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COVID-19 continues its rampage in children and in unvaccinated communities due to the Delta and Omicron variants

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ABSTRACT: With the onset of the Omicron variant transmissible, even among those having received two doses of vaccine, it is clear that the ongoing COVID-19 pandemic is of particular concern among children and in developing countries with lower vaccination coverage. Vaccine equity combined with a range of other practical control strategies among children and adults is fundamental for controlling global morbidity and mortality due to COVID-19, and to relieve the continuous cycle of poverty it purveys.

Keywords: COVID-19, Children, Risk, Transmission, Epidemiology.

Since the cluster of Coronavirus-2019 (COVID-19) was identified in Wuhan, Hubei Province, China on December 31, 2019, SARS-CoV-2 has led to 271 million cases and 5.3 million deaths worldwide as of December 17, 2021[1]. With the delta variant causing significant cases, morbidity, and mortality, the advent of the Omicron variant indicates no clear end in sight for the pandemic. In the span of just 3 weeks, the variant has entered 77 countries[2]. Omicron is ten times more infectious than the original strain and twice as infectious as the delta variant[3].

Early in the pandemic, children were deemed both unlikely to be implicated as the drivers of COVID-19 nor to contribute to mortality in the elderly population[4]. Now, children present a greater risk for the delta variant and represent the source (index case) for most outbreaks[5]. This variant is more transmissible and can be highly devastating in children and unvaccinated populations. This is also likely the case for Omicron – emerging evidence[6] from South Africa suggests a greater proportion of hospitalizations are among children.

One of the common drivers of the spread of coronavirus among children is the clustering of children in 'hotspots' such as sporting venues and schools. Where the UK has 'opened-up' after achieving high adult vaccination rates, it is estimated that there was at least one outbreak in every 250 schools, or 97 confirmed outbreaks in primary and secondary schools within a four-week period alone[7]. Transmission events have been recorded in sports facilities among children as young as five years[8], and in schools across many countries such as the UK, Chile, Sweden, Korea and the United States[9].

Outbreaks in schools that began among children have then spread to adults who are at higher risk of developing serious symptoms. An outbreak in an Israeli school triggered by two COVID-19-positive students spread to

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153 students and 25 staff members[9]. Furthermore, the attack rate was higher among staff (16·6%) than among students (13·2%). This is of particular concern as teachers must of course be present if schools are to operate.

Canberra, Australia's capital city, had remained essentially COVID-19 free for 18 months without a locally acquired COVID-19 case until an outbreak of Delta occurred, sending the entire city instantly into a 'snap' lockdown. The median age of this outbreak was 19·5 years and was mainly due to the occurrence of COVID-19 in primary and high schools[10]. Figure 1 highlights the degree to which children and young adults contributed to this outbreak, as well as their significantly lower vaccination rates compared to adults and the elderly. It can clearly be seen that as vaccination rates increase non-uniformly across age groups, the majority of transmission occurs in the younger age groups. Therefore, we are observing a trend towards a pandemic of children and unvaccinated populations.

The Delta variant led to a higher proportion of asymptomatic pediatric patients[11,12] but at this stage, little is known whether the situation will be any different with Omicron. Host factors such as pre-existing co-morbidities, malnutrition, poor infrastructure and sanitation can increase the risk of hospitalization and ventilation in an intensive care unit (ICU)[13]. Multisystem inflammatory disease syndrome of childhood (MIS-C) used to be the most common syndrome early in the pandemic and continues to prevail at the time of the Delta variant[14]. Early reports have investigated 'long COVID-19' – the persistence of symptoms beyond the typical duration of infection. Whilst only an emerging area of research, there is evidence that children and adults can have symptoms that last weeks[15]. However, it is too early to determine if there is evidence of long COVID-19 due to Omicron infection.

With many countries having extremely low vaccination rates, we can expect that coronavirus will be pandemic for years, particularly when incredibly infectious variants such as Omicron arise. Indeed, vaccination rates in some countries are as low as 5-10%[16], and this low level of vaccine uptake is likely one of the main drivers behind the emergence of the new Omicron variant. Despite establishment of the COVID-19 Vaccines Global Access (COVAX) by the World Health Organization (WHO), many countries in the developing world do not yet have access to sufficient vaccine supplies. Countries that produce vaccines prioritize

