Vaccine 28 (2010) 6298–6304

Contents lists available at ScienceDirect

Vaccine

journal homepage: www.elsevier.com/locate/vaccine

Impact of a statewide childhood vaccine program in controlling hepatitis A virus infections in Alaska☆

Rosalyn J. Singleton[a,b,*], Sarah Hess[a], Lisa R. Bulkow[b], Louisa Castrodale[c], Ginger Provo[c], Brian J. McMahon[a]

[a] Arctic Investigations Program, National Center for Emerging and Zoonotic Infectious Diseases, Centers for Disease Control and Prevention (CDC), Anchorage, AK, United States
[b] Alaska Native Tribal Health Consortium, Anchorage, AK, United States
[c] State of Alaska, Department of Health and Social Services, Section of Epidemiology, Anchorage, AK, United States

ARTICLE INFO

Article history:
Received 8 March 2010
Received in revised form 11 June 2010
Accepted 30 June 2010
Available online 15 July 2010

Keywords:
Alaska
Hepatitis A
Hepatitis A vaccine
Alaska Native

ABSTRACT

Historically, Alaska experienced cyclic hepatitis A virus (HAV) epidemics, and the HAV rate among Alaska Native people was significantly higher than among other racial/ethnic groups. We evaluated the impact of universal childhood vaccination, initiated in 1996, on HAV epidemiology in Alaska by analyzing HAV cases reported to the State of Alaska. HAV incidence in all age groups declined 98.6% from 60.0/100,000 in 1972–1995 to 0.9/100,000 in 2002–2007. The largest decrease (99.9%) was in Alaska Native people, whose incidence (0.3) in 2002–2007 was lower than the overall U.S. 2007 rate (1.0). Among age groups, the decrease (99.8%) among children aged 0–14 years was the largest. Routine childhood vaccination has nearly eliminated HAV infection in Alaska.

Published by Elsevier Ltd.

1. Introduction

Hepatitis A virus (HAV) is one of the most common causes of icteric hepatitis worldwide [1] and was one of the most frequently reported vaccine-preventable diseases in the United States [2,3]. Hepatitis A infection rates have differed historically by race; the highest HAV rates in the United States occurred among American Indian [4] and Alaska Native (AN) people [5]. In Alaska, from the 1950s to 1990s, HAV epidemics occurred every 10–15 years resulting in thousands of persons developing icteric hepatitis [3,4]. AN people in traditional rural villages were disproportionately affected by HAV epidemics. In a statewide epidemic occurring in the mid-1970s, AN persons accounted for >60% of reported cases, although they constituted only 16% of the state's population [4]. In 1993, a retrospective serosurvey showed evidence of past HAV infection, indicated by the presence of total antibody to HAV, among 85% of AN persons born before 1945 [4].

Hepatitis A vaccines, Havrix® (GlaxoSmithKline, Rixensart, Belgium) and Vaqta® (Merck & Co., Whitehouse Station, NJ), were developed in the 1980s. Formulations evaluated in randomized control trials had protective efficacies of 99–100% [6,7]. One of the immunogenicity trials, which included both children and adults, was conducted in Alaska in the late 1980s and the early 1990s [7]. In 1992, while the trials were ongoing, a large outbreak of HAV started in rural Alaska and spread to the urban areas. In 1992–1993, the peak reported incidence of HAV in the affected regions exceeded 2000 cases per 100,000 persons per year [8]. In an attempt to control this epidemic in the period immediately prior to HAV vaccine licensure, the Alaska Area Native Health Service, regional Alaska Native health corporations, and the State of Alaska Section of Epidemiology (SOE) conducted a demonstration project in 1993–1994 to administer Havrix® as part of the Phase III trials [8]. One dose of Havrix® was given to more than 5000 susceptible persons in 25 Alaskan communities, halting the epidemic within 4–8 weeks of administration in communities with high vaccination coverage [9].

Hepatitis A vaccines were licensed in 1995 and recommended by the Advisory Committee on Immunization Practice (ACIP) for routine vaccination of U.S. children in populations with high rates of HAV such as those found in American Indian and Alaska Native (AI/AN) communities throughout the United States [5]. An immunization effort, initiated in 1996–1997, that included AI/AN children as well as children from states with high HAV incidence led to a 20-fold decrease in HAV incidence from 1997 to 2001 among all AI/AN to a level similar to the overall U.S. rate, one of the

☆ The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the agencies.

* Corresponding author at: Arctic Investigations Program—CDC, 4055 Tudor Centre Dr., Anchorage, AK 99508, United States. Tel.: +1 907 729 3418; fax: +1 907 729 3429.
E-mail addresses: ris2@cdc.gov (R.J. Singleton), sehess24@yahoo.com (S. Hess), lrb2@cdc.gov (L.R. Bulkow), louisa.castrodale@alaska.gov (L. Castrodale), ginger.provo@alaska.gov (G. Provo), bdm9@cdc.gov (B.J. McMahon).

