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Original Research

Factors associated with mothers not vaccinating their children against mumps in Japan

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ARTICLE INFO

Article history:

Received 3 September 2014

Received in revised form

5 November 2015

Accepted 2 March 2016

Available online xxx

Keywords:

Mumps vaccine coverage in Japan

Predictors of vaccine acceptance

Vaccination in Japan

Mumps

Maternal awareness

Health belief model

Health behaviour

ABSTRACT

Objectives: In Japan, mumps immunization is not mandatory, and the prevalence of mumps immunization among eligible children is only about 30%, raising concerns about increased risk of meningitis, encephalitis and deafness caused by mumps. In 2011, to understand why families are not voluntarily immunizing their children against mumps, we surveyed mothers who were university graduates to examine the factors and barriers influencing mumps vaccination in Japan.

Study design: A cross sectional design.

Methods: We sent questionnaires including questions on demographic data and vaccination status, barriers and factors for immunizations to university alumnae to recruit participants. Data were analysed by Student's t-test for continuous variables and by univariate and multivariate analysis to obtain the odds ratio and adjusted odds ratio.

Results: Two hundred and twenty-six mothers with children responded with an average (range) age of 44.7 years (SD = 5.02; 30–55 years). Adjusted odds ratios (aOR) from logistic regression analysis identified fear of harmful side-effects (aOR, 2.55; 95% CI, 1.10 to 5.89), the vaccination not being mandatory (aOR, 3.30; 95% CI, 1.41 to 7.72), perceived non-efficacy (aOR, 6.21; 95% CI, 1.85 to 20.91) and being busy (aOR, 3.30; 95% CI, 1.21 to 9.01) were significantly and inversely associated with mumps vaccination. Recommendations from family doctors (aOR, 0.35; 95% CI, 0.17 to 0.71), living abroad when their children would be vaccinated (aOR, 0.10; 95% CI, 0.02 to 0.68) and the maternal age (aOR, 0.91; 95% CI, 0.85 to 0.96) were significant and positively associated with vaccination.

Conclusions: In the absence of mandatory vaccinations, a public education campaign about mumps, their potential consequences and the nature and value of vaccination could improve the prevalence of mumps vaccination among children and prevent the consequences of this disease.

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<http://dx.doi.org/10.1016/j.puhe.2016.03.002>

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Introduction

In Japan, the national immunization program (NIP) covers measles, rubella, poliovirus, DTPI (diphtheria, tetanus toxoids and cellular pertussis) and DTII (diphtheria and Japanese encephalitis). DTPI and DTII became mandatory in October 1994. These vaccination requirements have been adopted for decades, but the implementation delay had been called a vaccine gap. In 2012 a new preventive immunization law was adopted and OPV (Oral Polio Vaccine) was switched to IPV (Inactivated Polio Vaccine) and influenza virus type b, pneumococcus and human papilloma virus vaccines were added in 2013, followed by chicken pox vaccine in 2014. Children take measles and rubella single-dose vaccines separately or in combination as an MR vaccine.

However, immunizations for influenza, mumps and hepatitis A and B are neither in the national immunization program nor mandatory. Parents must pay for these immunizations if they choose to have their children vaccinated. There is national surveillance data for NIP but not for non-mandatory immunizations; precise childhood immunization rates for these non-mandatory immunizations are unknown but believed to be low at between 5% and 50%.^{1–3}

In 1989 domestic produced MMR (Kitasato AIK-C measles, Biken's Urabe Am9 mumps and Takeda To336 rubella) was introduced as part of NIP, followed by Takeda MMR (Schwarz FF8 measles, Torii's mumps and To336 rubella), Kitasato MMR (Kitasato AIK-C measles, Hoshino mumps and Takahashi rubella) and Biken MMR (Tanabe measles, Urabe Am9 mumps and Matsuura rubella).⁴ However, after being vaccinated for MMR, three children died, four were disabled, and 1032 need treatment for adverse events of aseptic meningitis.^{5,6} The incidence of aseptic meningitis was reported to be from 1 in 500 to 900 vaccines to 1 in 1200.^{5,7} There was concern that mumps vaccines contained in MMR vaccines caused these adverse events; the Ministry of Health, Welfare and Labour conducted nationwide surveys and tested mumps viruses isolated from cerebrospinal fluid for their relatedness to the mumps vaccine by nucleotide sequence analysis.^{8,9} As a result of these surveys and tests, the Urabe strain included in mumps vaccines was identified as the cause of the incidents. In 1993, the MMR was subsequently withdrawn from NIP in Japan.^{5,6} In the UK, the MMR containing Urabe Am9 was withdrawn in September 1992 after many meningitis cases were reported.¹²

