Review

When, and how, should we introduce a combination measles–mumps–rubella (MMR) vaccine into the national childhood expanded immunization programme in South Africa?

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A B S T R A C T

This article briefly reviews the history and epidemiology of measles, mumps and rubella disease and the case for introducing combination measles–mumps–rubella (MMR) vaccine into the national childhood immunization schedule in South Africa. Despite adopting the World Health Organization’s Measles Elimination strategy in 1996 and achieving a significant decrease in the incidence of measles, added effort is needed in South and southern Africa to reach the goal to eliminate endogenous spread measles. Mumps is still common disease of childhood and while there are few sequelae, even the rare complications are important in large populations. Congenital rubella syndrome is seldom reported, but it is estimated that of the million or so children born every year in South Africa over 600 infants are affected to some degree by rubella infection. The naturally acquired immunity to rubella in women of childbearing age in South Africa has been estimated at over 90%, so that introducing a rubella containing vaccine in childhood may paradoxically increase the proportion of girls reaching puberty still susceptible to rubella. The elimination of endogenous measles and rubella is being achieved in many countries in South America, and despite the recent measles epidemic, must still be seriously considered for South and southern Africa. Current constraints and potential steps needed to reach the goal in South Africa are discussed.

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1. Introduction

After polio eradication the one of the most sought after goals in child health is the elimination and eradication of measles together with rubella and eventually mumps. The achievements of the World Health Organization, of the Pan American Health Organization and many other country immunization programmes, of UNICEF, of Rotary, of the vaccine manufacturers, of the researchers and of the major donor organizations over the past three to five decades gives good cause to hope, that elimination and eradication of these four diseases within the next three to five decades is indeed more likely than it is not. MMR vaccine is one of the keys to such success.

2. Measles

“Count your children after the measles has passed” is an old Arabic proverb. The disease was described as distinct from small pox by the Persian physician Rhazes in the 10th century as “more dreaded than smallpox” [1]. The devastating nature of measles in previously unexposed populations, also in the Cape Colony in the 18th century, as described by Drutz and Morley, confirms this observation [2,3]. In the pre-vaccination era measles was estimated to cause six million deaths per year mostly in developing countries [4]. More recently WHO estimates of measles deaths globally have dropped from 733 000 in 2000 to 164 000 in 2008 and the aim to eliminate measles in six out of five WHO regions by 2020 does seem feasible [5].

Measles vaccine was officially introduced into the national immunization programme in South Africa in September 1975 and MMR vaccine into the private sector about the same time. From 1981 to 1990 there were between 15 000 and 22 000 clinical cases, and between 250 and 500 deaths, notified annually. In 1990 the Health Department at the time undertook a mass measles campaign and in 1991 the cases dropped to 4777 and the deaths to 29. In 1992, however, the number of measles cases rebounded, in slightly older children, with almost 23 000 cases and 53 deaths [6].

Following a WHO assisted review of the national immunization programme in South Africa in December of 1993 there was a significant strengthening of the whole of this programme which became known as the Expanded Programme of Immunization (EPI SA) [7]. The global polio eradication strategy and the measles elimination strategy were adopted, and a combined polio and measles
mass immunization campaign was launched in 1996 involving all children 6 months to under 15 years. This was followed by similar campaigns in 2000, 2004 and 2007 in all children 6 months to under 5 years. The incidence of measles dropped dramatically, with almost no cases or deaths being notified in 1997 and from 1998 to 2003 an average 30 cases a year, and no deaths, were reported. Between 2003 and 2005 there were several outbreaks of measles in the provinces of Gauteng, KwaZulu-Natal and the Eastern Cape with a few cases in the Cape Town area. A total of 1676 cases and 27 deaths were reported [8]. In 2006, 2007 and 2008, there were, respectively, 83, 30 and 40 measles cases were confirmed but no deaths reported to the National Institute for Communicable Diseases [9].

