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Broken down by age and sex:
Why reliable and timely population statistics are more important than ever

The current pandemic has highlighted the acute need for reliable and timely population statistics. This brief lays out the importance of sex and age disaggregated population data for addressing the Covid-19 crisis. Available resources and support are presented to allow national authorities to better access, analyse and disseminate these data.

This Stat Brief is issued without formal editing. It is authored by Petra Nahmias (nahmiasp@un.org), Chief of Population and Social Section, ESCAP Statistics Division. The author is grateful to the following reviewers for their valuable contributions: Gemma Van Halderen (Director, ESCAP Statistics Division), Rikke Munk Hansen (Chief of Environmental and Economic Statistics, ESCAP Statistics Division), Sharita Serrao (Statistician, ESCAP Statistics Division), Tanja B. Sejersen (Statistician, ESCAP Statistics Division), David Rausis (Associate Statistician, ESCAP Statistics Division), Patrick Gerland (Chief of Population Estimates and Projections Section, UNDESA Population Division), Christophe Lefranc (Technical Adviser on Population and Development, UNFPA Asia and the Pacific Regional Office), Linda Peters (Business Development, Esri), Andrew Tatem (Director, WorldPop Project, University of Southampton), Alessandro Sorichetta (Associate Professor, WorldPop Project, University of Southampton), Alessandra Carioli (Research Fellow, WorldPop Project, University of Southampton), Maksym Bondarenko (Head of WorldPop Spatial Data Infrastructure, WorldPop Project, University of Southampton), Patrycja Koper (GIS Research Technician, WorldPop Project, University of Southampton).

I. Why are population statistics so important?

The Asia- Pacific region has been the first to be impacted by COVID-19, with countries dealing with the epidemic with limited information and data on the risk factors and impacts of the pandemic. What has emerged clearly is that hospitalizations and deaths from COVID-19 interact closely with sex and age, especially once transmission is established with the older age groups.[1,2]

While there are many influences on rates of infection and mortality from COVID-19 in a population such as overcrowding, access to sanitation, access to healthcare, co-morbidities and household structure, the data on these factors are less easily available and the extent to which they influence outcomes is yet to be established. Data on the pandemic has, to date, been disproportionately from middle- and high-income countries with little information available on how the pandemic might evolve in low income countries. Population statistics, however, are available for every country and can therefore provide, from a demographic perspective at least, an approximation of vulnerability to COVID-19 morbidity and mortality. Additionally, policies to slow transmission need to consider both the age and sex composition of local and national contexts as well as the social interactions and living arrangements of older and younger generations.[3] Furthermore, policies to mitigate the impact – both immediate and in the longer term – of COVID-19 need to take into account the sex and age breakdown since existing inequalities may be deepened, as well as new gender and age specific challenges emerge, as a result of the evolving and fast changing situation.

[1] Dowd et al. (2020) "Demographic science aids in understanding the spread and fatality rates of COVID-19" https://www.medrxiv.org/content/10.1101/2020.03.15.20036293v2.full.pdf

