# CHILDREN: THE HIDDEN PANDEMIC

September 2022, Orphanhood and Caregiver Loss Based on Excess COVID-19 Death Estimates

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From March 1, 2020, through May 1, 2022, the number of children affected by COVID-19-associated orphanhood and caregiver deaths continued to

From March 1, 2020, through May 1, 2022, the number of children affected by COVID-19-associated orphanhood and caregiver deaths continued to grow. This new cumulative 26-month document is our third report, and it updates the two previous ones. The first of these was a full report and covered the original 14-month period (March 1, 2020, through April 30, 2021) in 'Children: The Hidden Pandemic, 2021'.[1] The second was an interim report, 'Children: The Hidden Pandemic, February 2022 Updated Interim Estimates', and it covered the first 20 months of the pandemic, which included rapid escalation of orphanhood and caregiver loss, linked to the emergence of the delta variant.[2] We now summarize cumulative trends in orphanhood and caregiver deaths in this brief third report, 'Children: The Hidden Pandemic – September 2022, Orphanhood and Caregiver Loss Based on Excess COVID-19 Death Estimates.'

The original full 2021 report provides an overview of lessons learned from the HIV/AIDS pandemic (Preface); a description of the global orphanhood and vulnerability problem in the context of COVID-19 (Introduction); global, regional, and national data for the first 14 months of the pandemic (Toll of COVID-19 on Children); risks of adverse consequences of orphanhood and caregiver death for children (Enduring Impact on Children, Families, and Communities), and a framework for urgently needed solutions (A Strategy for Caring Action). In this cumulative report for the first 26 months of the pandemic, we provide updates and progress for those topics covered in the 2021 report. We also include new global, regional, and national estimates for the numbers of children affected by COVID-19-associated orphanhood and caregiver death in every nation, as described in JAMA Pediatrics, September 6 2022.[3]

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# ACKNOWLEDGEMENTS

**"Children: The Hidden Pandemic, September 2022, Orphanhood and Caregiver Loss Based on Excess COVID-19 Death Estimates"**

Was prepared by the **Global Reference Group on Children Affected by COVID19: Joint Estimates and Action**, and links to the JAMA Pediatrics paper published Sept 6, 2022.3

**"Children: The Hidden Pandemic 2021** – A joint report of COVID-19-associated orphanhood and a strategy for action"[1] reflects the contributions of technical experts from all core agencies contributing as co-authors to the linked report in the Lancet, "Global minimum estimates of children affected by COVID-19associated orphanhood and deaths of caregivers: a modeling study" (Published Online July 20, 2021. Available at https://doi.org/10.1016/S01406736(21)01253-8)[4], prepared by the **Global Reference Group on Children Affected by COVID-19: Joint Estimates and Action.** This group includes:

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# THE TOLL OF COVID-19 ON CHILDREN,

Updated Orphanhood and Caregiver Loss Estimates, September 2022

## Estimating the Toll

This report updates our findings to provide the most current estimates of COVID19 associated orphanhood and caregiver loss during the first 26 months of the pandemic (March 1, 2020 – May 1, 2022).[3] In this report, we use newly available excess mortality data published by the World Health Organization (WHO) for every nation, to update global minimum estimates of COVID-19-associated orphanhood and caregiver death among children.[3] Although our paper also reports updated global orphanhood estimates using, in addition to WHO data, excess mortality data available from by The Economist and The Institute of Health Metrics and Evaluation (IHME), we limit our findings in this report to those based on WHO estimates, as they are lower and thus more conservative. Using pervious methodology for combining age-specific death and fertility rates, we computed excess-mortality derived estimates for children affected by pandemic-linked orphanhood and caregiver death in every country.[5] Excess deaths are defined as the number of deaths from all causes during the pandemic period, that are above and beyond what we would have expected to see under normal conditions for the same time frame. A description of our methods is found in Appendix II.

Using data from our study set comprised of 21 countries accounting for 76% of all COVID-19 deaths in 2020, we derived a global extrapolation model for the total number of children experiencing COVID-19-associated death of a parent or grandparent caregiver.[5] In this report, we multiply our orphanhood and caregiver loss to death ratio by the maximum between excess deaths and COVID-19 deaths, which we describe as 'composite deaths,' for every country with data.

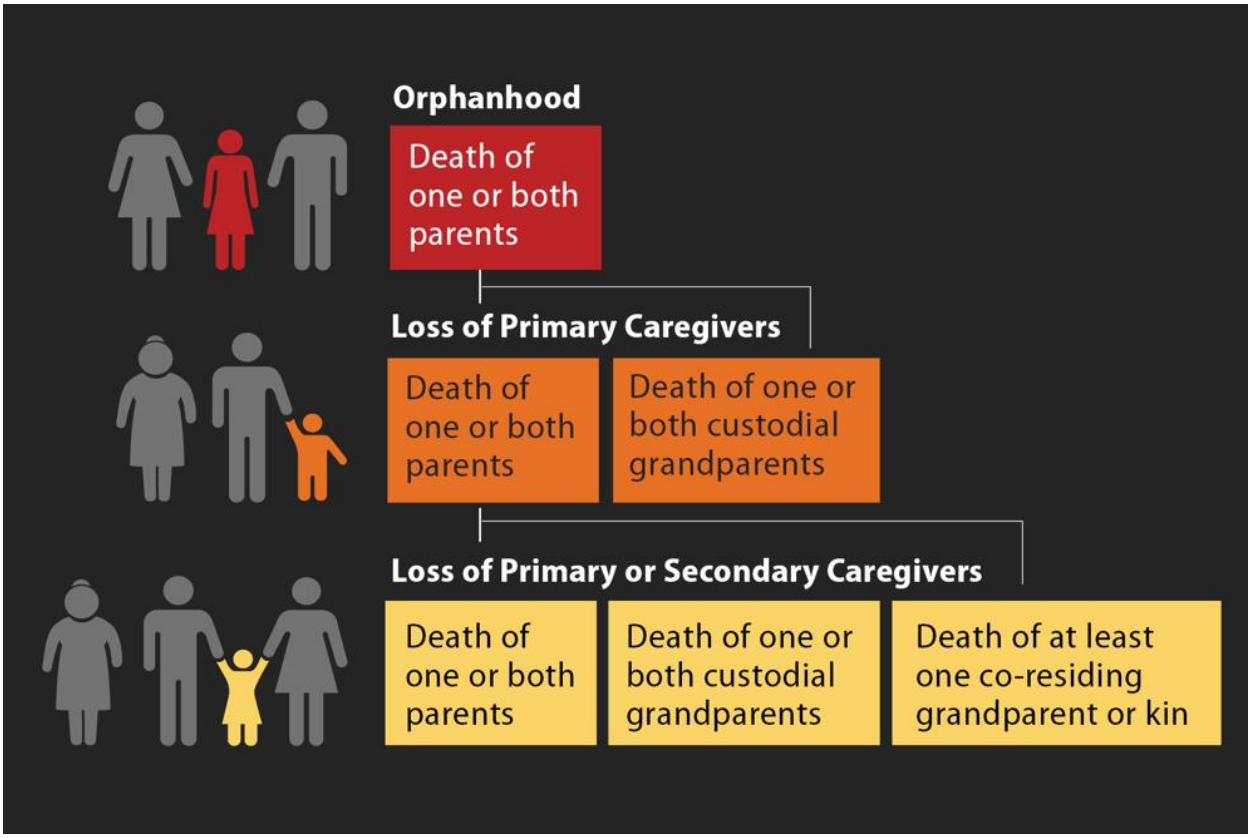



**Figure 1:** Definitions of orphanhood and loss of caregivers based on deaths of parents, custodial grandparents, and other co-residing grandparents or older kin. [3]

We consider three different categories of caregiver loss among affected children: orphanhood, primary caregiver loss and primary and/or secondary caregiver loss. We defined orphanhood using UNICEFs definition of the death of one or more parents; primary caregiver death as death of parents or custodial coresident grandparents (providing care for children in the absence of parents); and secondary caregiver death as death of coresident grandparents or other older kin (providing care through involvement or resources) in households with one or both parents present (See Figure 1).[5] Our use of the term "orphanhood" reflects our shared determination to rapidly advance urgently needed investments in support of family-based care, and to ensure every effort is made to avoid residential care, including orphanages or other institutionalization of children.

