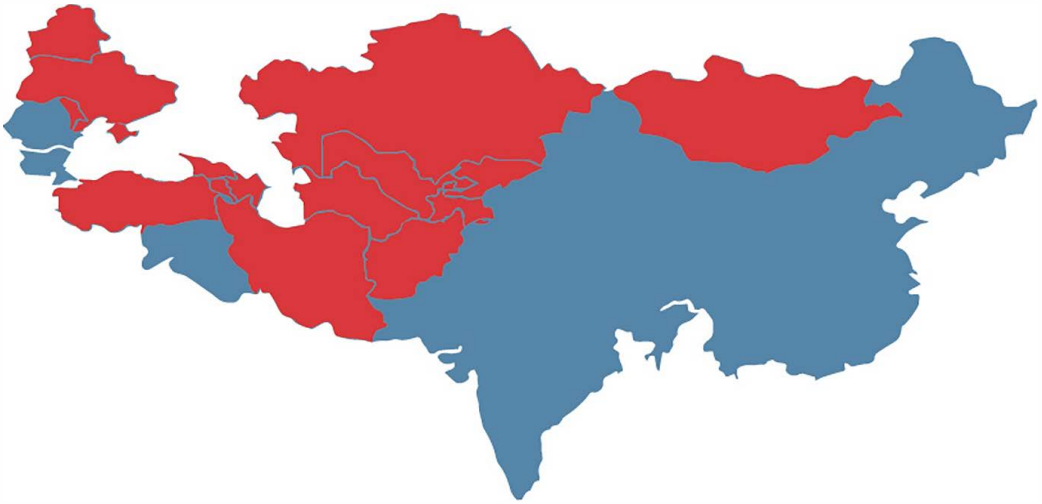
Areej H. Shoubaki, Mohammad Maayeh, Ashraf Aqel, Majed Asad

Learning from Practice: Public Health Teaching Case Studies from Eastern Europe and Central Asia



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Mass Food Poisoning in Ain-al-basha District/Jordan 2020: A Mid-Pandemic Outbreak Investigation

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Abstract

Background: In the summer of 2020, coinciding with relaxation of COVID-19 lockdown restrictions, residents of Ain-al-Basha celebrated Eid-Al-Adha by eating shawarma at a popular restaurant. Unfortunately, a week-long mass food poisoning outbreak ensued. With the Ministry of Health preoccupied with COVID-19 testing and vaccination campaigns, this report describes the epidemiological investigation and control measures swiftly undertaken by a strained health care system engaged on multiple fronts.

Methods: A case-control study was conducted. A case was defined as any resident of Ain-al-Basha who presented to the emergency departments of Balqa governorate from July 26 to August 2, 2020 with at least any two of the following symptoms: fever, abdominal pain, diarrhea, vomiting, or headache. Controls were well family members. All laboratory samples were processed centrally. Data analysis utilized MS Excel and SPSS v.24.

Results: 1109 people met the case definition. 613 required hospitalization, and 2 deaths occurred. Most cases aged between 6 and 40 years old. The epidemic curve indicated a point source and a 24–48-hour incubation period. All cases reported eating from a restaurant which served chicken shawarma meals [OR=21.7 CI=11.5-40.7]. *Salmonella enteritidis* was isolated from 60 stool samples

from randomly selected cases. Environmental and biological samples taken from the restaurant showed bacterial contamination related to food preservation methods. The restaurant in question was promptly shut down and strict food health control measures reinforced on the entire food sector.

Conclusion: The post-lockdown reopening of restaurants was predicated on strict compliance with infection control measures. However, these were inadequate to prevent a salmonellosis outbreak, highlighting the needed vigilance and flexibility of surveillance systems to competently cover all possible sources of infection under any conditions.