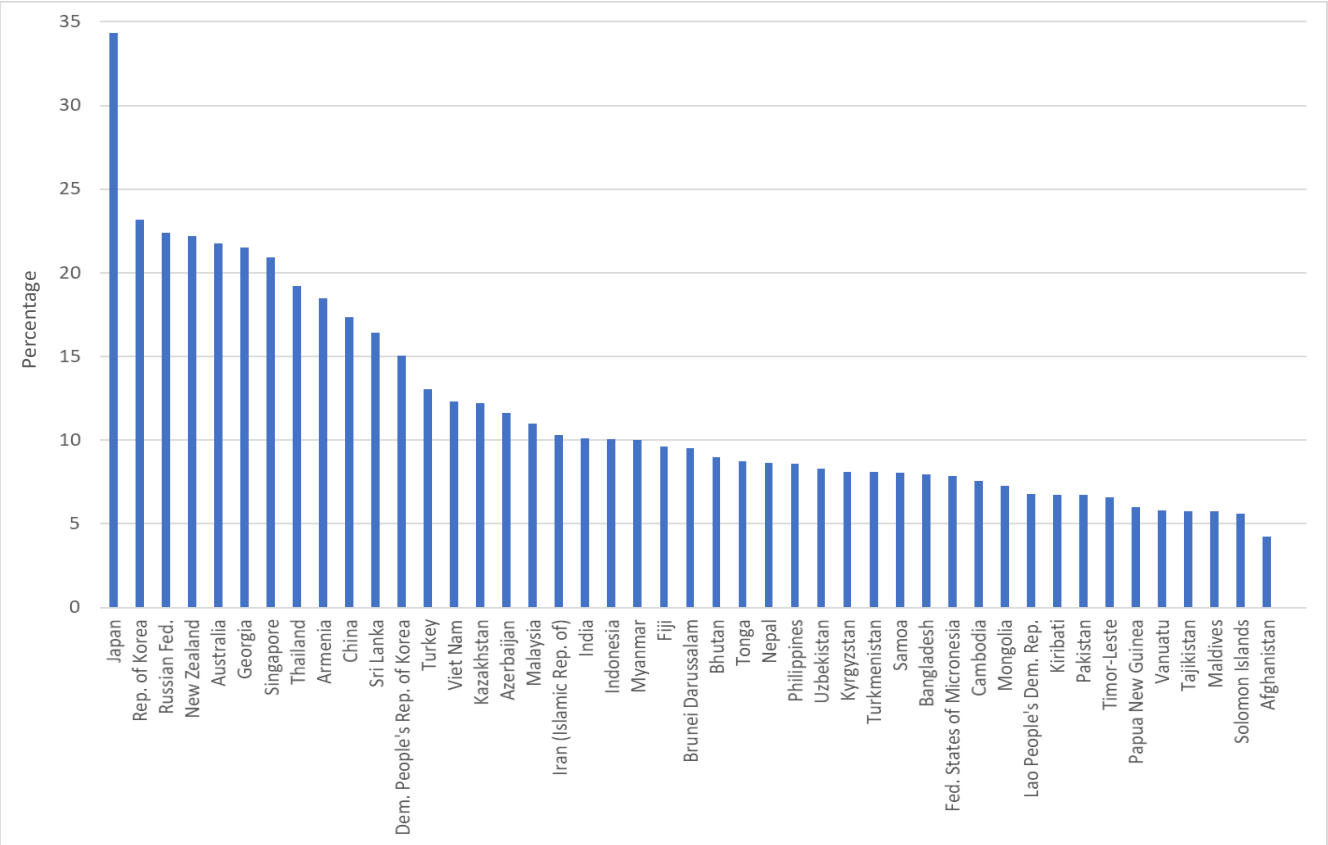
[2] Dudel et al. (2020) "Monitoring trends and differences in COVID-19 case fatality rates using decomposition methods: Contributions of age structure and age-specific fatality" https://osf.io/dtmve/

[3] Dowd et al. (2020) "Demographic science aids in understanding the spread and fatality rates of COVID-19" https://www.medrxiv.org/content/10.1101/2020.03.15.20036293v2.full.pdf

II. The impact of differing age and sex structures

The Asia-Pacific region is home to great variation in age structure, both within and between countries, with both some of the oldest and the youngest national populations in the world, as Figure 1 shows.

Figure 1. Proportion of population aged 60 and over in ESCAP member States, 2020[4]



Applying the case fatality rates (the proportion of people who die out of those who have tested positive from the disease) from Italian data can give an idea of the relative impact of this differing age-sex structure.[5] It is important to note that this estimation is not a projection or a model and is based only on Italian data.[6] There have been thus far, and are likely to continue to be, differences in the case fatality rate by country including in the relative impact of age and sex, partly due to real differences in the impact, for example due to the capacity of the health care system which may be overwhelmed when numbers are very high in a particular area, and partly due to inconsistencies and differences in how testing, hospitalization and mortality data are collated and reported.[7] Case fatality rates are, in particular, greatly influenced by the testing regimen in a country and the stage in the epidemic that a country is experiencing. For example, Republic of

[4] United Nations, Department of Economic and Social Affairs, Population Division (2019). World Population Prospects 2019, Online Edition. Rev. 1.

