# CHICKENPOX IN GHANA: IS IT TIME TO CONSIDER UNIVERSAL IMMUNIZATION?

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## Summary

Chickenpox is a very common disease worldwide. It is one of the most frequently reported infectious diseases in North America. Although childhood varicella disease is not usually a life-threatening condition, it can cause major financial and social problems to parents and society from lost working time spent looking after sick children. Besides, there is a large number of unrecognized complications including fatalities from invasive infections. The availability of an effective vaccine, has made universal immunization a cost-effective approach to prevention and minimizing the effects of the disease in some settings. The exact burden of the disease in Ghana and for that matter most of Africa is unknown. Thus, in Ghana, a surveillance system and selective immunization is recommended as more information is gathered on the burden of disease and its impact on Ghana and the rest of Africa.

***Keywords : Chickenpox, immunization, morbidity, Vaccination***

## Introduction

Chickenpox or Varicella is a very contagious disease which occurs worldwide[1,2]. It is one of the most frequently reported infectious diseases in North America and it impacts on the practice of Internal Medicine, Family Medicine, Paediatrics and Obstetrics. The minimum estimated number of individuals affected by varicella globally each year is 140 million cases, with severe complications
necessitating hospitalization occurring in 4.2 million and an estimated 4,200 deaths[1,2].

In 2008, 77,790, cases of chickenpox representing 0.7% of total outpatient morbidity were reported by the Ghana Health Service[3]. In 2002, 2003 and 2004, it was 35,667 (0.5%) 19,614 (0.3%) and 45,512 (0.6%) respectively, suggesting a gradual rise in the contribution of chicken pox to outpatient morbidity[3]. Unfortunately, more recent facility-based or population-based figures for Ghana are unavailable. However, chickenpox remains a problem in Ghana.
According to a report in 2003, chicken pox was among the top ten leading causes of out-patient attendance at the 37 Military Hospital in Accra[4].

In 2014, it was reported to be endemic in the Agona West municipality of Ghana[5]. A news article also reported an outbreak of chickenpox in a prison population in Ghana, which was difficult to control that same year. Although in most cases, childhood varicella disease is not a life- threatening condition, it can cause major financial and social problems to parents in lost working time spent looking after their sick children,
while the children themselves suffer from the disease and lose valuable time away from school[6].
Besides medical costs, infection in some previously healthy children, adolescents and adults can be complicated by serious secondary bacterial infections[1,2,7].

Historically, in the late 19th and 20thcenturies, outbreaks of chicken pox occurred close in time with outbreaks of scarlet fever in the USA[8]. Severe invasive disease became the subject of reports in the late 1980's and the 1990's[7,9,10]. Since the development of a vaccine against the disease in 1974 and commencement of universal varicella immunization in the USA in 1995, varicella disease has assumed global significance[2,11]. Introduction of the vaccine has led to significant reductions in varicella incidence, morbidity, mortality, hospitalisations and ambulatory visits in the population and in vulnerable groups[11,12,13]. Thus, some countries are reviewing the evidence for universal varicella immunization in their own setting[14,15]. This review looks at the evidence for universal varicella immunization in an African country, like Ghana. We searched google, google scholar, PubMed and Scopus for literature on the subject using search terms such as chicken pox, chickenpox, varicella, vaccine, vaccination, immunisation, cost-effectiveness, Accra, Ghana, Africa.

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Conflict of Interest : none declared

## Literature Review

Although in the majority of healthy children, chicken pox resolves with no complication, it has been associated with 2-3 hospitalisations per 1000 cases and 1 death per 60,000 cases[16]. The disease is characterised by a mild prodrome, prominent in adults, and a vesicular rash[16]. However, complications such as secondary bacterial infection, aseptic meningitis, encephalitis with cerebellar involvement and pneumonia, (viral or

bacterial), may occur. Rare complications include thrombocytopenia, arthritis, orchitis, uveitis, iritis, hepatitis, glomerular nephritis, pupura fulminans, transverse myelitis, Reyes syndrome and Guillian Barre syndrome[2,16]. Though the risk is low, Congenital Varicella Syndrome characterised by low birth weight, limb hypoplasia, skin scarring, eye and neural defects can occur after infection in the first 20 weeks of pregnancy[2,16]. Maternal varicella zoster virus (VZV) infection with a rash occurring 5 days before delivery and 2 days after delivery may result in severe disease in the neonate and mortality in 30%[16]. These neonates, patients older than 15 years, infants less than 1 year and immune-compromised individuals are most at risk. The virus remains latent after infection and may cause Herpes Zoster (shingles) later in life when immunity falls.

Chicken pox is regarded as the single largest risk factor for the development of invasive group A Streptococcal (GAS) infection in otherwise well children, with published rates of between 6-37% of total cases[7]. In the majority of cases an obvious source of infection, often the skin was found. In their study to describe the incidence and clinical features of invasive group A streptococcal infection in Ontario Canada, and determine the risk of invasive GAS infection following chickenpox, Laupland et al found the incidence to be 1.9 per 100,000 childrenper year, with 15% of children identified to have preceding chicken pox infection, all under the age of ten years[7]. The incidence of invasive group A Streptococcus was 58 times greater in patients with a history of varicella infection in the preceding two-week period compared with those without. Bacteremia without focus was one of the least common presentations[7]. Streptococcal Toxic Shock Syndrome (STSS) as well as invasive Group A Streptococcus (GAS) have been well described[7,17].