Keywords: outbreak investigation, foodborne diseases, Salmonella, Jordan

How to Use the Case Study

General instructions: This case study should be used as adjunct training material for novice epidemiology trainees to reinforce the concepts taught in prior lectures. The case study is ideally taught by a facilitator in groups of about 20 participants. Participants are to take turns reading the case study, usually a paragraph per student. The facilitator guides the discussion on possible responses to questions. The facilitator may make use of flip charts to illustrate certain points. Additional instructor's notes for facilitation are coupled with each question in the instructor's guide to aid facilitation.

Audience: This case study was developed for novice field epidemiology students. These participants are commonly health care workers working in the county departments of health whose background may be as medical doctors, nurses, environmental health officers or laboratory scientists who work in public health-related fields. Most have a health science or biology background.

Prerequisites: Before using this case study, participants should have received lectures on disease surveillance and outbreak investigation.

Materials needed: Flash drive, flip charts, markers, computers with MS Excel, Analytical software: Epi info or SPSS

Level of training and associated public health activity: Novice – **Outbreak investigation**

Time required: 2-3 hours

Language: English

Goal of Case Study:
The goal of this case study is to expand the capabilities of public health practitioners in foodborne outbreak investigation and implementation of control and preventive measures.

Learning Objectives – At the conclusion of the teaching session, participants will be able to:
1. Define and differentiate between "cluster", "epidemic", "outbreak", "foodborne outbreak"
2. Design a line list and understand its value
3. Analyze and interpret an epidemic curve
4. Choose the appropriate study design for hypothesis testing
5. Calculate rates (attack rate, case fatality rate), measures of association, and risk using analytical software
6. Develop recommendations in the field to help control and prevent similar outbreaks

Introduction/Background of the case study

Foodborne diseases are illnesses resulting from the ingestion of contaminated food or beverages, often caused by pathogens such as bacteria, viruses, and parasites, or by chemical substances. These diseases pose a significant public health challenge globally, with millions of cases reported each year. Common pathogens include Salmonella, Campylobacter, and enterohaemorrhagic Escherichia coli each associated with specific food sources and preparation practices. Symptoms can range from mild gastrointestinal discomfort to severe illness and even death, particularly among vulnerable populations such as the elderly and immunocompromised individuals[1]. The economic burden of foodborne diseases is substantial, encompassing healthcare costs and lost productivity, highlighting the need for effective prevention and control measures[2] .

Outbreak investigation is a cornerstone of epidemiology and public health surveillance. However, during 2020, the COVID-19 pandemic had significantly impacted public health systems worldwide, affecting not only how diseases were managed but also how foodborne outbreaks were investigated. The challenges posed by the pandemic have necessitated changes in traditional investigation methods, as public health resources were reallocated to manage the spread of the virus. Despite these challenges, ensuring food safety is always a public health priority, as foodborne illnesses consistently pose significant health risks[3].

By mid-summer 2020, the government of Jordan had gingerly started to relax some of the strict regulations and lockdowns instated since March of that year. Local businesses, and restaurants in particular, prepared to welcome customers eager to rejoin the social scene and enjoy eating out. Restaurant workers wore the mandated gloves and masks and served their customers all of whom were abiding to the strict COVID-19 regulations. All to ensure a return to normality. So it came to pass that a popular fast-food restaurant in Ain al Basha, a densely populated district in the northeastern part of the governorate of Balqa to the west of the capital, offered tasty chicken shawarma meals at half-price (see figures 1, 2). Chaos ensued…

Part 1: Story

As Dr. Muhammad was settling in his office at the surveillance department of the Ministry of Health (MOH) on the morning of Tuesday the 28th of July, he answered a rather early phone call. He had just posted the response teams' on-call schedule for the approaching 5-day long holiday next week. So, he was expecting people to call in with objections, complaints, or requests for schedule changes. It could have also been the director of communicable diseases calling, as usual, for the daily COVID-19 update and making sure enough teams were deployed to do enough testing. Alarmingly, it was an urgent call from the public health officer of the governorate of Balqa'. Since the early hours of the morning, she had been in constant contact with disease surveillance personnel from Prince Hussein hospital in the district of Ain -al- basha concerning a confluence of cases presenting to the emergency department (ED) with acute gastrointestinal symptoms throughout the previous night. What started with a family of 7 attending the ED around the evening quickly exceeded a hundred cases complaining of similar symptoms and many requiring admissions for urgent care. Another important piece of information was that most patients reported eating at a famous restaurant in the area.