[5] R code and calculations based on: https://www.r-bloggers.com/impact-of-a-countrys-age-breakdown-on-covid-19-case-fatality-rate-by-ellis2013nz/

[6] Other data is available from China and South Korea which show similar trends although the case fatality rates are higher in Italy. Since the most up to date data is available from Italy and because of differences in reporting and testing, and because this exercise is illustrative only rather than a projection, only the Italian data was used.

[7] See Dudel et al. (2020) "Monitoring trends and differences in COVID-19 case fatality rates using decomposition methods: Contributions of age structure and age-specific fatality" https://osf.io/dtmve/ for a breakdown of the relative contribution of age structure to the overall case fatality rate

Korea has a much lower case fatality rate than Italy but has also carried out much more widespread testing which means that more people with less severe symptoms are included in the denominator. However, the increasing likelihood of severe COVID-19 symptoms by age and for men is a consistent factor for all countries who have reported data and this weighting is intended to be illustrative only.

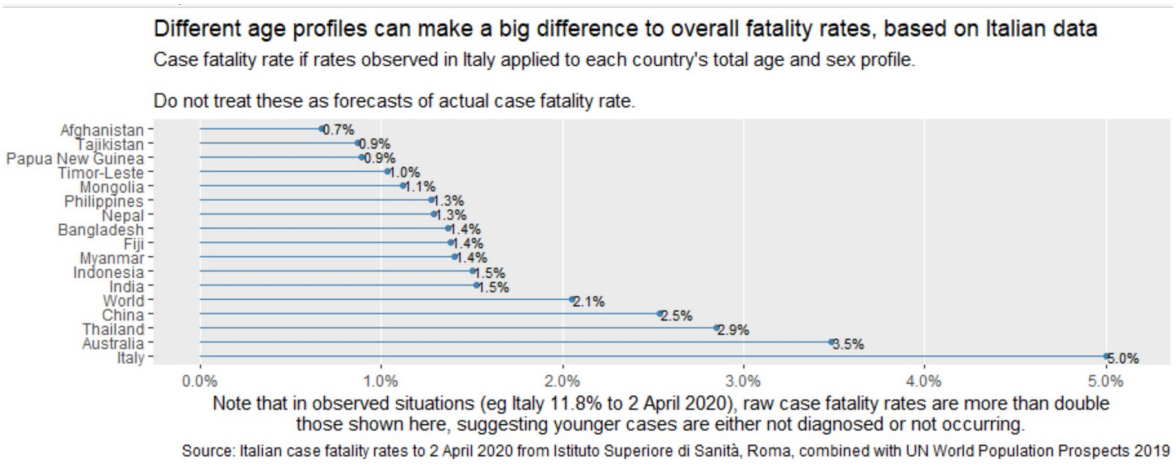
Indeed, when this approach is applied to the entire Italian population, the case fatality rate is significantly lower than that reported by Italy because Italian men and older Italians are more likely to be diagnosed with COVID-19 than expected from their representation in the population. Given the inherent biases and inaccuracies in the data, this has not been corrected for in order to not provide a false sense that this calculation is any sort of projection or forecast. Similarly, for China, the estimated figure is very different to that reported from China since it reflects only a comparative analysis of applying Italian figures to the entire Chinese population.

As can be seen below in Figure 2, based on a selected number of Asia-Pacific countries, the younger age-structure could prove to be relatively protective of COVID-19 mortality, holding all other factors equal and weighting case fatality rates using the Italian data. It is important to note that some of the region's poorest countries are vulnerable to high infection rates and poor outcomes from the pandemic on many dimensions including malnutrition and stunting, weak health systems, overcrowding, poor sanitation, and existing co-morbidities among others. However, many of these lower income countries also tend to have a younger age structure, for example Afghanistan. Holding all other factors equal and looking only at the age and sex population breakdown means that Afghanistan would have a case fatality rate of below 1%, far below that of many other countries, due to its more favourable demographic structure. Others, with older populations, such as Thailand and Australia (again holding all other factors equal) would have higher rates, although not reaching the levels seen in Italy. As more sex- and age-disaggregated data on COVID-19 infections, hospitalizations, need for intensive care and fatalities become available from other countries, including lower income ones, this exercise can be developed further and better reflect the situation in countries.

