

# Hepatitis A in Pohnpei State, Federated States of Micronesia, 2008–2009

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## Abstract

An epidemic of infectious hepatitis caused by the hepatitis A virus was detected in Pohnpei State, Federated States of Micronesia (FSM), beginning in November 2008. Epidemiologic investigation revealed that the index case occurred in late June 2008 in a traveler from nearby Chuuk State, which itself had experienced an epidemic of hepatitis A in the first half of 2008. Most cases have been confirmed by IgM serology, the rest by a clinically compatible syndrome with either jaundice or elevated liver enzymes. The most commonly affected group has been school-aged children; it is likely that the paucity of patients in the 40–50 year age group represents immunity conferred during the previous epidemic of hepatitis A in the early 1970's, as hepatitis A is not thought to be endemic in Pohnpei. As of September 17, 2009 there have been 300 reported cases with 17 hospitalizations (6%) and one death (0.3%). The epidemic peaked in April 2009, with a sharp decline in cases in June attributable with the end of the school year, as schools were found to be the major focus of infection. Efforts to control the outbreak have centered on public awareness and improved hygiene initiatives, particularly in schools. The greatest challenge to ongoing diminution of the outbreak is the recent resumption of the school year; control efforts, especially improved hygiene, will need to be sustained with renewed vigor if we are to extinguish the outbreak.

## Introduction

Hepatitis A (also known as infectious hepatitis, epidemic hepatitis, and epidemic jaundice) is a communicable disease caused by the hepatitis A virus (HAV). It is a self-limiting disease that results in full recovery in almost all cases.<sup>1</sup> It is however, a significant cause of morbidity and socio-economic losses in many parts of the world because it causes symptomatic disease mainly in children and young adults. Transmission of hepatitis A is fecal-oral, with water, food and infected persons playing an important role in the spread of the disease during outbreaks. Infections are common in areas where sanitation is poor and living conditions are crowded. Humans act as the primary reservoir for the disease.<sup>1</sup>

In many developing countries where hepatitis A is hyperendemic, nearly 100% of people acquire the infection asymptotically during infancy (with subsequent life-long immunity), resulting in a relatively low



burden of symptomatic disease.<sup>1</sup> As community hygiene improves, many individuals will not be exposed until childhood or later. This leads to an increase in the number of susceptible persons, who, if infected, will experience symptomatic disease. Therefore, paradoxically, as hygiene improves, the burden of hepatitis A disease in a community may increase.

In small, isolated island communities such as exist in the Federated States of Micronesia (FSM), the virus may be unable to maintain endemic circulation despite the developing country setting.<sup>2</sup> This may lead, over time, to a large proportion of susceptible individuals. Under these conditions, the introduction of a single source of contamination may result in an explosive epidemic. Historical records indicate that Pohnpei State, FSM, has had at least two major outbreaks: one in 1943, and a more recent outbreak around 1973.<sup>2</sup> The full extent of these outbreaks is not known, but many people admit to having been victims to the latter outbreak and remember being quarantined at a designated place on the island. One source states that there were over 3,500 reported cases during this outbreak.<sup>3</sup>

## Recognition and evolution of the outbreak

In November 2008, the Pohnpei Department of Health Services (DHS) was alerted to the presence of patients with signs and symptoms of diarrhea, vomiting, malaise, abdominal pain, fever, darkened urine and jaundice (Table 1), suggestive of hepatitis A. The Pohnpei State Hospital laboratory was able to confirm the etiology through the detection of increased anti-HAV IgM titers in several patients; when the specific test was unavailable, cases were diagnosed clinically by the presence of either jaundice or elevated alanine aminotransferase (AST) levels.

Initial epidemiological investigation revealed two index cases, both of whom were laboratory confirmed prior to the surge of cases in November. The first case was detected on June 27, 2008 and the second case on September 8. Both of these cases had traveled from Chuuk State several weeks prior to the onset of illness in Pohnpei. At the time, Chuuk had itself been experiencing an outbreak of hepatitis A that had begun in April of 2008.<sup>4</sup> Therefore it is likely that the outbreak was imported to Pohnpei from Chuuk by these two patients.

The number of people presenting to the clinics increased rapidly after November (Figure 1). The infection has been most common among children and young adults, mostly within the elementary age group (median age 12 years; range 1-88 years)(Figure 2). 58% of cases have been male. The cases have been scattered sporadically around the main island of Pohnpei, with considerable geographic variability in case counts (Figure 3). The number of cases peaked in mid-April 2009 and dropped sharply toward the end of June 2009, coinciding with the end of the school year.

