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Impact of rotavirus vaccine on diarrheal hospitalization and outpatient consultations in the Philippines: First evidence from a middle-income Asian country

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ABSTRACT

Background: Monovalent rotavirus (RV) vaccine was introduced in the Philippines in a phased manner beginning in 2012. To assess the impact of RV vaccine, we conducted a retrospective review of diarrheal admissions in two hospitals.

Methods: Records of physician-diagnosed diarrheal admissions were reviewed in D.O. Plaza Hospital (DOPH) from 2009 to 2016 in Agusan del Sur where RV vaccine was introduced in the immunization program; and in Cotabato Regional Medical Center (CRMC) from 2011 to 2016 in a region where the vaccine was not introduced. Reports from consultations in public health clinics in Agusan Del Sur and RV vaccine coverage were obtained.

Results: All-cause diarrheal admissions among children <5 years old in DOPH declined from 2013 to 2016 following RV vaccine introduction in 2012. Using the 2009–2011 mean number of hospitalizations as baseline ($\overline{X}$ = 1,141), the reductions were 28% (n = 821), 56% (n = 507), 63% (n = 417) and 59% (n = 466) in 2013, 2014, 2015 and 2016, respectively. In comparison, no substantial declines in diarrheal hospitalizations were seen in CRMC from 2011 to 2016. A declining trend was also seen in outpatient consultations in Agusan del Sur following RV vaccine introduction with declines of 27% (n = 2,333), 33% (n = 2,143), 45% (n = 1,764) and 67% (n = 1,059) in 2013, 2014, 2015 and 2016. From September 2012 to December 2016, the 1 and 2-dose RV vaccine coverage gradually increased from 5% and 4% in 2012 to 92% and 88% in 2015, but decreased in 2016 to 53% and 52%, respectively.

Discussion: RV vaccine introduction was associated with a substantial decline in diarrheal hospitalizations and outpatient consultations for diarrhea in Agusan del Sur, Philippines.

1. Introduction

Globally in 2015, diarrhea ranked as the fourth leading cause of death among children under 5 years of age [1] and the fourth leading cause of disability in this age group [2], resulting in 499,000 deaths [3]. In the Philippines in 2013, diarrhea accounted for 5169 estimated deaths among children under 5 years, comprising 7.3% of all deaths in this age group [4].

Rotavirus (RV) was the most common cause of diarrheal death globally in 2015, accounting for an estimated 146,000 deaths among children under 5 years old [3]. In the Philippines, it was estimated that in 2013, RV was responsible for 3.7% of all deaths among children under 5 years or 2599 deaths [5].

Because of the substantial burden of RV diarrhea, the World Health Organization (WHO) has recommended inclusion of RV vaccine in national immunization programmes of all countries globally since 2009 [6]. In July 2012, the Philippines added RV vaccine to its immunization program and made the monovalent RV vaccine (Rotarix®, GlaxoSmithKline) available free-of-charge

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to infants of families belonging to the lowest economic quintile. However, prior to nationwide introduction, policymakers requested further evidence on the effect of the introduction of RV vaccine in the Philippines. The Department of Health (DOH) identified the province of Agusan del Sur to conduct an effectiveness study due to the high number of diarrhea hospitalizations in young children, the capacity for surveillance and the relatively lower than average socioeconomic status of households in the province.

In Agusan del Sur, RV vaccine became available to the poorest quintile in September 2012, and in January 2013, availability was expanded to all age-eligible children in two municipalities, San Francisco and Prosperidad, and in July 2014 to the whole province. The two-dose course of RV vaccine is given to infants aged 6 weeks and 10 weeks. We assessed the impact of RV vaccine introduction in the province of Agusan del Sur by comparing diarrheal hospitalizations and deaths in the provincial public hospital and outpatient consultations for diarrhea in public health centers, before and after the introduction of RV vaccine. We also compared diarrheal hospitalizations in the Agusan del Sur provincial hospital with those in Cotabato Regional Medical Center (CRMC), where RV vaccine was not yet introduced in public health clinics.

2. Methods

2.1. Population and setting

Agusan del Sur is a land-locked province in the northern part of the island of Mindanao and has 13 municipalities and one city (Fig. 1). It is one of the most impoverished provinces in the Philippines with 58% of the population living below the poverty line [7]. D. O. Plaza Hospital (DOPH), located in the municipality of Prosperidad, is the biggest public, tertiary hospital, catering to the population of Agusan del Sur along with portions of another province, Surigao del Sur. A review of DOPH data from 2007 to 2012 indicate that approximately 70% of diarrhea cases seen in DOPH were from the municipalities of Prosperidad and San Francisco in Agusan del Sur.