Consequently, an investigation and response team, not otherwise engaged in active surveillance for COVID-19, was immediately dispatched from the central offices in the capital to visit the reporting hospital. The visit was conducted in coordination with liaising staff from the health directorate of Balqa'a and Prince Hussein hospital and included the following:

- Briefing from the directors of the health directorate and hospital in Balqa'
- Meeting with treating doctors on duty
- Meeting with the patients and their families who were presented to the Emergency department with symptoms and have been admitted to in the hospital during the visit.

Due to the overwhelming numbers of people presenting with acute gastrointestinal symptoms some of the cases were transferred to the emergency departments of nearby hospitals either in the same governorate of Balqa or neighboring governorates depending on bed capacity.

Part 1: Questions

Question 1: How would the event described above be classified (cluster, outbreak , epidemic, etc)? How does it differ than a "pandemic"?

Question 2: What conditions must be present for an outbreak or an epidemic to occur? And how would you define a foodborne outbreak?

Question 3: Can you go over the common steps of investigating a health event such as described?

Part 2: Methods

A line list was immediately drawn and distributed to all members of response teams to use while actively interviewing people who presented with clinical symptoms. (Answer Question 4)

In order to collect the needed data per the adopted line list a working case definition was agreed upon by the main response team and MOH specialists.

Case Definition: "People who visited Prince Hussein hospital, Ain-al-Basha health center, Al-Hussein/ Al-Salt hospital, or any private hospital in the country who primarily reside in district of Ain-al-Basha on and after July 27, 2020 complaining of at least any two of the following symptoms:

- Elevated body temperature
- Abdominal pain
- Diarrhea
- Nausea and vomiting
- Headache"

(Answer Question 5)

In parallel to the efforts of the MOH epidemiologist and public health workers other agencies such as environmental health, the food and drug administration, and the water company were notified at the same time and conducted collaborative investigations to glean the possible source of the outbreak each within its own purview and expertise. (Answer Questions 6,7).

The priority behind the investigation was to control the spread of the outbreak as soon as possible. So, Dr. Muhammad assigned a few Field Epidemiology Training Program residents to record and aggregate the data collected in the line lists, then analyze it using the most appropriate epidemiological methods. To expand the scope of the intended study, subjects were not limited to people who presented with symptoms but also relatives and other family members who did not became ill were interviewed as well. (Answer Questions 8,9).

Part 2: Questions

Question 4 : What is a "line list" ? What do the rows and columns each represent? Please construct one that is suitable for this situation.

Question 5: What are the main components of a case definition? Does the official case definition for this investigation comply and would you make any changes?

Question 6: What investigative procedures other than interviewing the affected and contact tracing should be carried out?

Question 7: List the broad categories of diseases that must be considered in the differential diagnosis of an outbreak of gastrointestinal illness.

Question 8: What study designs can be used to analyze the outbreak? Describe each study design and the measures of association that can be calculated for each.

Question 9: What study design would you choose for this event? Explain your choice.

Part 3: Results

Individuals who met the criteria set forth by the case definition first presented to the emergency department of Prince Hussein Hospital in Ain-al-Basha on Monday July 27, 2020. Symptoms started to appear on the late evening of Sunday July 26, 2020. For the first day of the outbreak investigation 466 cases were identified and 265 required admissions for treatment. In general, hospital stays didn't exceed 48 hours. The last reported case was discharged from hospital in good condition 2 weeks later on Friday August 7, 2020. By the end of the outbreak in early August, a total of 1109 acute gastrointestinal cases were reported. Of which 613 required hospital admission for further treatment. 7 cases required admission to intensive care units (ICU) at different hospitals. 46% of the cases were male and the youngest patient was 7 months old compared to the oldest who was 80 years. Unfortunately, 2 cases resulted in death; a 3 year old boy and 44 year old man. (Answer Question 10)

An epidemic curve was created from information collected during the first 4 days of the outbreak. (see figure 3) (Answer Questions 11,12).