## The Global, Regional, and National Toll

We describe global, regional, and national results, as well as scenario estimates for COVID-19-asscociated deaths, orphanhood, and death of grandparent caregivers in this section. Specifically, we report findings for one or more of these three categories of children: orphanhood, loss of primary caregivers, and loss of primary or secondary caregivers. caregivers.

The Global Toll: By May 1, 2022, the minimum number of children affected by COVID19-associated orphanhood was estimated to be 10.5 million children.

The World Health Organization characterized COVID-19 a global pandemic in March 2020. During the next 14 months, from March 2020 through April 30, 2021, our initial report showing a minimum estimate of over 1.5 million children affected by COVID-19associated death of parents and caregivers based on real-time mortality data available for those first 14 months.[4] The use of emerging excess mortality data for a greater number of countries, along with rapid escalation in deaths linked to the delta variant over the ensuring six months, showed this minimum estimate of orphanhood and caregiver loss increased to over 5.2 million children by 20 months into the pandemic.[5] Our new publication based on excess COVID-19 deaths six months later for every country shows that by 26 months into the pandemic, 10.5 million children are estimated to have suffered the death of a parent or grandparent caregiver responsible for their needs and nurture, (Figure 2). Of these, 7.9 million children lost a primary caregiver, and 7.5 million experienced orphanhood.

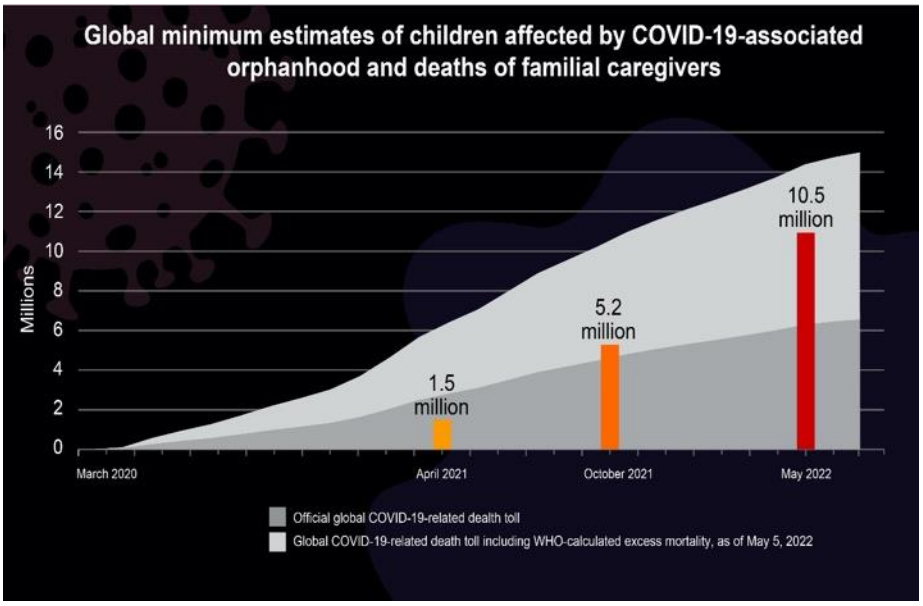



**FIGURE 2:** Global trends in reported COVID-19 deaths, excess COVID-19 deaths (based on WHO estimates), and children affected by pandemic-associated orphanhood, March 2020 – May 2022. [3]

The Regional Toll: The number of children experiencing death of a parent or other caregiver continues to increase in every region.

We found marked differences across regions in trends for the minimum number of children experiencing orphanhood or caregiver death due to excess COVID-19 deaths during the 26-month pandemic period (Figure 3). Orphanhood and caregiver death were highest in the South-east Asian and African Regions.[3]

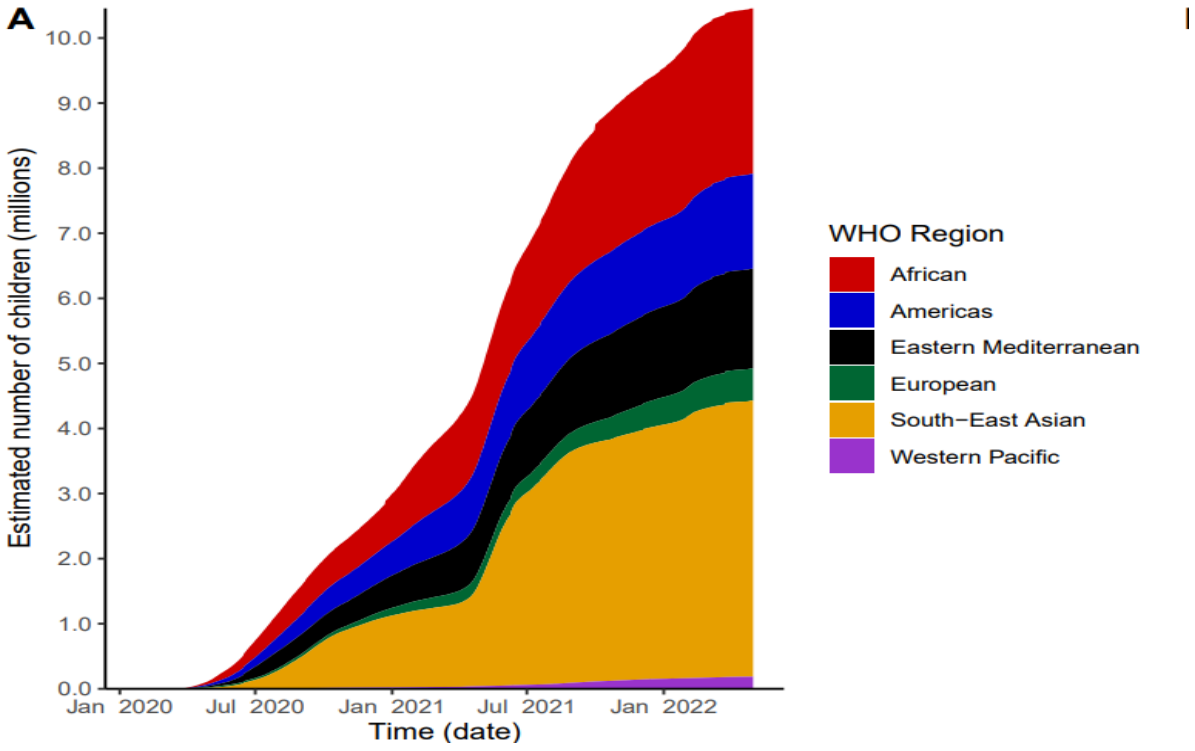



**Figure 3:** Cumulative Global Total of Children Affected by Pandemic Orphanhood by Region

We also examine the real-time orphanhood data by region through May 1, 2022, for children having lost one or both parents (Figure 4).[6] Even though there is an apparent slowing of orphanhood growth across regions towards the end of the time period, the low vaccine coverage in the African and Eastern Mediterranean Regions (27% and 57%, respectively, having received one or more doses as reported by the New York Times August 15, 2022), suggests that high proportions of the populations of children continue to be at risk for pandemic-linked orphanhood.