After the first mass campaign in 1996 most young health professionals in the country had never seen a case of measles, until about half way through 2009, when a scattering of reported cases around Pretoria and Johannesburg became a full blown epidemic, peaking in Gauteng in mid-October 2009 and in the rest of the country in mid-April 2010. Professor Lucille Blumberg of the National Institute of Infectious diseases in Johannesburg reported that at least one young doctor was admitted to intensive care with complications of measles. This was the first major country-wide measles epidemic in almost 17 years, with a total of over 18,000 laboratory confirmed cases reported by the time the epidemic tailed out in the middle of 2010 [10].

The response to this epidemic was to move forward the planned mass campaign for measles and polio firstly in Gauteng then to the other provinces, and as older age groups were involved, to include the age groups 6 months to 15 years. The case fatality rate from measles in this epidemic reported by the Western Cape Provincial Health Department on March 16th 2010 was about 1% (8765) [11]. As part of a review of the epidemic and campaign at the National Institute for Communicable Diseases (NICD) in Johannesburg in May 2011 it was recommended more work was needed to expand immunization coverage, to ensure effective information, education and communication and to strengthen surveillance and contact tracing, especially in informal areas around the towns and cities [12].

3. Mumps

Hippocrates described parotitis and orchitis in 500 BC [1]. In the pre-vaccine era, mumps epidemics were reported usually from schools, prisons, ships and military barracks about every 2–5 years. The sero-prevalence of mumps antibodies in pre-vaccine era was between 50 and 90% globally. The introduction of MMR vaccine dropped the incidence of mumps dramatically, though in recent years several epidemics of mumps were reported in university students in the UK and the USA [13,14]. McIntyre and Keen reported on 11,360 cases of viral meningitis investigated in Cape Town between 1981 and 1989 and found that 9% were due to mumps. The average age in this series was 3 years [15]. Complications from mumps such as orchitis (20–50%) and encephalitis (15%) are common but usually with full recovery. Permanent deafness occurs in 1:20,000 cases and is permanent [1]. Mumps is inconvenient and uncomfortable, and costly if admitted to hospital and while the sequelae of mumps maybe rare, in large populations these become significant especially if preventable [13].

4. Rubella

Rubella was first identified as distinct from measles by German physicians in the early 19th century. Rubella like mumps tends to occur in periodic epidemics in pre-adolescent children [1]. Congenital rubella syndrome (CRS) was recognised for the first time in 1940 in Sydney Australia by an ophthalmologist, Norman Gregg, who after overhearing mothers of infants with congenital cataracts share in the waiting room that they had had rubella while pregnant, did a record review and linked an unusual increase of congenital cataracts, and later of congenital heart disease and deafness in infants, to an epidemic of rubella which had spread to the population from a local army camp [16].

The global toll of CRS in 2000 was estimated at 100,000 cases per year [17]. In South Africa, it has been estimated that of the million or so children born in 2005, 654 or 16 to 69/100,000 live births were affected to some degree by congenital rubella infection [18]. Diagnosing congenital rubella is difficult. Those who are picked up early, tend to have a congenital cataract or a serious heart lesion. Sometimes a CRS related defect is only suspected when a child finds school work difficult [19]. So that even if not of widespread public concern, introducing MMR vaccine into the South African immunization programme seems to make sense both from a humanitarian and a cost perspective [20].

Replacing measles vaccine with MMR should not pose significant logistic or health budget problems. Even though the current public tender price for measles vaccine is about US$0.30 a dose in a 10 dose measles vial, and whole sale cost of single dose MMR vaccine to the private sector is currently about US$14.30, the government tender the prices should be closer to UNICEF tender prices—currently between US$1 and US$2 a dose [21]. And despite MR vaccine being half the price of MMR, it seems sensible to use MMR vaccine to avoid both the disease and the rare sequelae. And with more manufacturers starting to make the newer vaccines, the tender prices for rotavirus and pneumococcal vaccines in South Africa are likely to decrease, so that the cost of MMR should not have health budget implications.