As of September 15, 2009 there have been 300 reported cases with 16 hospitalizations (6%) and one death (0.3%), a 4-year old girl.

In response to the outbreak, the Pohnpei DHS created a task force to investigate contributing factors and develop control measures. The team members included key staff from the hospital administration, medical staff, laboratory, the EpiNet focal person, and environmental sanitation.



## Environmental factors potentially contributing to the outbreak

As part of the outbreak investigation, the Task Force conducted an environmental investigation to determine factors contributing to the continuation of the outbreak.

Data sources from the Pohnpei Environmental Protection Agency (EPA) showed that most of the community water supplies in Pohnpei are heavily contaminated with fecal coliforms and *E. coli*, organisms that are found in both human and animal feces. Only the town of Kolonia, and some parts of Nett, Uh, Madolenihmw, and Sokehs get treated municipal water; however, the quality of the water gets poorer as it extends further out from the treatment unit. The Pohnpei Public Utilities Company (PUC), which manages the water and sewage treatment facilities in Pohnpei, indicated that its water treatment facilities had not been renovated in many years due to a lack of funding.

Pit latrines are the most common type of toilet for most households in Pohnpei. Studies during the 2000 cholera outbreak demonstrated that these toilets were associated with an increased likelihood of infection, particularly those that were poorly maintained.<sup>5</sup>

Inspection of schools revealed that most have proper toilet facilities and running water, but the water quality is poor (many schools obtain their drinking water directly from nearby streams) and there is no toilet paper and soap for hand washing at most schools.

Large social gatherings that involve feasting and drinking of locally prepared sakau (a drink similar to kava, prepared from the pepper plant *Piper methysticum*) are a common practice in Pohnpei, and could easily potentiate the spread of water-borne diseases including hepatitis A.

Interviews with patients did not reveal any point sources of infection. Environmental testing for HAV itself was not possible.

## Outbreak control measures

The Task Force disseminated Health alerts and public awareness messages on personal hygiene to the general public, emphasizing hand washing and water disinfection. The Task Force also held meetings with school principals and municipal government officials, the PUC and the Governor of Pohnpei. Symptomatic patients were requested to stay home from work or school for 10 days from the onset of symptoms.

Similar to what was done during the 2000 cholera outbreak, a bucket hand washing system was instituted in all the affected elementary schools: the first bucket was filled with water and was used to wash hands with soap, and the second bucket contained dilute chlorine bleach and was used to rinse hands. The system and training on its use were provided to teachers and students by Pohnpei DHS and the Micronesia Red Cross Society. Additionally, soap, bleach, toilet paper, and hand sanitizers were purchased by the World Health Organization and distributed to all the schools.



## Discussion

Prior to 2008, hepatitis A had not been confirmed in Pohnpei since 1973. The present large outbreak seems to have been introduced from Chuuk State via two travellers who acquired the disease there and subsequently brought it to Pohnpei. The equally explosive Chuuk outbreak similarly likely began with a traveller from an endemic country; like Pohnpei, Chuuk does not appear to be capable of sustaining the virus endemically.

Support for the theory that HAV has not been circulating endemically in Pohnpei can be found in the age distribution of patients in the present outbreak. There is a paucity of patients older than 30, individuals who were likely to have been infected during the 1973 outbreak. This effect is similar to what was found in the study by Wong, et al, where serosurveys conducted in 1963 demonstrated a complete lack of antibodies in individuals younger than 20 years (those born since the 1943 outbreak), and near ubiquity of antibodies in those older than 20 years.<sup>2</sup>

The present outbreak seems to have been largely driven by transmission in elementary schools, underscoring the importance of education and provision of supplies for improved sanitation and hygiene in this setting. Other unhygienic factors, as discovered by the environmental investigation, also likely contributed to the severity of the outbreak. There has been geographic heterogeneity in case counts, likely caused by a variety of contributing factors including differential water quality, sanitation, population density, and access to testing. The outbreak was ultimately brought under control by the end of the school year. The greatest challenge to ongoing diminution of the outbreak is the resumption of the new school year; control efforts, especially improved hygiene, will need to be sustained with renewed vigour if we are to extinguish the outbreak.