CRMC in Cotabato City is a tertiary training and teaching hospital serving Cotabato City and North Cotabato. Cotabato City is located on the central and western part of the island of Mindanao and North Cotabato is adjacent to the city (Fig. 1). In 2012, the poverty levels of North Cotabato and Cotabato City were 42% and 44% [8]. CRMC has been a sentinel site for RV surveillance since June 2013, and registered the second highest number of cases in the surveillance with 251 cases in 2013 (second to DOPH).

2.2. Eligibility and data collection

Patient records were eligible for inclusion if the patients: (1) presented with diarrhea and were diagnosed as acute gastroenteritis or acute diarrhea by physicians, (2) were <5 years of age at the time of diagnosis, and (3) were residents of Agusan del Sur admitted between January 1, 2009 and December 31, 2016 (for DOPH) or were residents of Cotabato City or North Cotabato province and admitted between January 1, 2011 and December 31, 2016 (for CRMC). We excluded patients who had nosocomial diarrhea and those with chronic diarrhea. A uniform data extraction form was used for identified cases and entered in an electronic database (Microsoft® Excel for Mac 2016 ver. 15). The following information was collected: demographic profile (age, sex, address/location) and clinical profile for hospitalized cases (date of admission or outcome, degree of dehydration, length of hospitalization).

In addition, for Agusan del Sur, reports from the Field Health Service Information System (FHSIS) of the Epidemiology Bureau of the DOH were obtained. FHSIS collates data on national programs of the DOH (e.g., child care, immunization, family planning use, etc.) in public clinics. Data from public community clinics called Barangay (community) Health Stations and Rural Health Units across the country are aggregated per clinic and submitted to FHSIS regularly. No individual-level information from the clinics was available. From this database, we obtained the number of children with diarrhea given oral rehydration therapy (ORT/ORS) with or without zinc and immunization coverage for the province as a whole, and disaggregated by municipality.

2.3. Data analysis

2.3.1. Trends in diarrheal hospitalizations in DOPH

Demographic and clinical characteristics of hospitalized all-cause diarrhea admissions were tabulated. For DOPH, the number of cases during the pre-vaccine introduction (baseline) period (from January 2009 to December 2011) was compared to the number during the post-introduction period (from January 2013 to

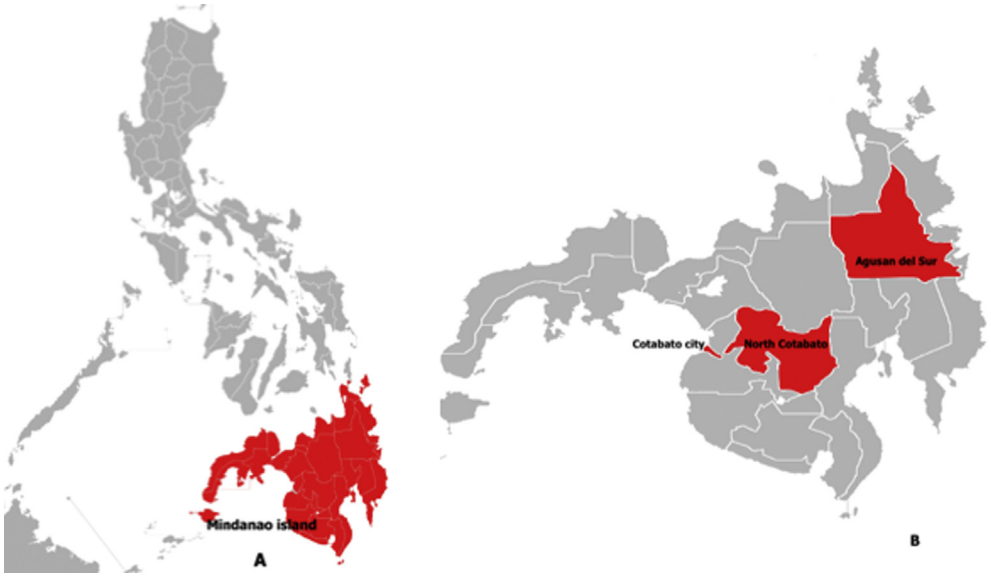

Fig. 1. Study sites: Location of the island of Mindanao in the Philippines (A); Location of Agusan del Sur, served by D.O. Plaza Hospital and Cotabato City and North Cotabato, served by Cotabato Regional Medical Center (B).

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