Questions about what people had to eat prior to developing symptoms revealed that all affected cases had previously consumed chicken shawarma meals from a popular restaurant in Ain-al-Basha, which was advertising special offers/reduced prices on shawarma meal, within 1-2 days before onset of symptoms. (Answer Questions 13).

The vast majority of the cases stated that they had consumed meals from the implicated restaurant. It was a fast food establishment with a limited menu. A analytical study was performed on 538 residents of Ain-al-basha to help narrow down the food items served that were the likely source of the outbreak. This sample included cases and family members who shared meals but didn't fall ill. (Answer Question 14).

Laboratory results

Stool Analysis/ Culture Results:

1. Out of 56 randomly selected cases, 56 were culture positive for Salmonella enteritidis and 10 also tested positive for Rotavirus.
2. All Stool cultures from the restaurant's staff were negative for Shigella and Salmonella species.

Laboratory Analysis of Water Samples performed by Environmental Health Directorate and Balqa Health Directorate:

1. All samples taken from the pumping station and water mains were clear.
2. All samples taken from the private residences of cases were clear.
3. Some of the restaurant's water tanks were found to lack covers allowing for dirt and debris to collect inside some of them. Excess Chlorine test was at 0 mg/L.

Results from the parallel investigation conducted by the Food and Drugs Administration:

1. Discovery of contamination of restaurant surfaces with Enterococcus Faecalis , indicating low adherence to personal hygiene and health practices at the restaurant.
2. Campylobacter spp was isolated from different food items processed and sold to consumers at the restaurant. This bacterial species is transmitted by cross-contamination or undercooking of raw food. The fact that it was isolated form the pickles which does not undergo cooking or application of temperature changes further indicates the poor health practices of the restaurant's staff.
3. Isolation of Bacillus Cereus from certain food items implying non-adherence to proper food conservation practices as it indicates being stored in inappropriate temperatures

Part 3 Questions

Question 10: Define case fatality rate and what does it signify ? Can you calculate one for this event?

Question 11: What is an epidemic curve? Why is it important in investigating an outbreak?

Question 12: What important information about the outbreak can you derive form the epidemic curve provided above? How does it compare to other possible patterns?

Question 13: What other information is helpful in identifying the causative agent of an outbreak and how is it used to declare that it has ended?

Question 14: From the data file provided in annex 1, calculate the appropriate measure of association to find which food item was the likely source of the outbreak. (Employ Epi info, SPSS, or any statistical software is available)

Question 15: Annex 2 is a table of the odds ratio for each food item investigated. Do these values match the ones you calculated for the previous question? How would you interpret these results and why is the confidence interval important?

Part 4: Discussion

This outbreak investigation report describes a rare mass food poisoning event in a densely populated district of Jordan. The fact that it occurred in the middle of the Covid 19 pandemic of 2020 lends it further significance.

The ministry of health declared the outbreak to the public since the first day it was alerted on Tuesday 27, 2020. Later, it declared its conclusion on August 11, 2020. Although the majority of cases were self-limited and even those who required hospitalization were in good condition and discharged promptly, the outbreak regrettably resulted in 2 deaths. The first recorded death was of a 3-year-old, otherwise healthy child. The second death was of a 40-year-old man who suffered from unspecified comorbidities.

The vast majority of cases reported eating meals made primarily form chicken from a popular restaurant. Although the menu lists several other options of chicken dishes, Shawarma and its condiments (mayonnaise and garlic sauce) which are made out of eggs had the highest odds ratio as determined in the case control study.