These differences demonstrate how critical up to date and accurate population statistics are for preparing for COVID-19 response. As Dowd et al. (2020) describe, an understanding of the population at risk and patterns of intergeneration contact – underpinned by consideration of the population age and sex structure – will help inform governments about targeted actions to protect those at highest risk of mortality both within and across countries.[8]

[8] Dowd et al. (2020) "Demographic science aids in understanding the spread and fatality rates of COVID-19" https://www.medrxiv.org/content/10.1101/2020.03.15.20036293v2.full.pdf

Figure 2. Case fatality rates if the rates observed in Italy were applied to each country's total age and sex profile

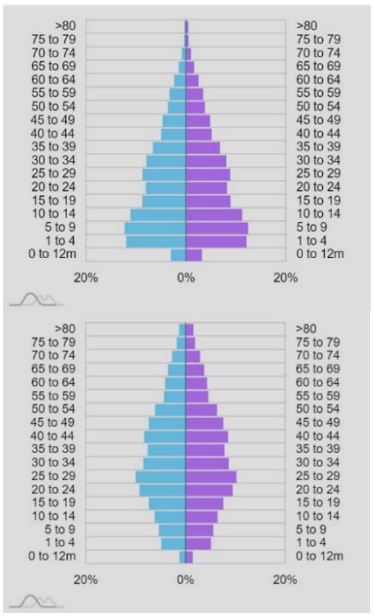


Within countries, there is also great variability in the age structure. At the sub-national level, some areas will be more vulnerable to COVID-19 in terms of age and sex structure with implications for government response.

Using data from WorldPop,[9] examples of subnational variation in age and sex structure are shown from Thailand and Lao People's Democratic Republic (PDR) in Figure 3. The map shows the percentage of men aged 80 and over – the most vulnerable group to poor COVID-19 outcomes - in each administrative area. As can be seen, in some regions the proportion of this population is seven to eight times as large as in others, with the variation higher in Thailand than in Lao PDR. For each country, two examples of the age-sex structure in a sub-national area are shown with the population pyramid and the proportion of those aged 60 and older. In one of the youngest administrative areas in Lao PDR, the elderly account for 5.3% of the total population rising to 13.4% in one of the older regions. Thailand, with its lower fertility rates, has a significantly older population. Even one of its youngest administrative areas has 10.7% elderly while one of its older administrative areas has almost one in three people (32.1%) aged 60 and over. Clearly any preparation for COVID-19 impact at the local level must take this age and sex structure into account.

[9] WorldPop (www.worldpop.org - School of Geography and Environmental Science, University of Southampton; Department of Geography and Geosciences, University of Louisville; Département de Géographie, Université de Namur) and Center for International Earth Science Information Network (CIESIN), Columbia University (2018). Global High Resolution Population Denominators Project - Funded by The Bill and Melinda Gates Foundation (OPP1134076). WorldPop was initiated in 2013 and produces detailed and freely-available population and composition maps for all countries All the sub-national age/sex data can be accessed here: https://www.portal.worldpop.org/demographics/

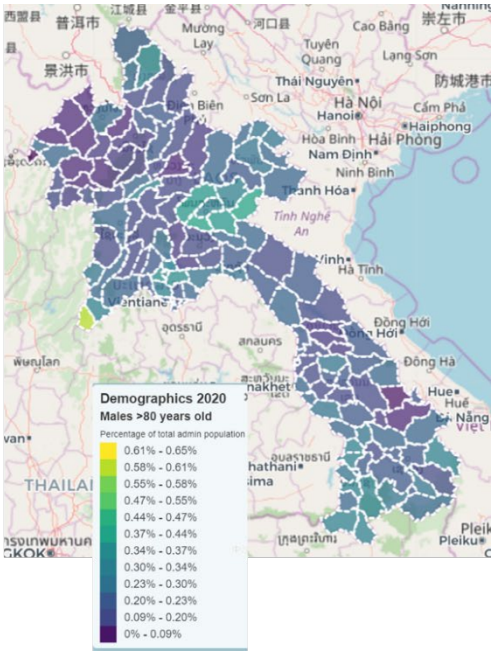
Figure 3. Sub-national age-sex structures in Lao PDR and Thailand[10]