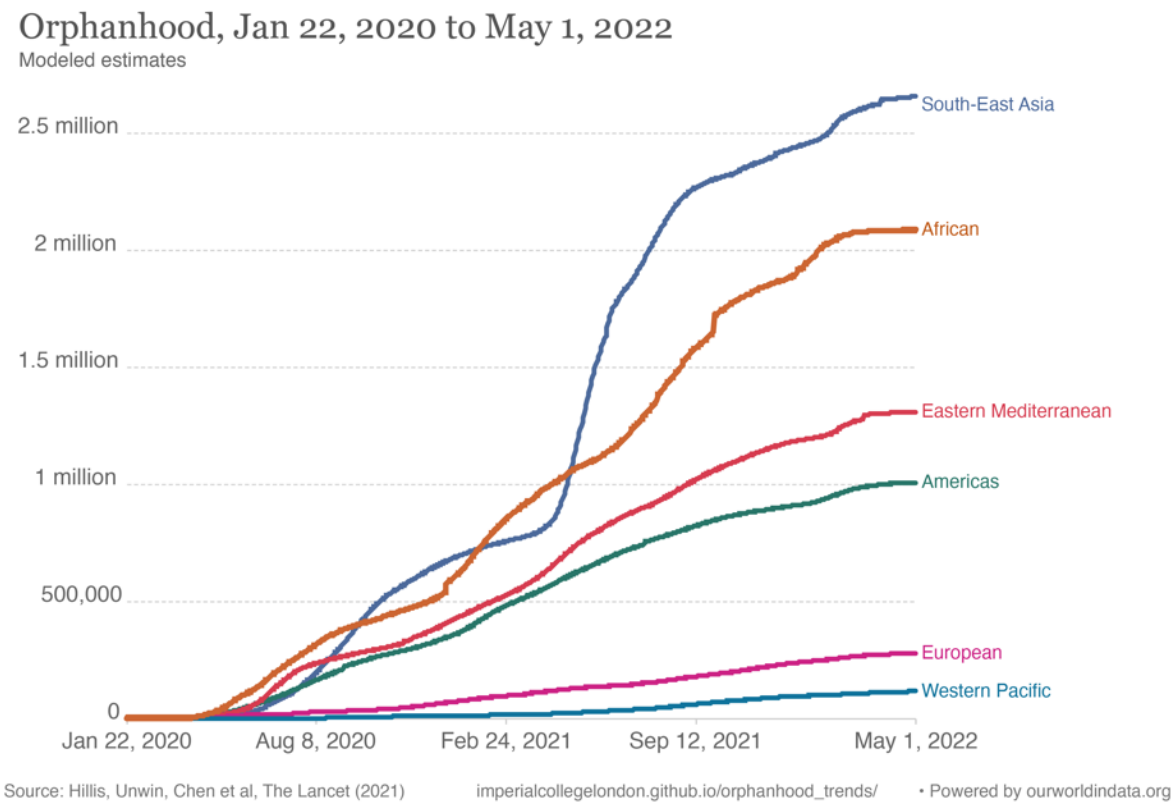



**Figure 4:** Real-time Estimates of Children Experiencing Pandemic-associated Orphanhood by Region, March 1, 2020, through May 1, 2022. [6]

We report in the Table, the total numbers of children experiencing orphanhood, primary caregiver death, and primary or secondary caregiver death during the first 26 months of the pandemic.

| Region | Minimum estimates of orphanhood | Minimum estimates of primary caregiver loss | Minimum estimates of primary and/or secondary caregiver loss |
|---|---|---|---|
| Africa | 2,140,500 | 2,254,900 | 2,541,800 |
| Americas | 1,009,700 | 1,096,400 | 1,459,400 |
| Eastern Mediterranean | 1,310,900 | 1,381,100 | 1,530,180 |
| Europe | 279,800 | 321,800 | 495,700 |
| South-East Asia | 2,660,800 | 2,760,700 | 4,241,400 |
| Western Pacific | 117,500 | 129,700 | 187,300 |

**TABLE:** Regional minimum estimates of children's loss of caregivers based on WHO excess mortality, March 1, 2020, through May 1, 2022[6]

The National Toll: Countries having the highest numbers of children facing loss of caregivers due to COVID-19 are distributed widely across global regions

As shown in the map in Figure 5, we observed the largest burden of orphanhood and death of grandparent caregivers from March 1, 2020, through May 1, 2022 – the first 26 months of the pandemic – in India, Indonesia, Egypt, Nigeria, Pakistan, Mexico, DRC, Brazil, USA, Ethiopia, South Africa, Russia, Kenya, and Peru.[3,7]

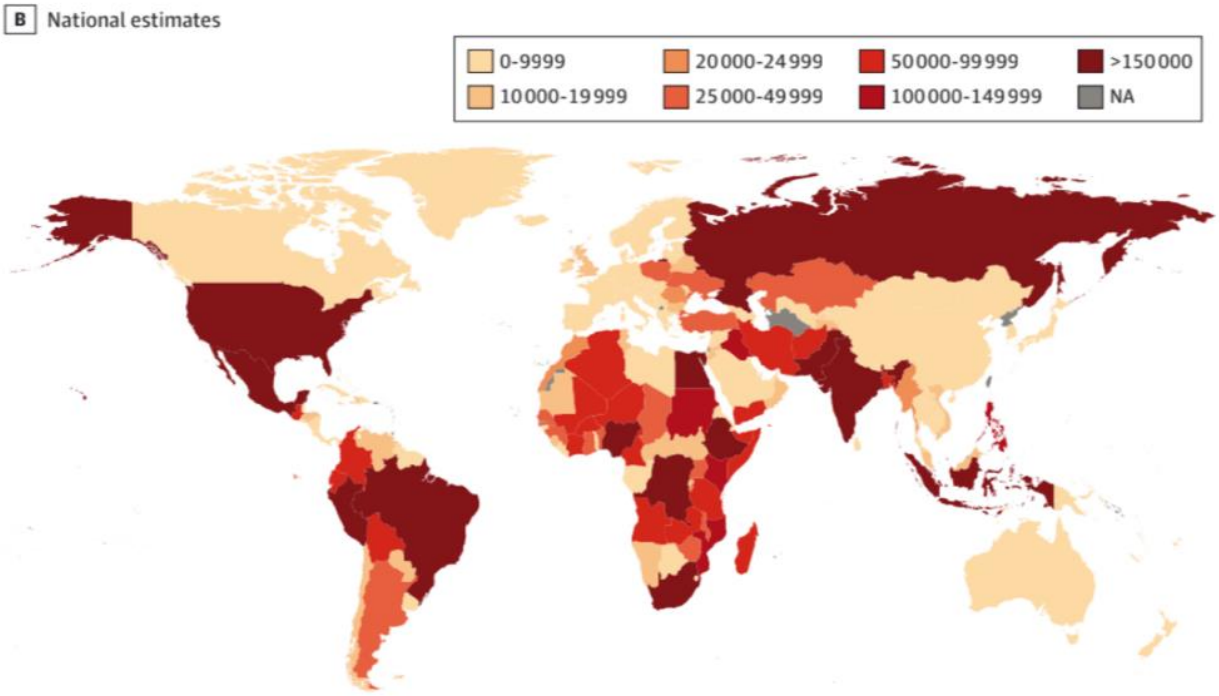



**Figure 5:** National Estimates of Children Affected by Pandemic-associated Orphanhood and Caregiver Death, March 1, 2020, through May 1, 2022.[7]

## National Trends Using Real-Time COVID-19 Orphanhood Calculator Widget

We observed marked differences between countries in COVID-19-associated orphanhood or death of caregivers. These numbers can be found for any country in the world using the real-time COVID Calculator.

**For Imperial College's Country Calculator** giving up-to-date minimum estimates by country of minimum estimates of children affected by COVID-19 orphanhood and death of caregivers:
https://imperialcollegelondon.github.io/orphanhood_calculator

**For Imperial College's Interactive Visualization** enabling comparisons between countries and over time of minimum estimates of children affected by COVID-19 orphanhood and death of caregivers:
https://imperialcollegelondon.github.io/orphanhood_trends

