Short communication

Universal measles-mumps-rubella vaccination to new recruits and the incidence of mumps in the military

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ARTICLE INFO

ABSTRACT

In response to the resurgence of mumps, the Korean Armed Forces started the measles-mumps-rubella (MMR) vaccination to all new recruits regardless of prior vaccination history. We evaluated the effectiveness of the vaccination by comparing the incidence between the military and civilian populations before and after implementation of the new policy. The standardized incidence ratio of mumps in the military was 7.06 in the prevaccine period, which declined to 0.96 in the postvaccine period. Vaccine effectiveness was estimated at 86.4%. Incidence rate ratio was lower in the 1996–1998 birth cohort (BC) compared with 1989–1995 BC (0.10 vs. 0.55), suggesting higher effectiveness of vaccination in the 1996–1998 BC. Our data provide evidence for the use of the MMR vaccination in the prevention of mumps in high-risk adults.

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1. Introduction

Mumps is a viral infection that causes fever and painful swelling of the salivary glands. Although its clinical course is usually mild and self-limited, mumps sometimes causes severe complications including orchitis and meningitis [1]. While the incidence of mumps has declined dramatically after the widespread use of mumps vaccine [2], multiple occurrences of outbreaks among highly vaccinated populations have been observed in the postvaccine era [3]. Such outbreaks commonly occur in young adults in congregated settings, as with recent epidemics in multiple college campuses in the United States [4]. The resurgence of mumps has been attributed to waning immunity and the relatively low effectiveness of vaccines.

In Korea, the measles-mumps-rubella (MMR) vaccine was added to the National Immunization Program in 1985. Two-dose MMR vaccination has been recommended since 1997, and the vaccination record became mandatory for primary school entrance in 2001. Despite these measures, the incidence of mumps has increased since 2007 and a large epidemic occurred in 2013 [2]. In response to the reemergence of mumps, the Korean Armed Forces implemented universal MMR vaccination to all new recruits

in 2012. We examined the incidence of mumps before and after the universal MMR vaccination in military personnel.

2. Material and methods

All male citizens who are medically fit are required to serve in the military for 21–24 months between ages 18 and 31. Thus, the Korean military is a mobile population with a fixed size of which a relatively constant number are replaced by new recruits each month. Herd immunity in the military acquired by natural outbreak would not be maintained since those who develop immunity will leave the military within two years at most. Starting in 2012, the Korean Armed Forces has vaccinated all new recruits with the MMR vaccine regardless of prior vaccination history. Jeryl Lynn or RIT 4385 strains of the mumps virus are included in the vaccine.