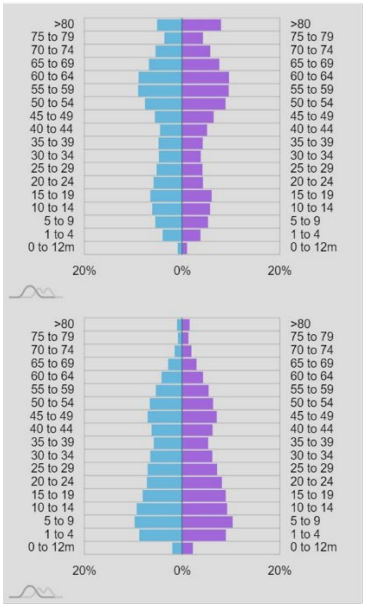


Lao PDR

Admin name: Luangprabang Pak Xeng
Total aged 60+: 5.3%
Men aged 60+: 2.6%
Women aged 60+: 2.7%

Admin name: Xayabury_Botene
Total aged 60+: 13.4%
Men aged 60+: 6.7%
Women aged 60+: 6.7%

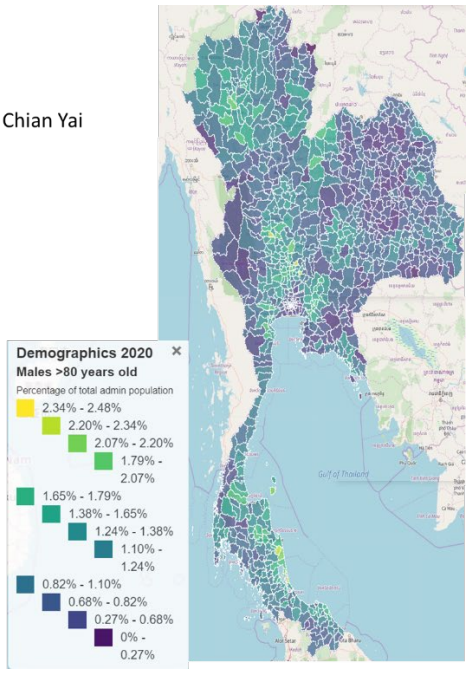




Thailand

Admin name: Nakhon Si Thammarat Chian Yai
Total aged 60+: 32.1%
Men aged 60+: 14.5%
Women aged 60+: 17.6%

Admin name: Tak Tha Song Yang
Total aged 60+: 10.7%
Men aged 60+: 5.4%
Women aged 60+: 5.3%



While the COVID-19 pandemic has highlighted the need for reliable and up to date population estimates, including at the sub-national level, it also impacts the ability of countries to produce these statistics. Some 150 countries are scheduled to begin census enumeration in 2020 and 2021 which clearly will be disrupted in many cases. Additionally, civil registration and vital statistics systems, the other main source for population data, already facing challenges in many countries, are under further strain to perform in pandemic conditions.

[10] https://www.portal.worldpop.org/demographics/

III. Help is available

UNESCAP Statistics Division is committed to working with countries and development partners to support the provision of population statistics for COVID-19 response. We will be prioritizing support for countries with lower statistical capacity to facilitate their ability to respond with evidence-informed policies based on reliable and timely population statistics.

There is a lot of open and freely accessible information and help available now.

Data

WorldPop has data available which countries can access and download for their own purposes. The data comes from a variety of sources including census tabulations, census microdata, household surveys such as Demographic and Health Surveys and Multiple Indicator Cluster Surveys, United States Census Bureau and UN DESA population estimates with the administrative unit to which the data are disaggregated dependent on data availability. More details may be found in Pezzulo et al. (2017).[11]

Developed at the University of Southampton and under the leadership of Professor Andy Tatem, WorldPop is made up of more than 30 members of staff, including demographers, geographers, ecologists, statisticians, epidemiologists, spatial analysts, and computer scientists. The methods used are designed with full open access and operational application in mind, using transparent, fully documented and shareable methods to produce easily updatable maps with accompanying metadata. All WorldPop data is available for download here: https://www.worldpop.org/. Subnational age and sex structure data can be visualized and downloaded here: https://www.portal.worldpop.org/demographics/.