Foodborne outbreak investigations are multisectoral by nature and the process is intricate, involving epidemiological analysis, laboratory testing, and environmental assessments. Understanding the methods and challenges involved in these investigations is crucial for public health professionals, as it enhances their ability to respond effectively to outbreaks and protect public health[1]. This outbreak investigation illustrated collaboration between all the stakeholders involved in disease surveillance and food safety. Investigative teams from the MOH, Jordanian Food and drug Administration, and Environmental health directorate ran parallel investigations augmenting each other. Laboratory results were obtained early in the timeline of the outbreak. Clinical tests confirmed salmonellosis and environmental testing of the restaurant in question indicated poor compliance to food safety measures and hygiene practices in food preparation and preservation after finding a mixture of bacteriological contaminants. The implicated restaurant under its current administration was fined and permanently shut down.

A study in the United States showed a significant decline in the rates of foodborne diseases during the 2020 and early months of the COVID-19 pandemic[3]. Preventive measures taken during the pandemic may have also contributed to the reduction of rates of foodborne diseases[3, 4]. However, for this outbreak, deficiencies in quality of food storage and handling caused contaminated food to be sold to the unsuspecting public.[i]

One of the major concerns during the outbreak was hospital capacity. Large sections of the country's hospital had been converted to isolation wards for COVID-19 cases, so vacant hospital beds were limited. MOH compensated by organizing a hospital bed control center to distribute cases that required admission for acute gastrointestinal symptoms as efficiently as possible. Fortunately, at the time admissions for active COVID-19 cases were on the lower side.

Another area of concern was false rumors propagated on social media about a variant of COVID-19 that originated in Jordan and mainly presented as acute gastroenteritis. Another misleading issue was is that some skeptical citizens thought the situation was deliberately exaggerated by the government in order to return to stringent restrictions and a wider scale lockdown. A rumor devastating to the economics of the food sector was that all restaurants which were under lockdown had expired food products that they wanted to get rid of by selling them as soon as possible to the unsuspecting public.

Part 4: Questions

Question 17 : From the information provided throughout the report, can you consolidate epidemiological findings with laboratory test results provided?

Question 18: Referring to the outbreak investigation steps discussed earlier, speculate on the possible negative impact of pandemic restrictions on the course of a foodborne outbreak investigation.

Question 19: Breakdown the response plan to this outbreak according to the following components: (Coordination, surveillance, laboratory, case management, hazard containment, risk communication, logistics)

Question 20: How would you employ community involvement and communication to help prevent foodborne outbreaks?

Dr Muhammad summarized the findings and included the following response steps taken during the investigation and immediately after it in his final report:

1. Conduct an outbreak investigation and collect relevant data via the specially designed line list in cooperation with Balqa Health Directorate.
2. Placed Ain-al-Basha district under active surveillance.
3. Treating and following-up on cases.
4. Deploying outbreak investigation teams to cover all concerned hospitals to investigate the affected cases.
5. Collect stool samples from randomly selected cases and sending them to the central laboratories of MOH.
6. Collaborate with Environmental Health Directorate to ensure the safety of the water supply to the area.

7. Collaborate with the Food and Drug Administration to investigate food-producing institutions and restaurants in Ain-al-Basha district.
8. Immediate closure of House of Shawarma Restaurant by the Balqa Health directorate and disposal of all food items.
9. Collect stool samples from the suspected restaurant's staff and sending them to the central laboratories for stool cultures

Part 5: Conclusion

After taking all available epidemiological data and laboratory test results into consideration the oversight committee assigned to lead this outbreak investigation concluded that this incident constituted a salmonella food poisoning outbreak directly related to consuming contaminated food items from the shawarma restaurant in the district of Ain-al-Basha. Control measures were taken during and immediately following the outbreak.

The post-lockdown reopening of restaurants was predicated on strict compliance with infection control measures. However, these were inadequate to prevent a salmonellosis outbreak, highlighting the needed vigilance and flexibility of surveillance systems to competently cover all possible sources of infection under any conditions.

Part 6: Questions

Question 21: What general control measures and/or recommendations would you give to help control this outbreak and prevent future ones?

Acknowledgements

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