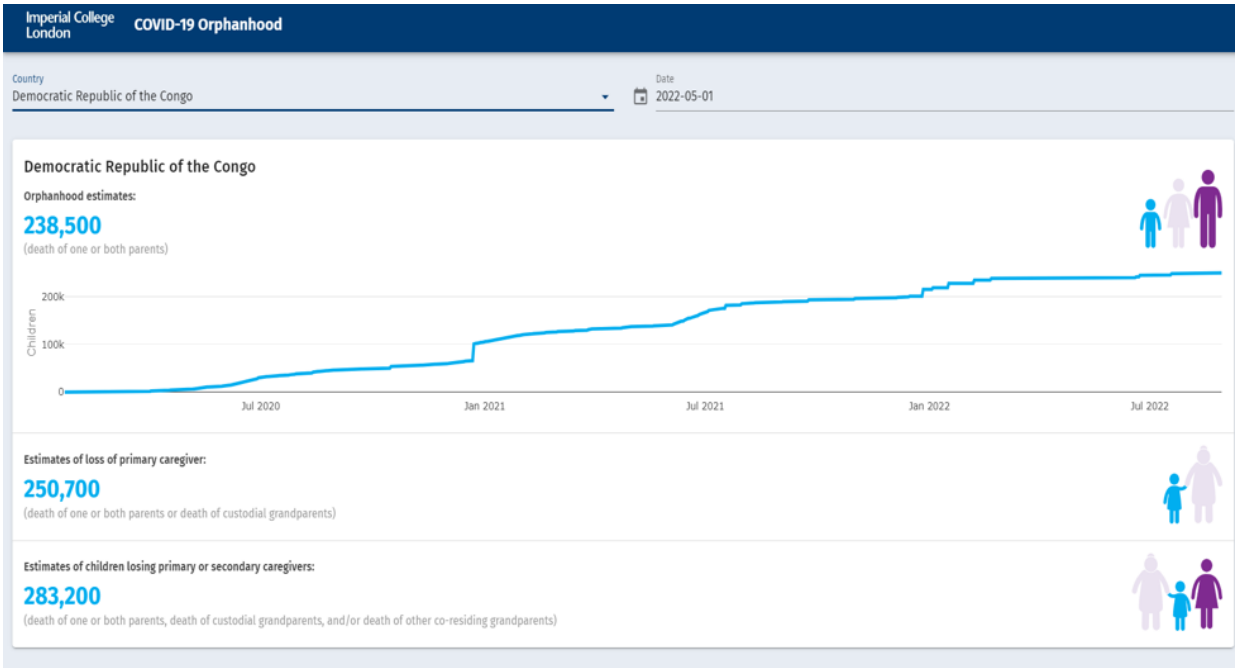



**Figure 6:** Real-time Imperial Orphanhood Calculator Data for Democratic Republic of Congo, March 1, 2020, through May 1, 2022. [6]

Calculations of estimated orphanhood cases per 1,000 children showed highest rates in Bolivia and Peru – where 1 of every 50 children were bereft of their caregivers in roughly two years. In Namibia, Egypt, Bulgaria, South Africa, Ecuador, Eswatini, Botswana and Somalia, approximately 1 of every 100 children were bereft of their caregivers in this same period. (Figure 7).

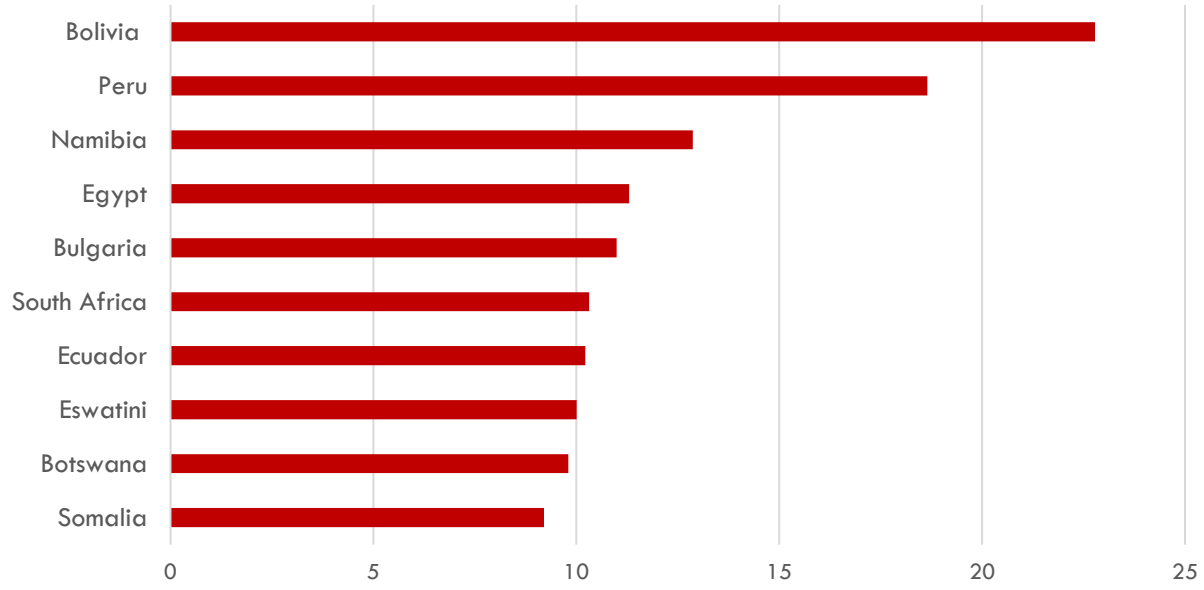


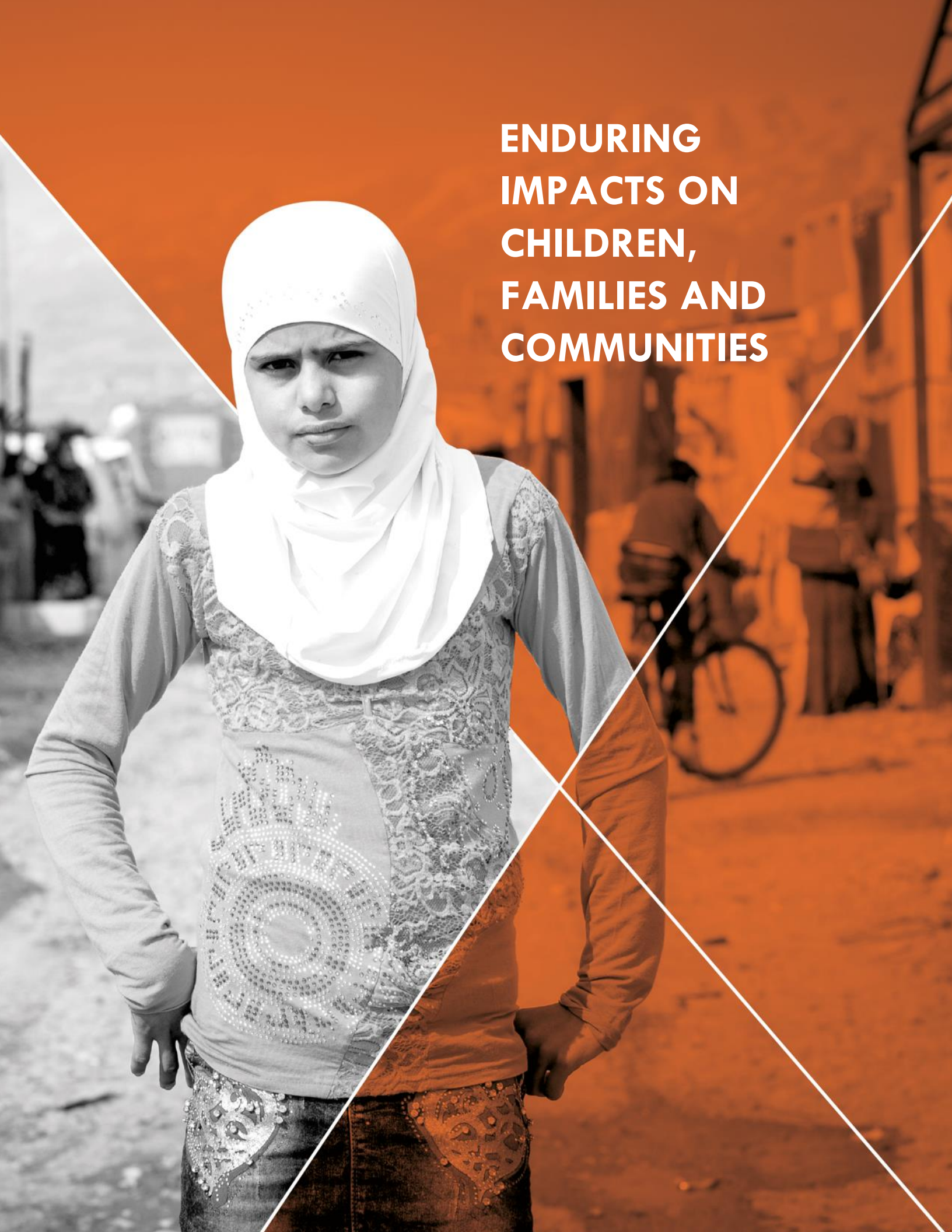

**FIGURE 7:** National rates of COVID-19-associated orphanhood and caregiver death per 1,000 children, as of May 1, 2022. [6]

## Monitoring the Toll

Modeling provides an avenue for generating preliminary minimum estimates of the magnitude of COVID-19-associated orphanhood and death of caregivers, but what is most needed is to identify and care for the children behind the numbers. Thus, there is an immediate need to strengthen child-focused monitoring systems so governments and partners can provide a real-time response to children in need.