## Conclusions and recommendations

At the time of writing, this outbreak is ongoing, albeit at a low level. To extinguish the outbreak and prevent its recurrence, we recommend several key interventions: 1) schools should incorporate soap and toilet tissue in their budgets and maintain the bucket hand washing systems in place; 2) schools should install relatively inexpensive water purification systems, which have been piloted in several schools, in areas without PUC water; 3) the Department of Education should incorporate the hygiene curriculum currently taught in the Early Childhood Education (ECE) program into all grades 1-8, so that hygiene awareness and skills can be maintained; 4) the EPA and PUC should partner with communities to jointly address the improvement of water systems and toilet facilities; 5) outreach efforts should likewise be undertaken as partnerships, and be aimed at changing hygiene behaviours, not just raising awareness; 6) the EPA should develop standards for food safety during gatherings e.g., funeral, feasts etc.; and 7) the DHS and EPA should work with PUC to improve the sewage and water purification systems, including adding chlorine injectors along the municipal water distribution lines in order to insure adequate chlorination to all points on the network. While hepatitis A is mostly a self-limiting disease, the tragic death of a child during this outbreak reminds us that it must be taken seriously as a public health issue. The recommendations presented here are equally applicable to controlling other food- and water-borne diseases, which together account for one of the largest burdens on the local healthcare system.



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## Tables and Figures

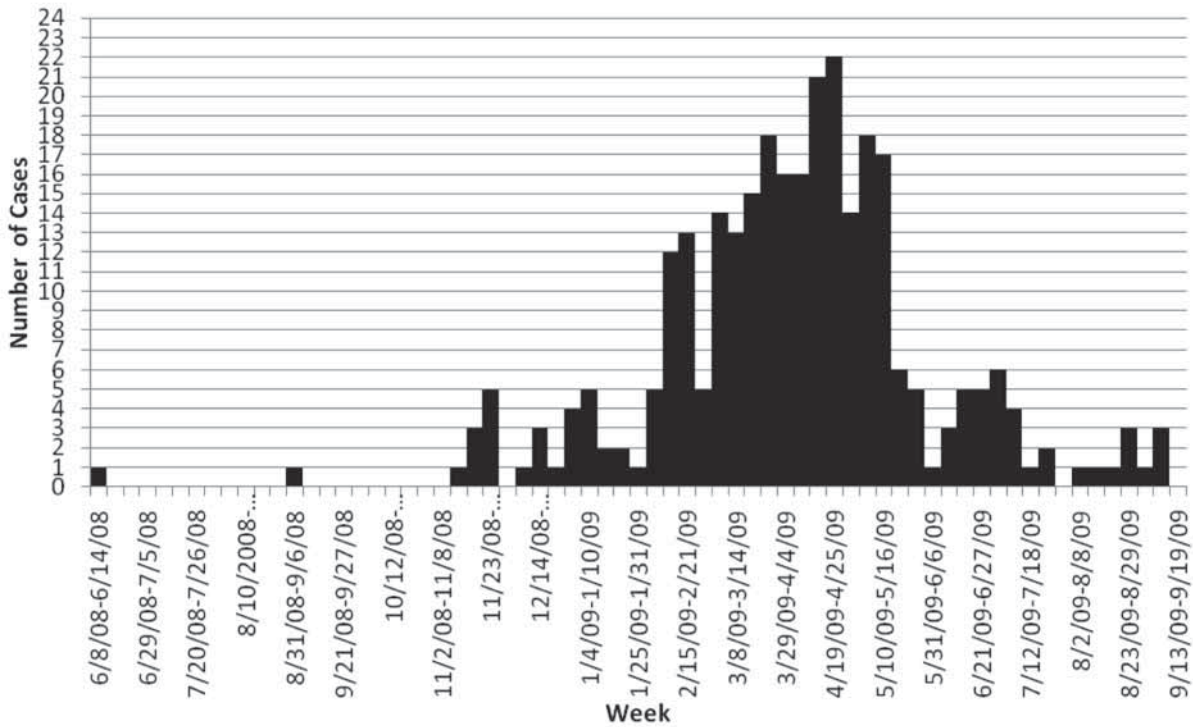
**Table 1: Most common symptoms and signs of hepatitis A, Pohnpei, 2008–2009 (n=217)**

Symptom or sign	Number of cases	Percentage of cases
Abdominal pain	159	73
Dark urine	154	71
Anorexia	153	71
Fatigue	152	70
Fever	150	69
Jaundice	143	66
Nausea / vomiting	137	63
Diarrhea	63	29
Arthralgia	49	23
Clay-colored stool	13	6

The most common symptoms and signs were abdominal pain, dark urine, and anorexia.