Group A streptococcus causes cellulitis, necrotizing fasciitis, septic arthritis, pneumonia, streptococcal toxic shock-like syndrome, meningitis and bacteremia. Case-fatality rates in the Laupland study were 56% for Streptococcal Toxic Shock Syndrome, 10% for Necrotizing Fasciitis, and 4% overall[7]. The presence of chronic underlying illness other than asthma was associated with death (relative risk [RR]: 11; 95% confidence interval [CI]: 2.4-45). In their conclusion Laupland et al suggested that childhood invasive GAS disease occurs at an incidence similar to the adult population and that Chickenpox dramatically increases the risk for acquiring invasive GAS disease[7]. They recommended thatuniversal chickenpox vaccination could potentially prevent up to 15% of all pediatric invasive GAS disease. Data from the Strep-EURO surveillance program estimated the incidence of invasive GAS infection as 3.5 per 100,000/year in England, Wales and Northern Ireland and 3.6 per 100,000/year in Scotland[18]. Within Europe, trend patterns vary markedly, but they suggested an overall increased incidence over the past two decades.

While practicing in the UK, the corresponding author was involved with the management of two children who developed invasive streptococcal infection following VZV infection which has since been published[19]. Both children, whowere from the same daycare facility, presented within 14 days of each other. One survived but required intensive care at a tertiary Paediatric Intensive Care Unit. The other did not survive. Following the incident, a ten-day course of oral penicillin was prescribed to all children attending the child care facility, and all children older than a year with no previous history of VZV were vaccinated. Health alerts were sent to all general practices and accident and emergency departments within the region.

Meningitis is a significant cause of mortality in Ghana and most of Africa. "The African meningitis belt" in sub-Saharan Africa, a region that extends from Ethiopia to Senegal, is particularly vulnerable to meningococcal disease epidemics during the dry harmattan season[20,21]. Other studies have found pneumococcalmeningitis due to streptococcus pneumoniae to be the most important causative agent of bacterialmeningitis in certain areas of the belt[22,23]. The association between Group A streptococcus and Staphylococcus aureus has been consistentlyreported, but one between Streptococcus pneumonia or meningococcus and Chickenpox has not been established[7,9,10]. Howeverisolated cases of pneumococcus and chickenpoxhave been reported[10]. Sincechickenpox causes mucosal damage thatcouldpredispose to invasive pneumococcal or meningococcaldisease, itwouldbeintriguing to examine the epidemiology of chickenpox in the meningitisbelt to determinewhether, likescarletfever, thesediseases are related. Mortality from chickenpox, and its relationship with invasive Group A Streptococcus (GAS) have not been studied extensively in Ghana but it does not mean the relationship as established in the West does not exist. Ghana, like the rest of Africa, has several risk factors for severe chicken pox disease[24]. Theseinclude, the high prevalence of HIV disease, overcrowding in big cities, weak health systems to manage complications and the occurrence of the disease at an older age than it occurs in the West[24]. While varicella associated morbidity and mortality in Africa is currently under review, a review of varicella seroprevalence in Singapore, Malaysia, Philippines, Thailand and India, showed a low seroprevalence in children and greater susceptibility in adolescents and young adults[25]. A seasonal prevalence was reported in India with most cases occurring in the cooler months. Data from Latin America and the Caribbean's on the other hand revealed that, children were most affected with an incidence of 42.9 cases in under 15-year olds per 1000 individuals per year[26]. The general admission rate was 3.5 per 100,000 population. In Turkey, varicella-related hospitalizationwas 5.29-6.89 per 100,000 in all children between 0-15 years with most cases occurring in children under five years, in spring and summer months[27]. Universal varicella

immunization is practiced in Turkey, Taiwan and Japan[13,27,28]. Prior to this, vaccination coverage was found to be higher in some high-income households in Japan[28].

Currently, two live attenuated virus vaccines, Varilrix and Varivax, containing the Japanese varicella virus strain Oka, are in use and both have been found to be safe and highly immunogenic[1,2]. They can be given as a single dose, though a two-dose regimen is recommended to prevent breakthrough disease[1,12,13]. It is available as a monovalent vaccine or in combination with MMR (measles-mumps-rubella vaccine). The side effects are minor, and the common ones are redness, pain and a rash at the injection site[1,11]. Vaccine failure leading to school outbreaks involving immunized children has also been noted[1,13]. Presently in Ghana, the vaccine is being administered at the government's special vaccination centre and a few other private immunization centres mainly to people who need to meet their requirements for travel.