In Japan mumps vaccination became voluntary after that. Single dose vaccines of the Hoshino-L32 and Torii strain have been consistently provided up to now for over 20 years⁵ and the coverage rate of mumps vaccinations subsequently dropped from almost 90% to about 30–50%.^{6,9,10}

Currently MMRII, containing the Jeryl Lynn strain (Merck Sharp & Dohme) is widely used worldwide;¹² more than 400 million doses of MMRII have been used in 72 countries as combination vaccines. The incidence of aseptic meningitis from the Jeryl Lynn strain ranges from as low as zero,^{13–15} or 1 in a million,¹⁶ to 1 in 150,000.¹⁷ In Japan, the MMRII vaccine is not officially authorized by the Ministry of Health, Labour, and Welfare. The incidence of aseptic meningitis of the single dose mumps vaccines currently used in Japan are estimated to be

400 in 1 million doses for the Hoshino-L32 strain and from 100 to 600 in 1 million doses for the Torii strain, which are not as low as we expected.^{18,19} To improve the mumps vaccination rate, a national government subsidy and policies are necessary and the vaccine must be included in NIP. However, there are no guarantees that cases of postvaccination aseptic meningitis will be reported. It will be necessary to review the safety of the current mumps vaccinations available in Japan and to introduce new and safer vaccines if possible.

The World Health Organization (WHO) recommends including mumps vaccinations in national immunization programs in their position papers, but as of 2016, Japan has not done so.²⁰ Currently for mumps vaccinations, two MMR doses have been adopted worldwide and 120 among 194 WHO member countries provide more than two MMR doses while 11 countries provide one MMR dose as of 2014.²¹ Among 34 OECD member countries, only Japan does not include mumps vaccine or MMR in NIP. In nearby Asian countries, Hong Kong, China and the Republic of Korea adopt two MMR doses and the People's Republic of China (PRC) one dose.²¹ Due to the widespread of mumps vaccines in the world, reported cases of mumps in the world are mainly from the PRC and Japan (Fig. 1).

This low rate of mumps vaccinations among eligible children in Japan is a public health concern. In 2006, 1.18 million cases of mumps were reported in Japan. Currently, annual estimates are more than one million cases, with about 60% being children between 0 and 6 years old and the other 40% is a large population including grownups.²² In the US, the annual incidence rate of mumps for children 5–9 years old is only 7 per 100,000 children among vaccinated children but 6205 per 100,000 children for those not vaccinated.²³

The increasing complications from mumps, including meningitis, encephalitis and deafness, are also a public health concern in Japan.^{24,25} The correct numbers of these complications in Japan are unknown due to lacking a large national database for collecting and managing the data, but previous studies reported that 13 out of 1051 natural mumps cases derived meningitis¹⁸ and approximately 1800–2000 natural mumps cases caused deafness annually in Japan.^{22,24,26}

Under this low mumps coverage rate in Japan, it is necessary to understand the barriers and factors influencing children's mumps vaccination rates from a wide range of perspectives, but there have been no published studies conducted to identify determinants for increasing mumps vaccinations in Japan. Studies suggest that maternal awareness including health belief model factors influence children's vaccination increases,^{27–30} but we believe other factors are specific to Japan. In Japan, it is common for mothers to take their children to be vaccinated. Accordingly, we surveyed a group of mothers to determine what factors influenced their decisions to have their children vaccinated including the change in maternal consciousness from the 1990s when the mumps vaccination rate was 90% to today where the rate has dropped more than half.

Methods

As there was no national database about non-mandatory immunization available in Japan, we decided to survey a

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