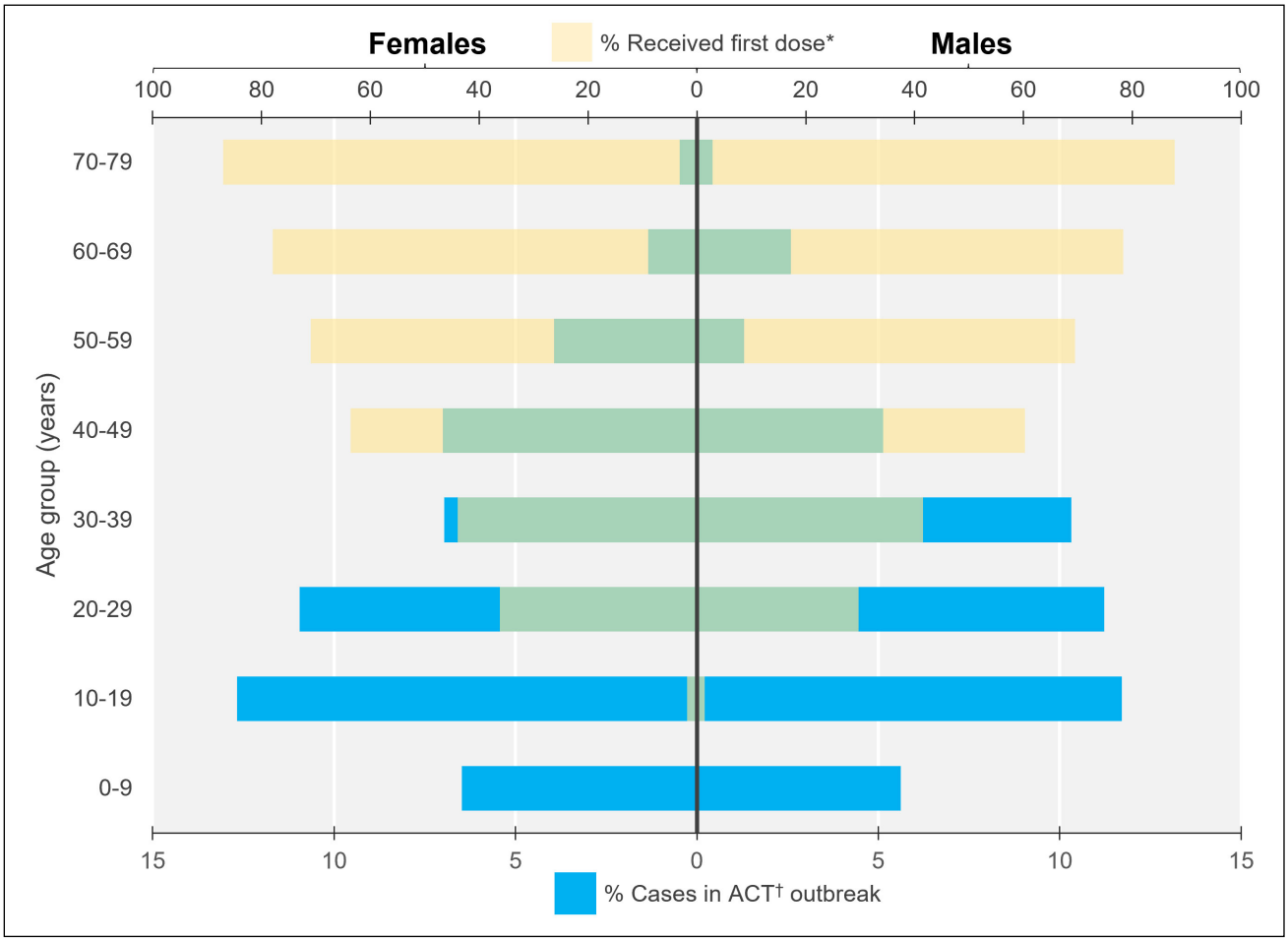

Figure 1. Population pyramid of distribution of cases in ACT outbreak August 12-28, 2021, and first dose vaccination. Overlapped regions do not indicate cases in individuals who have been vaccinated, but rather an overlap of two separate population pyramids.
*Percentage within age group derived from Australian population as of August 2021.
†Australian Capital Territory.
Data retrieved from ACT Health/ABS.
Case numbers in ages 80+ < 4 persons and therefore not shown.

their own communities, even providing booster shots, despite the fact that poorer nations are yet to receive their first dose of vaccine. Consequently, we anticipate vaccination rates will remain low in these countries for some years to come. Tedros Adhanom Ghebreyesus, the director-general of the WHO, has been highly critical of this unequal rollout of the COVID-19 vaccines. "Every day, there are six times more boosters administered globally than primary doses in low-income countries. This is a scandal that must stop now," he said on November 13, 2021. The picture is even worse for children as it is only very recently that COVID-19 vaccination programs have been extended to children in a number of developed countries, with vaccine rollouts generally having commenced among the most vulnerable groups, followed by the adult population. It is likely, therefore, that children in developing countries will be one of the last groups to receive their first dose of vaccine, a failing that needs to be considered a global issue. This is because it is now recognized that children contribute to the transmission of coronavirus even in countries with high vaccination rates, let alone those poor countries with only 5-10% coverage, an unacceptable position that, additionally, creates a fertile breeding ground for coronavirus mutations.

It is clear that COVID-19 vaccination on its own alone is insufficient to prevent large scale mortality and hospitalizations in developed countries[17]. Accordingly, there is an increasing awareness that additional measures to reduce transmission are necessary[18,19], along the lines advocated by OzSAGE, a multi-disciplinary Australian network, which advocates "Vaccine-Plus" for the safe lifting of restrictions and an exit strategy from the pandemic involving practical, actionable solutions such as safe indoor air (ventilation) masks, and other non-pharmaceutical interventions including testing, tracing, and the wearing of masks[20]. Improved ventilation and the use of appropriate air filters may be particularly effective in schools, homes, and indoor venues given that outbreaks have occurred when air conditioning use was increased emphasizing the role of aerosol transmission in COVID-19 outbreaks[9].

The emergence of the Omicron variant and its rapid spread demonstrate that vaccine inequity continues to be a considerable failing both in developed and developing countries, a feature that contributes to prolonging the pandemic, placing the whole world at continued risk of COVID-19 and continuing the negative impact on global economies[16]. Furthermore, the severity of COVID-19 is increased by co-morbidities, such as malnutrition, that are more prevalent in developing countries, sustaining a continuous cycle of poverty.

As a global community, we need to acknowledge that this coronavirus threat will remain constant into the foreseeable future and that vaccination cannot combat its public health impact in isolation. In addition to greater attention being placed on global vaccine equity, an awareness of the role that children play in COVID-19 transmission, and the implementation of additional control strategies and practical interventions to minimize global transmission will be required.

Conflict of Interests:
The authors declare that they have no conflicts of interest.

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