Mumps is a notifiable disease in Korea. Cases in civilians are reported to the Korea Centers for Disease Control and Prevention (KCDC), while military cases are reported to the Armed Forces Medical Command. The age-specific incidence of mumps in male civilians aged 18–31 was obtained from the Infectious Diseases Web Statistics System of the Korea Centers for Disease Control and Prevention (http://is.cdc.go.kr). As the epidemiology of mumps in highly vaccinated countries shows occasional resurgences, we determined that the before-and-after design would be vulnerable to the shift in background incidence. Thus, we examined the ratio of incidence rates of mumps in the military against those in the civilian population. As the age-specific incidence of mumps in
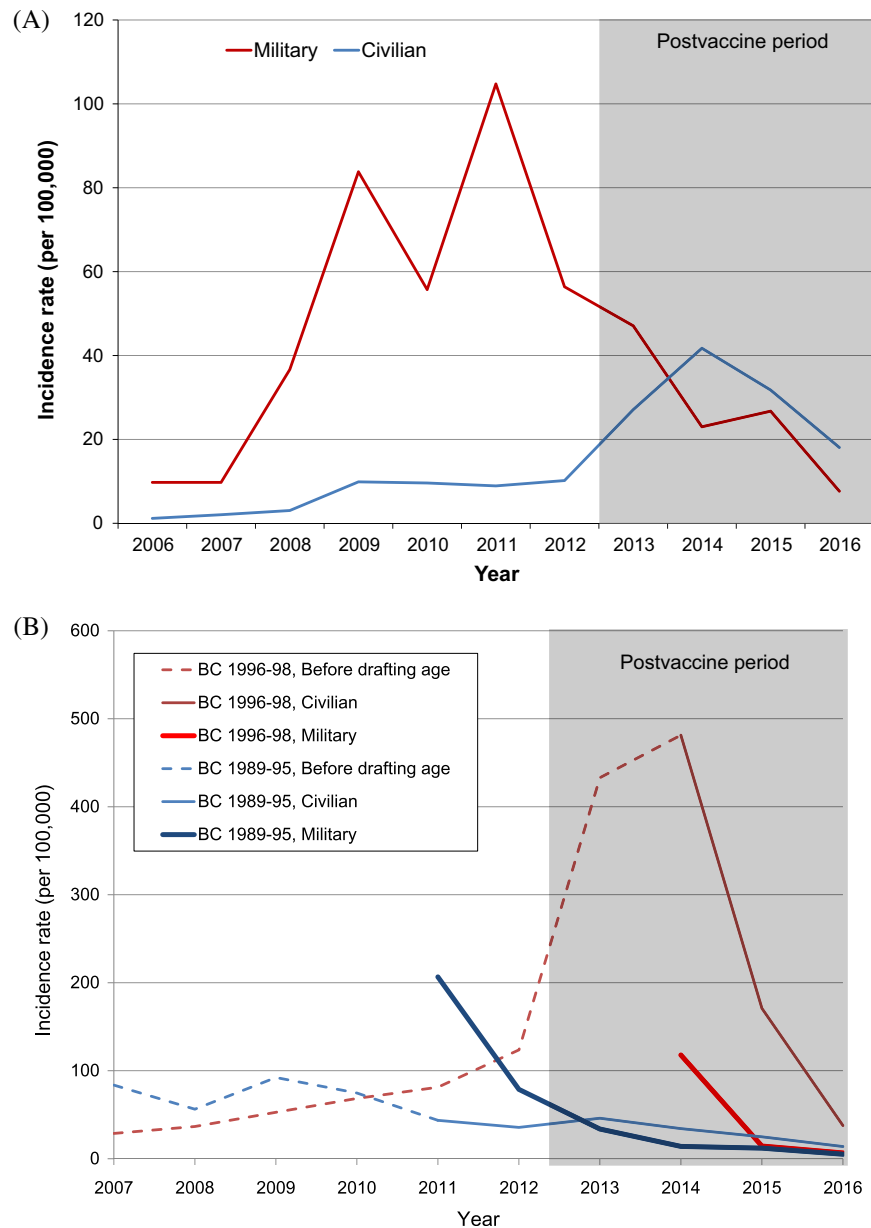
(A)

(B)

Fig. 1. (A) Overall annual incidence rates of mumps in the military and civilian populations. (B) Age-standardized incidence rates in the birth cohorts (BCs) 1989–95 and 1996–98. Incidence rates before a given BC reaches the minimum age for military service (dotted lines), in civilians after reaching the age (thin solid lines), and in the military (thick solid lines) are shown.

Table 1
Incidence and vaccine effectiveness of mumps during prevaccine and postvaccine periods in the military and in civilian population. Incidence rates are shown as the annual number of cases per 100,000 population. Standardized incidence ratio was calculated by dividing the actual incidence rate by the expected incidence rate in the military that was estimated from the age-specific incidence rate in civilian population (indirect standardization). Incidence rates in specific birth cohorts were age-standardized by direct method.

		Overall		1989–1995 birth cohort	1996–1998 birth cohort
		Prevaccine (2007–2011)	Postvaccine (2013–2016)	Postvaccine (2013–2016)	Postvaccine (2013–2016)
Incidence rate (Mean annual population, thousands)	Military	58.14 (420)	26.23 (406)	16.25 (348)	28.11 (347)
	Civilian	6.68 (5170)	29.70 (4943)	29.79 (2468)	280.86 (1097)
Standardized incidence ratio (95% CI)		7.06 (6.67–7.46)	0.96 (0.88–1.06)		
Incidence rate ratio (95% CI)				0.55 (0.51–0.58)	0.10 (0.09–0.11)
Vaccine effectiveness (%, 95% CI)[a]		86.4 (84.1–88.2)			

[a] Effectiveness was calculated as $[1 - (SIR_{post}/SIR_{pre})] \times 100$. SIR_{post}, standardized rate ratio in postvaccine period; SIR_{pre}, standardized rate ratio in prevaccine period.