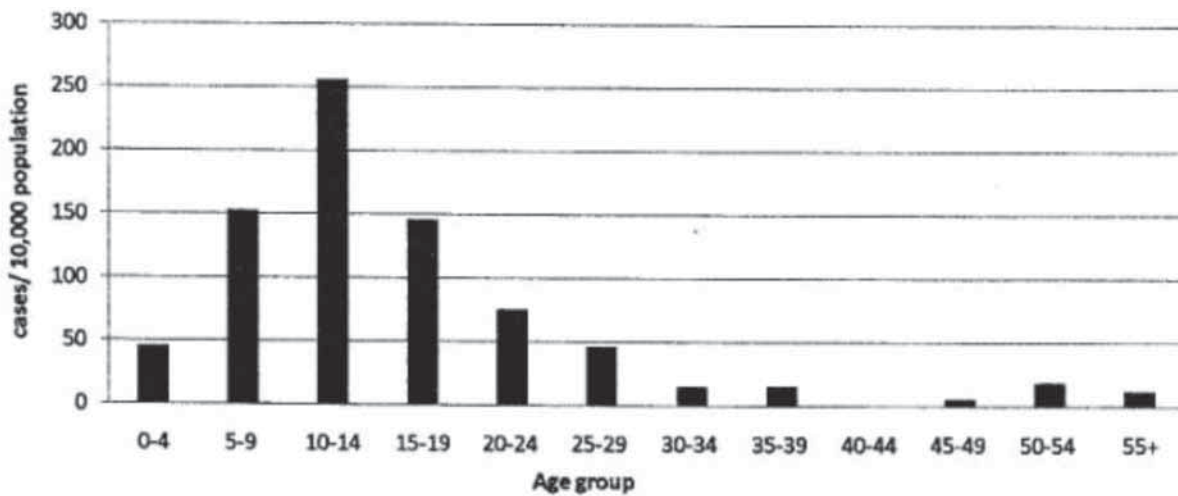


**Figure 1. Hepatitis A cases by date of onset, Pohnpei State (FSM), 2008 – 2009**



*The outbreak peaked in late April, 2009, but continues at a low level at the time of writing.*

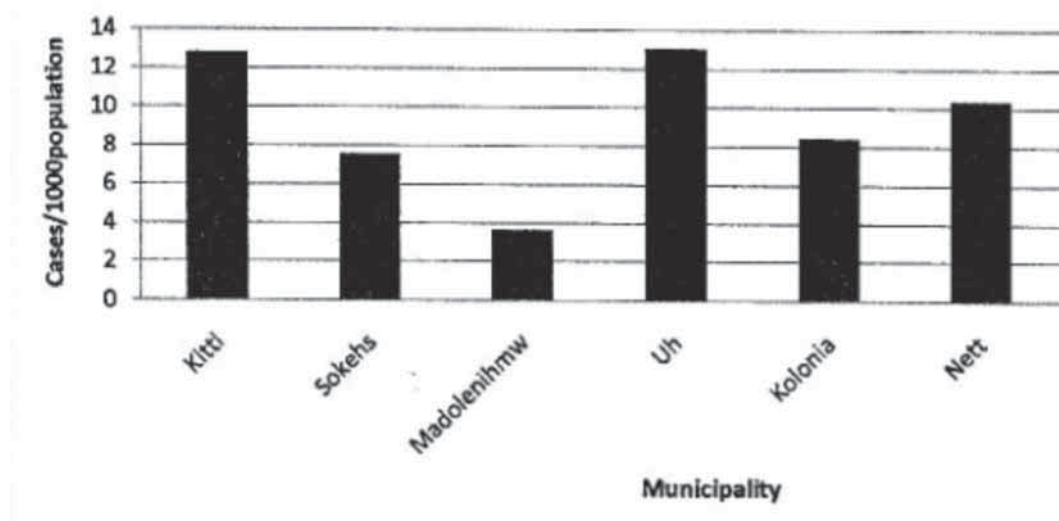
**Figure 2: Hepatitis A cases by age group, Pohnpei State (FSM), 2008-2009**



*Most cases were concentrated in school-age children, with a paucity of cases older than 30, particularly in the 40-49 year age range.*



**Figure 3. Hepatitis A cases by municipality, Pohnpei State (FSM), 2008-2009**



*Cases were widely dispersed geographically, with considerable variation in case counts between municipalities. Areas shown are the six municipalities on the main island of Pohnpei; no outer island municipalities were affected.*

*“Take care of your body. It’s the only place you have to live.”*

*Jim Rohn*



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