Before vaccine licensure in the United States, about 4 million cases per year resulting in nearly 10,000 hospitalisations and 100 deaths occurred[11,29]. Children bore the brunt of the health burden, accounting for more than 46% of deaths[12]. The risk of severe complications and death was highest among infants, adults, and immuno-compromised individuals[12,30,31,32]. Moreover, complications and deaths were commonly described among previously healthy individuals[33].

Currently, the worldwide epidemiology of varicella has changed dramatically since the introduction of the varicella vaccine in 1995. In the United States and Canada, routine childhood immunization has reduced disease incidence, complications, hospital admissions, and deaths in children and in the general population, indicating strong herd immunity. Several other countries, including Uruguay, Germany, and Australia, have adopted similar immunization programs[13,34]. Other countries like the UK have a selective vaccination policy which means that immunization is only offered to high risk groups such as non- immune health care workers and household contacts of the immuno-suppressed[15].

There are several reasons for the reluctance to introduce universal vaccination of varicella vaccine although a safe and effective vaccine exists. The reasons for this includes, the cost involved, fear of an increase in the incidence of Herpes Zoster due to reduced exposure to the virus and an upward shift in the age of reported cases to older age groups which increases the propensity for severe disease[1,11,13,15]. In addition, it depends on public health priorities and the general perception among both the public and health workers,since they may see chickenpox as a mild disease and value natural immunity, making the argument for routine immunization unconvincing[13,35]. The predicted increase in Herpes Zoster infection has been reported by some countries but has not been observed by others, in any case, it may not show for several years and remains a subject of controversy which requires further study[11,13,15,36]. There has also been a slight increase in the peak incidence age of varicella infection though the incidence rates in adolescents and adults have fallen[12,13,15]. Concerns about cost are tenable as vaccine protection is reported to be optimal only after two doses which makes the cost prohibitive for most low and middle income countries whose vaccination programmes are supported externally by the global fund[1,12,13,15].

The World Health Organisation's position is that although the burden of severe disease due to VZV infectionis generally lower than that of other vaccine-preventable diseases, the public health value of the vaccine in lowering morbidity and mortality due to the disease is well established[1]. Therefore, it recommends that, where varicella infection is an important public health burden, countries should consider introducing the vaccine in the routine childhood programme if they have enough resources to achieve 80% coverage in order to reduce the possibility of an age shift of primary infection[1,2]. However, before countries decide to vaccinate, there should be a surveillance system to determine the burden of disease which should continue after introducing the vaccine[1,2]. They also recommend immunising special groups such as household contacts of immunocompromised persons, susceptible health workers and immunocompromised patients with HIV infection, Acute Lymphoblastic Leukaemia, and certain solid tumors if they meet specified criteria. Post-exposure prophylaxis is only recommended if the vaccine has been introduced[1].

It might appear that the safer option for preventing chicken pox in Ghana, especially in communities where facilities are not available to manage the most serious and potentially fatal invasive complications, would be universal VZV immunizations if this can be afforded. However, there are several factors which militate against this. Cost will be an issue as funding for immunisations is limited. Besides Ghana, is still struggling with a high burden of disease and mortality from pneumonia, diarrhoea and malnutrition so death from chicken pox may not receive the same the kind of prominence and significance as it does in western countries with low child mortality. For this reason, when considering an additional vaccine, it needs to be weighed against the cost benefit of introducing another child health intervention or vaccine which might be more cost effective inreducing morbidity and mortality[37,38]. Furthermore, the detailed background preparatory work to determine the burden of disease and its effects prior to introducing the vaccine as well as a surveillance system to assess the effects are lacking. This makes the argument for universal immunization less convincing. Additionally, public opinion and education needs to be considered due to the perception among the general population and some in the medical community that the disease is a non-life threatening condition so vaccination is unnecessary and co-morbidities may go unrecognized.

So, is it time to consider universal varicella immunization in Ghana? Currently there is insufficient evidence for this to be aggressively promoted. However, the available evidence is more in support of vaccination of high risk individuals, collection of information on the burden of disease and setting up a surveillance system so that this position can be revisited at a future date. Meanwhile, the government can make the vaccine and the immunoglobulin available to those that need it most, especially the immunosuppressed andstrengthen the health system to make this possible[1]. There is, however, a growing middleclass population in Ghana and other middle income African countries, who may be able to afford the vaccine and want it for their children. The private sector may be able to meet this need, as is done in South Africa, nevertheless, it could cause an age-shift due to low coverage[39].

## Conclusion and recommendation

Presently, the exact burden of chickenpox in Ghana is unknown. With the availability of a safe and effective vaccine, preventing varicella deaths and GAS disease, especially septicaemia through vaccination should be considered a public health priority. Investigation and mandatory reporting of all varicella-related hospitalisations and deaths will provide more accurate and complete data on the age distribution of the disease, and its health and economic effects. This can be done by making varicella, a reportable disease on its own and linking it to the disease surveillance system currently in place. In addition, health personnel and the public need re-orientation on the disease to increase awareness and reporting of its co-morbidities. Once the aforementioned conditions are realised, then it may become necessary to re-consider the country's readiness foruniversal varicella immunization. In the meantime, it would be prudent for the government and relevant public health agencies to consider selective immunization in the health setting.

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