In high-burden countries for pandemic orphanhood and caregiver loss, quantitative modeling tools can generate sub-national estimates on the location and characteristics for the numbers of children affected. This data can inform targeted on-the-ground programs to find and link both children lacking adult care and children made vulnerable by the loss of a caregiver, to safe and nurturing family-based care and support services. Such targeting requires collaboration among health, social protection, and education sectors. Complementary avenues for strengthening orphanhood monitoring and targeting include syncing with community-based programs that identify and support vulnerable children, developing surveillance systems that use digital health platforms, studies that monitor and prevent institutionalization and migration to street life, and using vital registration, identification, or social registry systems to identify children lacking adequate safe and nurturing adult care. For example, in Brazil, death certificates include a field for children under age 18 living in the home of the decedent(s), which helps link referrals to case managers and facilitate early intervention. Beyond effective monitoring and targeting, it is essential to expand policymakers' understanding of the needs of children affected by orphanhood and of effective approaches to support this new group of pandemic-affected children, to be able to strengthen their effective integration into appropriate national and local responses and programs. Children affected by COVID-related orphanhood have unique needs. Those without adult care will require family-based placement solutions, those remaining in a single headed household or taken in by kin may require psychosocial, economic, and parenting support, and bereaved children in general may benefit from grief counseling. The monitoring tools will help policy makers understand these needs and invest in ensuring appropriate care for affected children.

# ENDURING IMPACTS ON CHILDREN, FAMILIES AND COMMUNITIES



## Severe and Complex Consequences of Orphanhood and Caregiver Loss

Parental or caregiver death is permanent; consequences for children can be devastating and enduring, with orphanhood increasing the risks of institutionalization, family economic hardship, separations, disruptions, physical, emotional, and sexual violence.[8] Orphanhood increases the risks of mental ill health, suicide, infectious diseases such as HIV/AIDS, chronic diseases, adolescent pregnancy, and poor educational outcomes.[9] Evidence from previous epidemics shows that ineffective responses to the death of a parent or caregiver - even when there is a surviving parent or caregiver - can lead to deleterious psychosocial, neurocognitive, socioeconomic educational, and biomedical outcomes for children.

The severity of consequences is matched by their complexity. Orphanhood is an adverse experience for a child of any age as they face grief, disruptions in care, and vulnerabilities associated with family disintegration. Parental loss also increases risks of institutionalization at any age, with associated negative consequences for development, socialization, and wellbeing. However, the specific impacts of orphanhood — and the corollary program and policy responses — vary with age and setting.[10]

Children in their early years need continued investments in nurturing care, including health and nutrition, cognitive stimulation, and protection from stress. Disruptions in these core investments put their development at risk, including health, education, income, and stability into adulthood – all of which influence the well-being of communities. School-age children face the added challenge of staying enrolled and focused on learning. For adolescents – who account for 2 out of every 3 children experiencing COVID-associated orphanhood[5] – key risks are sexual violence, exploitation, HIV, suicide, and dropping out of school. These are further influenced by gender, with adolescent females at greater risk of sexual violence and exploitation and child marriage, while adolescent males risk exploitation from violent groups such as gangs and militias.

Across all age groups, COVID and the measures to contain it can compound and intensify the experience of grief through the isolation and inability to participate in bereavement practices of lockdowns, the disruption from routines of school closures, and the reduced resilience of household financial and emotional resources already hard stretched and stressed by the pandemic. Mortality in the pandemic has been disproportionately among males, and 3 of every 4 children affected by COVID-associated orphanhood lost their fathers.[5] This leaves many families struggling with not only the burden of losing a family member, but also massive financial shock, especially in contexts where men are typically the primary income earners. The growing toll of orphanhood and of paternal deaths is particularly challenging in countries where safety nets and social insurance remain limited and where women attract lower earnings and more precarious employment. Individuals and households facing orphanhood without access to social protection are often forced to adopt risk management strategies that introduce new risks, such as child marriage, transactional sex, and leaving school to work or care for siblings.[5]

# A STRATEGY FOR CARING ACTION

**Summary:** These updated estimates based on excess COVID-19 deaths reported by WHO for every country in the world, show that by May 1, 2022, pandemic-associated orphanhood and caregiver death had left 10.5 million children under age 18 bereft of the mothers, fathers, grandmothers, and grandfathers responsible for their needs and nurture. Of these, 7.5 million children had been orphaned.[3]

**The Strategy:** *The Global Reference Group on Children Affected by COVID-19 and Crisis: Joint Estimates and Action* focuses on the empirical, as well as the evidence-based program and policy recommendations, surrounding this tragic crisis. These are outlined in 'Children: The Hidden Pandemic, 2021',[1] as the 3-pronged 'Strategy to guide responses by policymakers, development institutions, and civil society organizations. The Strategy includes *Preventing* death of caregivers, *Preparing* families and caregivers to provide safe and nurturing family-based support, and *Protecting* children using evidence-based strategies that address their risks of poverty, childhood adversity and violence, and strengthen their recovery. These strategies provide promising 'cash plus care' models that combine income transfers with caregiver support, as well as support for education and life skills. These combination approaches are aligned with the WHO INSPIRE framework, which is a technical package developed by ten key multilateral, bilateral, and global partnership organizations to protect children from violence.[11]

**The Urgency**: The urgency of recognizing and addressing orphanhood as a monumental public health problem is highlighted in *The Lancet Public Health* Editorial in August 2022, in this opening statement: "The death of a parent is one of the last taboos in public health."[12] The death of a parent is one of the last taboos in public health."[12] The editor cites sobering evidence on consequences and encouraging research on solutions. Then, she concludes, "After 2 years of the pandemic, with millions of preventable deaths worldwide, the consequences of losing a parent for the children and caregivers left behind have only multiplied. Enabling open conversations about grief among [children and] young people afflicted by a parental death and offering proven multidisciplinary support services to affected families is now its own public health emergency of international concern."[12]

**Progress:** Recognizing the urgent threat of pandemic orphanhood, our *Global Reference Group* aims to catalyse safe and loving family-based care for children. To this end, the *Group* has, and will continue to, generate compelling and actionable data that links to effective, sustainable, and scalable action. A first step in this process was *raising awareness* about the magnitude of the problem and the proven hope through tested solutions.[4] Since July 2021, the seven (7) papers and reports addressing pandemic orphanhood and caregiver loss among children have *raised awareness* through media coverage in over 1,000 outlets in over 20 nations, and nine (9) languages, including by David Muir at ABC News; Rhitu Chatterjee at NPR; Dr. Rochelle Walensky, Director of the CDC; and Samantha Power, USAID Administrator.

The *Global Reference Group* has also collaborated with multilateral and bilateral aid agencies such as CDC, USAID, WHO, World Bank, and UNICEF, and faith- and community-based organizations supporting children at the grassroots level. These partners produced real-time data that can be linked to programs that seek to protect children and families. Such programs will also help protect children from institutionalization and from entering the population of street youth. Furthermore, as a result of our estimates, the White House National COVID-19 Preparedness Plan (March 2022) and Presidential Memorandum on the long-term effects of COVID-19 recognize the need to support children bereaved by COVID-19 in the U.S. The White House further highlighted the magnitude of the pandemic's impact, citing the millions of children orphaned by

COVID-19, as part of the 2nd Global COVID-19 Summit, including in remarks by President Biden and the statement from Secretary Becerra. At that Summit the White House also published a series of commitments, including one by the COVID Collaborative, working with Oxford University and New York Life Foundation, to "catalyze country-level policies to incorporate family-based care for COVID-bereaved children into national COVID-19 response plans, focusing on high-burden countries in sub-Saharan Africa." In response to our papers and reports, a groundswell of advocacy for the plight of pandemic-affected children emerged from the International NGO community in their report Urgent Action Needed to Overcome the Threat of COVID-19-associated Orphanhood and Caregiver Death. At the state level in the U.S., California is considering a bill to support these children. *Global Reference Group* members have also participated in briefings with the Pope—resulting in a Vatican statement on the need to support COVID-orphaned children. Our global data have additionally informed the President's Emergency Plan for HIV/AIDS Relief's Country Operating Plans where AIDS and COVID pose a dual threat to children and their families. Additionally, legislative, and programmatic initiatives have been adopted or proposed for children who have suffered the death of their parents and caregivers, at national or city-levels such as in Peru, Mexico, Brazil, Colombia, Eswatini and South Africa.[7]

## Conclusions

At the 2nd Global COVID-19 Summit (May 12, 2022), President Biden emphasized the need to honor those who have died and those who have been orphaned, and the urgency of collective action by all countries. Given the magnitude and lifelong consequences of orphanhood, integration into every national pandemic response plan of timely care for these children will help mitigate lasting negative impacts. Effective, caring action to protect children from immediate and long-term harms of COVID-19 is an investment in the future, and a moral and public health imperative.