Almost 70% (130/193) of other WHO member states have replaced measles vaccine with the combination measles, mumps, rubella (MMR) or measles–rubella (MR) vaccine, the question must be asked, “If there are relatively inexpensive MR or MMR vaccines have been introduced into the childhood immunization programme of majority of countries, why hasn’t South Africa?” [22]. The problem is that unless routine immunization programmes can demonstrate the ability to consistent achieve a high national immunization coverage for measles vaccine in all sub-districts, introducing rubella vaccine to the childhood immunization schedule is likely sooner or later to lead to an increase of congenital rubella syndrome, as has indeed happened in Greece and Brazil [23,24]. Thus demonstrating in practice that partial immunization coverage with rubella vaccine results in an increase in CRS. Schoub et al. have expressed concern that the incomplete coverage of MMR in the private sector will result in more young women susceptible to rubella than before, because the natural spread of the virus is inhibited. They provided serological evidence that the immunity gap for rubella in women of childbearing age using private sector health care, was about 11% compared to 5% in those using the public sector health care, and found that only about 60% of MMR doses needed to cover the estimated 100,000 children who had access private health care were distributed in South Africa in 2007 [18]. Vynnycky et al. have expressed similar concerns about the availability of MMR in the private sector [25].

When introducing a vaccine such as MMR, which has caused controversy in a number of countries, Larson et al. have pointed out that good communication about the science, efficacy and safety of vaccines may not alleviate the anxieties many parents have about immunization [26]. Leach and Fairhead argue that often the need is not primarily about providing appropriate information or even the building of trust, but of learning to engage effectively with parents and communities, and to appreciate that such dialogue is more likely to facilitate than constrain efforts to promote the acceptance of vaccines [27].
So the question should really be: when and how should South Africa introduce rubella containing measles vaccine? Schoub et al. have recommended that the introduction be preceded by a targeted programme especially for schoolgirls, supported by sero-surveillance and be repeated annually for at least the 5 years [18]. In South America, where elimination of endogenous measles has been achieved and there is excellent progress on the elimination of endogenous rubella, the Pan American Health Organization (PAHO) recommends a similar approach: (1) starting off with mass campaign of both males and females (the target group depending on the epidemiology of rubella in the country), reaching coverage levels close to 100%; (2) ensuring the highest political commitment and, through intensive social mobilization, and by encouraging full population participation; (3) careful local micro-planning with a practical information system; (4) capacity to detect and rapidly respond to safety and supply concerns and other emerging issues during campaigns [28].

Once measles vaccine coverage over 85% uniformly in all provinces has been verified for a period long enough to be considered sustainable, measles vaccine should be replaced with MMR vaccine in the childhood immunization schedule at 9 and 18 months, preceded by the kind of process shown to be successful in South America.

While efforts to achieve a uniformly high sustained coverage of measles and other vaccines in South Africa should be continued to be enthusiastically implemented, the following actions should be considered:

1. That a surveillance system for congenital rubella syndrome (CRS) is setup in South Africa, along the lines recommended by WHO [29].
2. That the Southern African Development Community (SADC) should continue strengthen measles control efforts so that the Region can, sooner rather than later, move to a strategy to eliminate the endogenous spread of measles and rubella and mumps based on the South American model [28].
3. That the education, information and communication efforts around measles, rubella and mumps be strengthened and sustained, especially the information that families using private sector health care maybe more susceptible to congenital rubella—needs to be more clearly and effectively communicated [18,25,28].
4. That consideration should be given to adding a MMR vaccine to the national immunization schedule around entry to high school, regardless whether MMR or measles vaccine was given as an infant [18,23].
5. That tertiary educational institutions where a large numbers of young people gather, one dose of MMR vaccine should be strongly encouraged for all students irrespective of immunization history [18,23].

Despite the recent measles epidemic, the goal we set ourselves in South Africa in 1996 to eliminate measles is not that far off. With the new vision to develop a more effective community based primary health care approach, the time does seem right to renew efforts to reach this goal in time to report positively on measles elimination in time for the Millennium Development Goals 2015, and to be well on our way to achieving the same for rubella [30].

**Conflict of interest statement**

None declared.

**References**