0264-410X/$ – see front matter. Published by Elsevier Ltd.
doi:10.1016/j.vaccine.2010.06.113

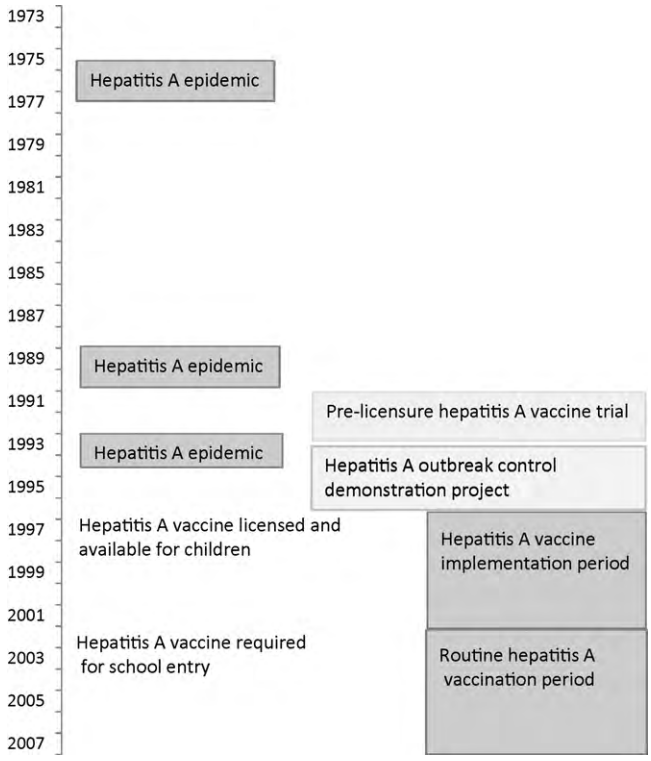

Fig. 1. Timeline of hepatitis A virus and vaccination in Alaska.

largest decreases in HAV reported [10]. During 2001–2007, HAV infection rates among AI/AN people were lower than rates among other racial/ethnic populations in the United States, reaching 0.5 per 100,000 population among AI/AN people, and hepatitis A vaccination coverage among 24- to 35-month-old AI/AN children was higher than that in U.S. children from other racial/ethnic populations [11].

The Alaska SOE implemented universal hepatitis A vaccination with state-supplied vaccine for all Alaska children ages 2–14 years in January 1996 [12]; the vaccine recommendations were expanded to 2–18 years in 1997 [13]. Beginning in 2001, hepatitis A vaccine was required by the State of Alaska for daycare and school attendance; in 2006 the age recommendations were expanded which included 1–18 year olds [14] (Fig. 1).

In this paper we analyzed all Alaska HAV cases reported to the Alaska SOE from 1972 to 2007 to assess the impact of routine statewide childhood hepatitis A vaccination in decreasing HAV infections in all Alaskans and compared results in AN with other racial and ethnic groups living in Alaska.

2. Methods

2.1. Population statistics

Denominators for calculating incidence rates were derived using the 1970, 1980, 1990 and 2000 U.S. census data. We evaluated cases and population by race (AN vs. other), region, and age group. The average change in population for each group was calculated and the estimated population per group was interpolated for 1972 through 2007. Alaska Native people included Eskimo, Aleut, Athabascan, Tsimpsian, Haida, Tlingit, and non-Alaska American Indian groups; all others were considered non-Alaska Native. However, in 8.8% of cases, race was not stated. Persons were considered urban if they resided in the Municipality of Anchorage or the Matanuska-Susitna Borough. All others were considered rural. The denominators used for periods greater than one year were the sum of the estimated populations for each year.

2.2. Hepatitis A virus infection surveillance

Cases of acute hepatitis have been reportable to the Alaska SOE since statehood; specific hepatitis types, including HAV infections, have been reported to the Alaska SOE since 1974 [15]. A confirmed case is defined as an acute illness with discrete onset of symptoms and with the presence of jaundice or elevated aminotransferase levels, and either a serologically confirmed immunoglobulin M (IgM) antibody to HAV or an epidemiological link to a person who has laboratory-confirmed HAV [16]. During the time period of interest, 1972–2007, HAV cases were reported to the Alaska SOE by health care providers and by laboratories including the Alaska State Virology Laboratory, Alaska Native Medical Center, and out-of-state commercial laboratories. Demographic data collected included age group, location of exposure, race/ethnicity, and region of residence.

The age group variable identified age in 5-year increments from 0 to 89 years of age. These were collapsed into age categories of 0–14, 15–24, 25–44, and 45 and older for analysis. The location of exposure was categorized as exposed within Alaska or exposed outside of Alaska (imported case); race/ethnicity was categorized as AN, other, and unknown; and region was categorized as Anchorage/Matanuska Susitna Valley, Gulf Coast, Interior, Northern, Southeast, and Southwest regions.

2.3. Vaccine coverage

Estimated vaccine coverage with hepatitis A vaccine among children 24–35 months of age was reported by the National Immunization Survey for the United States and individual states during 2003–2005. Data tables for the National Immunization Survey were downloaded [17]. In addition, estimated hepatitis A vaccination coverage was provided from the 2006 National Immunization Survey (Written communication, CDC).

2.4. Statistical methods

Yearly incidence rates of HAV were reported by age, AN race, and region for 1972–2007. We calculated mean incidence for five time periods: three pre-licensure periods (early, 1972–1982; middle, 1983–1993; and late, 1994–1995), early vaccine implementation period (1996–2001), and the routine vaccination period (2002–2007) following school requirements for HAV vaccination. Comparisons between AN and non-Native people were reported with a relative risk (RR), 95% confidence interval (95% CI) and *P*-value for significance testing.

2.5. Imported cases

Alaska SOE classified HAV cases as “imported” when investigation of the case revealed that exposure occurred outside of Alaska. No evaluation of the completeness of reporting of the exposure location has been performed; however, it is likely that the few cases occurring after routine vaccination were more carefully evaluated than cases occurring during peak HAV incidence years.

3. Results

3.1. Hepatitis A virus disease rates

Prior to routine hepatitis A vaccination in 1996, the average yearly incidence of HAV infection in Alaska was 60 per 100,000 persons, with a high of 386.9 during an epidemic year and a low of 3.4 during an inter-epidemic year. In the pre-vaccine period