# APPENDIX I

Global, Regional, and Country Estimates for Children Affected by COVID-19-associated Orphanhood and Death among Caregivers, March 1, 2020, through May 1, 2022, based on JAMA Pediatrics [3]

| Country | Minimum estimates of orphanhood | Minimum estimates of primary caregiver loss | Minimum estimates of primary and/or secondary caregiver loss |
|---|---|---|---|
| **Africa** | 2140500 [1445100, 2796500] | 2254900 [1533200, 2935000] | 2541800 [1732100, 3309800] |
| **Algeria** | 78700 [48000, 113100] | 83800 [51400, 119900] | 93700 [60800, 130900] |
| **Angola** | 44400 [0, 97700] | 46700 [0, 102700] | 52700 [0, 115900] |
| **Benin** | 21800 [1500, 44200] | 22900 [1600, 46500] | 25700 [1800, 52200] |
| **Botswana** | 7400 [4000, 11600] | 7900 [4300, 12400] | 9100 [5200, 13700] |
| **Burkina Faso** | 48600 [9100, 88500] | 51100 [9600, 93000] | 57500 [10800, 104400] |
| **Burundi** | 17000 [0, 35400] | 17900 [0, 37200] | 20200 [0, 41900] |
| **Cabo Verde** | 360 [100, 700] | 390 [100, 800] | 560 [200, 1000] |
| **Cameroon** | 66300 [21500, 111600] | 69700 [22600, 117300] | 77700 [25200, 130600] |
| **Central African Republic** | 12600 [0, 26600] | 13300 [0, 28000] | 14800 [0, 31300] |
| **Chad** | 37500 [2600, 73100] | 39400 [2800, 76800] | 44500 [3100, 86800] |
| **Comoros** | 1300 [200, 2500] | 1400 [200, 2600] | 1500 [200, 2800] |
| **Congo** | 8500 [700, 17000] | 9000 [800, 17800] | 10000 [800, 19800] |
| **Cote d'Ivoire** | 51500 [8500, 98200] | 54100 [8900, 103200] | 60500 [10000, 115400] |
| **Democratic Republic of the Congo** | 238500 [59700, 416000] | 250700 [62800, 437300] | 283200 [71000, 494100] |
| **Equatorial Guinea** | 3200 [800, 5700] | 3400 [800, 6000] | 3800 [900, 6600] |
| **Eritrea** | 5700 [0, 12800] | 6000 [0, 13500] | 6500 [0, 14700] |
| **Eswatini** | 4300 [2300, 6600] | 4600 [2500, 7000] | 5100 [2900, 7700] |
| **Ethiopia** | 195800 [41200, 335900] | 205800 [43400, 353000] | 225700 [47500, 388100] |
| **Gabon** | 2900 [0, 5800] | 3100 [0, 6100] | 3300 [0, 6700] |
| **Gambia (Republic of The)** | 5600 [2100, 9400] | 5900 [2200, 9800] | 6700 [2500, 11100] |
| **Ghana** | 39700 [100, 79800] | 41700 [100, 83900] | 45400 [200, 91600] |
| **Guinea** | 25600 [700, 52800] | 26900 [700, 55400] | 30100 [800, 61900] |
| **Guinea Bissau** | 5900 [1700, 9900] | 6100 [1800, 10400] | 6800 [2000, 11500] |
| **Kenya*** | 89300 | 93200 | 100900 |
| **Lesotho** | 5200 [0, 11100] | 5500 [0, 11800] | 6000 [0, 12700] |
| **Liberia** | 7400 [0, 16400] | 7800 [0, 17200] | 8600 [0, 19000] |
| **Madagascar** | 60800 [7600, 118900] | 63900 [8000, 125000] | 70100 [8800, 136900] |
| **Malawi*** | 28900 | 31700 | 35000 |
| **Mali** | 55300 [17900, 93800] | 58100 [18800, 98600] | 65700 [21200, 111400] |
| **Mauritania** | 14200 [7300, 21800] | 15000 [7700, 23000] | 16700 [8600, 25600] |
| **Mauritius** | 52 [0, 200] | 59 [0, 200] | 130 [0, 300] |
| **Mozambique** | 85100 [20900, 155800] | 89400 [22000, 163700] | 100200 [24700, 183500] |
| **Namibia** | 12400 [8000, 16900] | 13000 [8400, 17900] | 14000 [9100, 19200] |
| **Niger** | 70500 [21100, 117300] | 74100 [22200, 123300] | 83800 [25100, 139500] |
| **Nigeria*** | 371100 | 380000 | 430300 |

| Country | Minimum estimates of orphanhood | Minimum estimates of primary caregiver loss | Minimum estimates of primary and/or secondary caregiver loss |
|---|---|---|---|
| **Rwanda** | 10100 [0, 24500] | 10600 [0, 25700] | 11600 [0, 28100] |
| **Sao Tome and Principe** | 440 [100, 800] | 460 [100, 900] | 510 [100, 1000] |
| **Senegal** | 31000 [13000, 50700] | 32600 [13600, 53300] | 36400 [15200, 59600] |
| **Seychelles** | 83 [0, 200] | 90 [0, 200] | 120 [0, 200] |
| **Sierra Leone** | 14100 [800, 28300] | 14800 [900, 29700] | 16200 [900, 32700] |
| **South Africa*** | 144100 | 164600 | 206800 |
| **South Sudan** | 16900 [0, 36000] | 17800 [0, 37800] | 19900 [0, 42200] |
| **Togo** | 490 [400, 500] | 510 [500, 600] | 570 [500, 600] |
| **Uganda** | 40600 [0, 93600] | 42600 [0, 98300] | 47700 [0, 109900] |
| **United Republic of Tanzania** | 79300 [500, 158700] | 83300 [600, 166800] | 93500 [600, 187100] |
| **Zambia** | 45400 [18300, 74400] | 47700 [19200, 78200] | 53300 [21500, 87400] |
| **Zimbabwe*** | 34700 | 36400 | 38900 |
| **Americas** | 1009700 [961300, 1066100] | 1096400 [1044900, 1155800] | 1459400 [1404000, 1520400] |
| **Antigua and Barbuda** | 29 [0, 100] | 32 [0, 100] | 50 [0, 100] |
| **Argentina*** | 33600 | 35700 | 45800 |
| **Bahamas** | 130 [0, 300] | 140 [0, 300] | 260 [100, 500] |
| **Barbados** | 38 [0, 100] | 43 [0, 100] | 81 [0, 200] |
| **Belize** | 290 [100, 600] | 320 [100, 700] | 440 [100, 900] |
| **Bolivia (Plurinational State of)** | 75400 [47500, 105800] | 80900 [51600, 112500] | 95900 [67700, 124900] |
| **Brazil*** | 152900 | 176200 | 256900 |
| **Canada** | 2500 [1200, 4900] | 2800 [1400, 5500] | 5900 [3400, 9800] |
| **Chile** | 5000 [2500, 9600] | 5600 [2800, 10700] | 10800 [6400, 17900] |
| **Colombia*** | 50400 | 55900 | 82500 |
| **Costa Rica** | 1200 [500, 2400] | 1300 [600, 2700] | 2400 [1200, 4400] |
| **Cuba** | 1500 [400, 3600] | 1700 [400, 4000] | 3300 [900, 7100] |
| **Dominica** | ** | ** | ** |
| **Dominican Republic** | 4900 [1400, 10300] | 5400 [1500, 11100] | 7400 [2200, 14300] |
| **Ecuador** | 41500 [23800, 65500] | 45000 [26200, 70300] | 59100 [39000, 83500] |
| **El Salvador** | 3900 [1600, 8000] | 4400 [1800, 8700] | 6900 [3200, 12500] |
| **Grenada** | 50 [0, 100] | 55 [0, 100] | 86 [0, 200] |
| **Guatemala** | 48000 [31900, 64200] | 51400 [34500, 68100] | 59100 [43300, 74600] |
| **Guyana** | 1700 [800, 3100] | 1900 [900, 3300] | 2400 [1200, 4000] |
| **Haiti** | 10200 [0, 42400] | 10900 [0, 45000] | 12300 [0, 49800] |
| **Honduras** | 11400 [5800, 20400] | 12400 [6300, 21900] | 16300 [9100, 26400] |
| **Jamaica** | 830 [200, 1900] | 920 [200, 2100] | 1500 [400, 3200] |
| **Mexico*** | 210900 | 224600 | 311600 |

| Country | Minimum estimates of orphanhood | Minimum estimates of primary caregiver loss | Minimum estimates of primary and/or secondary caregiver loss |
|---|---|---|---|
| **Nicaragua** | 5800 [2900, 10200] | 6300 [3200, 11000] | 8400 [4800, 13400] |
| **Panama** | 4500 [2500, 7000] | 4800 [2800, 7500] | 6200 [4000, 8800] |
| **Paraguay** | 11100 [6200, 17300] | 12000 [6900, 18500] | 15700 [10200, 21900] |
| **Peru*** | 121800 | 130200 | 180000 |
| **Saint Kitts and Nevis** | ** | ** | ** |
| **Saint Lucia** | 22 [0, 100] | 25 [0, 100] | 56 [0, 200] |
| **Saint Vincent and the Grenadines** | 96 [0, 300] | 110 [0, 300] | 180 [0, 500] |
| **Suriname** | 640 [300, 1100] | 690 [400, 1200] | 910 [600, 1400] |
| **Trinidad and Tobago** | 400 [200, 800] | 450 [200, 900] | 830 [500, 1400] |
| **United States of America*** | 198900 | 213200 | 250200 |
| **Uruguay** | 1400 [700, 2600] | 1600 [800, 2800] | 2500 [1500, 4000] |
| **Venezuela (Bolivarian Republic of)** | 8700 [100, 20800] | 9500 [100, 22600] | 13300 [200, 29700] |
| **Eastern Mediterranean** | 1310900 [979100, 1669200] | 1381100 1032200, 1759000] | 1530200 [1152700, 1941600] |
| **Afghanistan** | 81500 [25200, 138800] | 85700 [26500, 145800] | 94100 [29100, 160200] |
| **Bahrain** | 270 [100, 500] | 300 [100, 600] | 490 [300, 800] |
| **Djibouti** | 1200 [500, 2300] | 1300 [500, 2400] | 1600 [700, 2800] |
| **Egypt** | 398900 [314900, 474000] | 421100 [334000, 499000] | 453700 [366700, 537600] |
| **Iran (Islamic Republic of)*** | 60800 | 61700 | 81500 |
| **Iraq** | 112900 [80300, 147700] | 118700 [84500, 155300] | 128200 [91300, 168600] |
| **Jordan** | 10800 [6900, 15300] | 11600 [7500, 16300] | 13700 [9800, 18100] |
| **Kuwait** | 1100 [500, 2100] | 1200 [600, 2200] | 1900 [1000, 3100] |
| **Lebanon** | 5200 [2900, 9300] | 5800 [3200, 10100] | 8800 [5600, 13600] |
| **Libya** | 2700 [1100, 5400] | 3000 [1200, 5900] | 4400 [2000, 7800] |
| **Morocco** | 17300 [2000, 38300] | 18800 [2200, 41300] | 25000 [3000, 52100] |
| **Oman** | 9400 [6000, 13200] | 10100 [6500, 14000] | 11900 [8500, 15500] |
| **Pakistan** | 360800 [77900, 672900] | 380300 [82000, 708900] | 409000 [88300, 763600] |
| **Qatar** | 230 [100, 500] | 260 [100, 500] | 450 [200, 800] |
| **Saudi Arabia** | 6400 [0, 16200] | 7000 [0, 17500] | 9800 [0, 23200] |
| **Somalia** | 66100 [27500, 107400] | 69500 [28900, 112900] | 78500 [32600, 127600] |
| **Sudan** | 100900 [25000, 176500] | 106000 [26300, 185600] | 117700 [29300, 206100] |
| **Syrian Arab Republic** | 6800 [0, 20200] | 7300 [0, 21600] | 8400 [0, 24500] |
| **Tunisia** | 8500 [4700, 14600] | 9300 [5300, 15800] | 13700 [8800, 20500] |
| **United Arab Emirates** | 110 [0, 400] | 130 [0, 400] | 280 [0, 800] |
| **Yemen** | 59000 [20000, 103700] | 62000 [21100, 109100] | 66900 [22800, 117800] |
| **Europe** | 279800 | 321800 | 495700 |

| Country | Minimum estimates of orphanhood | Minimum estimates of primary caregiver loss | Minimum estimates of primary and/or secondary caregiver loss |
|---|---|---|---|
| | [257800, 319700] | [298500, 364100] | [468900, 539400] |
| **Albania** | 340 [100, 700] | 370 [100, 800] | 550 [300, 1000] |
| **Andorra** | ** | ** | ** |
| **Armenia** | 930 [400, 1800] | 1000 [500, 2000] | 1400 [700, 2300] |
| **Austria** | 480 [200, 1000] | 520 [200, 1100] | 770 [400, 1400] |
| **Azerbaijan** | 5400 [2700, 10300] | 5800 [2900, 10900] | 6900 [4000, 11600] |
| **Belarus** | 7500 [3700, 14700] | 8400 [4200, 16200] | 15000 [8600, 25400] |
| **Belgium** | 1300 [600, 2500] | 1400 [700, 2700] | 1900 [1100, 3200] |
| **Bosnia and Herzegovina** | 190 [0, 400] | 210 [100, 500] | 370 [200, 700] |
| **Bulgaria** | 6100 [3100, 11600] | 6900 [3600, 12800] | 13200 [7900, 21600] |
| **Croatia** | 370 [100, 800] | 400 [200, 800] | 650 [300, 1200] |
| **Cyprus** | ** | ** | ** |
| **Czech Republic** | 4400 [2200, 8300] | 4900 [2500, 9200] | 9100 [5400, 14700] |
| **Denmark** | 320 [100, 700] | 340 [100, 700] | 460 [200, 900] |
| **Estonia** | 140 [0, 300] | 150 [0, 300] | 220 [100, 400] |
| **Finland** | 120 [0, 300] | 130 [0, 300] | 200 [100, 400] |
| **France*** | 6600 | 7000 | 8800 |
| **Georgia** | 2600 [1200, 5000] | 2800 [1300, 5300] | 3300 [1800, 5600] |
| **Germany*** | 5800 | 6500 | 9300 |
| **Greece** | 340 [100, 700] | 370 [100, 800] | 630 [300, 1100] |
| **Hungary** | 3400 [1700, 6500] | 3800 [1900, 7300] | 7700 [4500, 12600] |
| **Iceland** | ** | ** | ** |
| **Ireland** | 340 [100, 700] | 360 [100, 700] | 480 [200, 900] |
| **Israel** | 7400 [4600, 10800] | 7700 [4800, 11200] | 6600 [4300, 9500] |
| **Italy*** | 4700 | 5200 | 8300 |
| **Kazakhstan** | 30300 [17200, 50300] | 31700 [18100, 52400] | 29000 [18200, 45200] |
| **Kyrgyzstan** | 7700 [4500, 11700] | 8000 [4700, 12200] | 6900 [4400, 10400] |
| **Latvia** | 400 [200, 800] | 430 [200, 900] | 590 [300, 1100] |
| **Lithuania** | 800 [400, 1600] | 860 [400, 1700] | 1200 [600, 2100] |
| **Luxembourg** | ** | ** | ** |
| **Malta** | ** | ** | ** |
| **Monaco** | ** | ** | ** |
| **Montenegro** | 190 [0, 400] | 200 [100, 400] | 270 [100, 500] |
| **Netherlands** | 1100 [500, 2200] | 1200 [600, 2400] | 1700 [900, 2900] |
| **North Macedonia** | 360 [100, 800] | 390 [200, 800] | 600 [300, 1100] |
| **Norway** | 110 [0, 300] | 120 [0, 300] | 160 [0, 300] |
| **Poland*** | 9900 | 13000 | 28300 |
| **Portugal** | 350 [100, 800] | 380 [100, 800] | 630 [300, 1200] |

| Country | Minimum estimates of orphanhood | Minimum estimates of primary caregiver loss | Minimum estimates of primary and/or secondary caregiver loss |
|---|---|---|---|
| **Republic of Moldova** | 820 [400, 1700] | 930 [400, 1900] | 2100 [1200, 3600] |
| **Romania** | 11700 [5900, 22700] | 13100 [6600, 25100] | 24700 [14500, 40700] |
| **Russian Federation*** | 72000 | 96100 | 182700 |
| **San Marino** | ** | ** | ** |
| **Serbia** | 1200 [600, 2500] | 1300 [600, 2700] | 2100 [1200, 3800] |
| **Slovakia** | 2200 [1100, 4300] | 2500 [1200, 4800] | 5000 [2900, 8200] |
| **Slovenia** | 210 [100, 500] | 230 [100, 500] | 320 [100, 600] |
| **Spain*** | 3400 | 3800 | 8200 |
| **Sweden** | 1000 [500, 2000] | 1100 [500, 2200] | 1400 [800, 2500] |
| **Switzerland** | 350 [100, 700] | 380 [100, 800] | 560 [300, 1000] |
| **Tajikistan** | 16400 [9200, 25300] | 17100 [9600, 26300] | 15000 [8300, 23600] |
| **Turkey** | 26000 [13100, 48200] | 27700 [14100, 51000] | 33100 [19200, 54800] |
| **Ukraine** | 12300 [6000, 24200] | 13900 [6800, 27100] | 29400 [16800, 49800] |
| **United Kingdom*** | 13000 | 13500 | 15700 |
| **Uzbekistan** | 9100 [4600, 16600] | 9600 [4900, 17400] | 9900 [5700, 16400] |
| **South-East Asia** | 2660800 [1980500, 3501300] | 2760700 [2058600, 3626000] | 4241400 [3164600, 5530800] |
| **Bangladesh** | 29300 [8300, 66700] | 32400 [9300, 73300] | 52100 [15900, 107300] |
| **Bhutan** | ** | ** | ** |
| **India*** | 2168500 | 2222700 | 3487400 |
| **Indonesia** | 437400 [232700, 755500] | 477400 [256800, 817900] | 658100 [392000, 1014400] |
| **Maldives** | 40 [0, 100] | 45 [0, 100] | 79 [0, 200] |
| **Myanmar** | 12600 [0, 31200] | 13800 [0, 33800] | 20500 [0, 47100] |
| **Nepal** | 4800 [1500, 11000] | 5400 [1700, 12100] | 9300 [3200, 18900] |
| **Sri Lanka** | 5300 [2900, 8900] | 5800 [3200, 9600] | 8400 [5400, 12300] |
| **Thailand** | 1700 [800, 3300] | 1900 [900, 3700] | 4100 [2300, 6700] |
| **Timor-Leste** | 1200 [0, 2900] | 1300 [0, 3100] | 1400 [0, 3300] |
| **Western Pacific** | 117500 [99200, 139400] | 129700 [110200, 153300] | 187300 [163200, 215300] |
| **Australia** | 1000 [500, 1900] | 1100 [500, 2100] | 2000 [1100, 3200] |
| **Brunei Darussalam** | 28 [0, 100] | 32 [0, 100] | 56 [0, 100] |
| **Cambodia** | 7100 [500, 15800] | 7700 [600, 17000] | 9800 [700, 20500] |
| **China** | 1600 [800, 3200] | 1800 [900, 3500] | 3300 [2000, 5500] |
| **Fiji** | 740 [400, 1000] | 790 [500, 1100] | 920 [600, 1200] |
| **Japan** | 1400 [600, 2700] | 1600 [700, 3000] | 3500 [2000, 5800] |
| **Lao People's Democratic Republic** | 2300 [0, 9600] | 2500 [0, 10300] | 3000 [0, 12100] |
| **Malaysia** | 7000 [3600, 12500] | 7800 [4100, 13700] | 12500 [7600, 19300] |

| Country | Minimum estimates of orphanhood | Minimum estimates of primary caregiver loss | Minimum estimates of primary and/or secondary caregiver loss |
|---|---|---|---|
| **Mongolia** | 2100 [1400, 2800] | 2200 [1500, 3000] | 2500 [1800, 3200] |
| **New Zealand** | 120 [0, 300] | 130 [0, 300] | 220 [100, 400] |
| **Papua New Guinea** | 1300 [0, 13900] | 1400 [0, 14700] | 1500 [0, 15900] |
| **Philippines*** | 81500 | 90200 | 128100 |
| **Republic of Korea** | 550 [100, 1400] | 630 [100, 1600] | 1600 [300, 3700] |
| **Singapore** | 80 [0, 200] | 91 [0, 200] | 210 [100, 400] |
| **Vanuatu** | ** | ** | ** |
| **Viet Nam** | 10700 [5800, 18900] | 11800 [6500, 20600] | 18000 [11400, 27600] |
| **Global** | 7519200 [6404600, 8679100] | 7944600 [6790100, 9146000] | 10455700 [8941400, 11998400] |

For every row of the table, uncertainty intervals are shown in brackets.
* This denotes our 21 study countries where no uncertainty estimates are given[4]
** Data are not reported due to small numbers
*** Daily death data combines the countries making up United Kingdom

# APPENDIX 2

## Modeling methods

We adapted previously published methods[4,5] to estimate orphanhood and caregiver loss from excess death estimates made by The Economist,[13] The Institute of Health Metrics and Evaluation (IHME),[14] and the World Health Organization (WHO).[15] However, for the purposes of this report we only describe those estimates based on WHO excess mortality, as they were the most conservative. We consider three different categories: orphanhood, primary caregiver loss and primary and/or secondary caregiver loss. We defined orphanhood using UNICEFs definition of the loss of one or more parents; primary caregiver death as death of parents or custodial coresident grandparents (providing care for children in the absence of parents); and secondary caregiver death as death of coresident grandparents or other older kin (providing care through involvement or resources).[4,5]

In Unwin et al.,[5] we use a logistic regression model to calculate orphanhood and caregiver loss ratios to deaths based on total fertility rate. We fit this model to data calculated from 21 study countries (Argentina, Brazil, Colombia, England & Wales, France, Germany, Kenya, Malawi, Mexico, Nigeria, India, Iran (Islamic Republic of), Italy, Peru, the Philippines, Poland, Russian Federation, Spain, South Africa, United States of America, and Zimbabwe). In the current report, instead of using COVID-19 death data from Johns Hopkins University for all countries as in our most recent report,[16] we multiply our orphanhood and caregiver loss to death ratio by the maximum between excess deaths and COVID-19 deaths for every country with data, from two time periods: January 1, 2020, through December 31, 2021 (end of reporting period from IHME and WHO datasets) and January 1, 2020, through May 1, 2022. This enables us to account for underreporting in COVID-19 data and is consistent with previous methodology.[4,5]

We use a death adjustment factor for each country to update our data outside the time-period for the IHME and WHO data, calculated on December 31, 2021, when we have data for both excess and COVID-19 deaths. Specifically, we assume the ratio of excess deaths to COVID-19 deaths through Dec 31, 2021, was consistent with the ratio between January 1, 2022, and May 1, 2022, for WHO and IHME estimates. We, therefore, multiplied the new COVID-19 deaths by the ratio for the prior period to generate an estimate of country-specific excess deaths for this new period. If COVID-19 deaths were greater than excess deaths, we used the reported value of COVID-19 deaths. The Economist data are released weekly and available through May 1, 2022, so no data adjustment factor is needed. The Economist dataset includes 224 countries, IHME includes 190 countries, and estimates based on WHO methods include 181 countries, due to how the data are grouped.

We consider uncertainty in both the total fertility rate and excess deaths using bootstrapping, similar to methods previously described.[4,5] For all three data sets, we assume the total fertility rate is normally distributed with the standard deviation based on the lower and upper bounds. We do not allow the total fertility rate to vary for our 21 study countries and use the ratios generated for the study opposed to ones estimated from the logistic model. For the IHME and Economist data we also assume the number of excess deaths were normally distributed with the standard deviation based on the lower and upper bounds. However, for the WHO data we sample the excess deaths with replacement from their 1000 Markov Chain Monte Carlo draws. Consistent with previous methodology,[4] we assume deaths were constant across all samples if COVD-19 deaths were greater then excess death. We use 5,000 samples for our bootstrap since at this number of samples, the error has begun to converge.[17]

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