WorldPop has already helped countries faced with census enumeration challenges. In 2017, researchers from WorldPop worked closely with the Afghanistan national statistical office to integrate available data in a spatial statistical modelling framework. New population estimates were produced down to 100m grid cells for the country, with associated measures of uncertainty. More details on the Afghanistan case study are available here in an article published in the Proceedings of the National Academy of Sciences of the United States of America https://www.pnas.org/content/115/14/3529.

Technology

The WorldPop data is spatially-enabled. This makes it very accessible to end-users. The data can be downloaded as CSV, GeoTIFF, and shapefiles for use in GIS tools. This enables the NSO to integrate the population data with other data of relevance to policy makers such as location of services (e.g. hospitals), location of risk spots (e.g. aged care facilities) and logistical information (e.g. transport systems).

An example of statistical-geospatial integration in support of CoVID-19 was released by the Australian Bureau of Statistics and is available here. This example integrates data modelled from the Australian National Health Survey to produce interactive maps examining the geographic distribution of people with a range of chronic health conditions, across several age groups, by Statistical Area Level 2 (SA2) of residence. These groups are considered by the WHO to be at a higher risk from COVID-19 and these maps can be used in conjunction with local or expert knowledge to provide insights into the geographic spread of these conditions https://absstats.maps.arcgis.com/apps/MapSeries/index.html?appid=bacd58f73b554c329f431ceb02ef9ab8.

However, to use it one needs access to GIS technology. The good news is such technology can be accessed right now.

Free software is available through QGIS and R Studio. QGIS is most widely used for developing static maps and geodata database modelling. R-Studio may be used to develop automation modelling like automapping, geospatial statistical analysis, machine learning and artificial neural network for future prediction mapping. This software has various packages to develop static and dynamic geospatial maps. R-Shiny was the most recently developed package in R-Studio which is used to develop dynamic data Visualization and realtime mapping.

[11] https://www.nature.com/articles/sdata201789#Sec2.

QGIS and R-studio are easily accessible and can be downloaded from the below links.

- QGIS: https://qgis.org/en/site/forusers/download.html
- R studio: https://rstudio.com/products/rstudio/download/

ArcGIS is a widely used technology available from Esri Inc, https://www.esri.com/en-us/arcgis/about-arcgis/overview. There are different programs available today to help you get access to this technology, including specific resources for COVID that are made freely available A list of Esri supported resources related to COVID-19 is provided in Annex 1.

UN Department of Economic and Social Affairs Statistics Division is also supporting countries wishing to access the Esri ArcGIS technology through the Open SDG Data Hub project. The Open SDG Data Hub project is open to all countries and Esri's software is donated, at no cost for three years, to all IDA countries. At the end of the three-year period, if the country wishes to continue to use the licences and subscriptions, it can do so at an 85% discount on maintenance for an annual subscription until 2030. Annual costs will be based on the number of users and scale of capabilities and specific countries in need. The following are eligible IDA countries in Asia-Pacific: Cambodia, Fiji, Kiribati, Lao-PDR, Marshall Islands, Micronesia, Mongolia, Myanmar, Papua New Guinea, Samoa, Solomon Islands, Timor-Leste, Tonga, Tuvalu, Vanuatu. Afghanistan, Bangladesh, Bhutan, Maldives, Nepal, Pakistan. For more information, see http://unstats-undesa.opendata.arcgis.com/.

Skills

So you have access to the spatially enabled population data and the technology, but don't know how to use it? No problems. There are a host of free online GIS training courses available. A selection is available here https://geoawesomeness.com/free-online-gis-courses-geospatial-skills/.

Fundamental Principles of Official Statistics

All of this is empowering you as champions for the UN Fundamental Principles of Official Statistics.

- You would be providing indispensable data about the demographic, social, economic and maybe even environmental situation of your country. Data that is of practical use. Data that is made available on an impartial basis to all.
- You are deciding on the methods and procedures for the collection, processing, storage and presentation of the data. You are deciding based on professional considerations including scientific principles and professional ethics.
- You are presenting information that facilitates correct interpretation for your countries circumstances.
- You are able to respond to comments on erroneous interpretation or the misuse of the statistics because you have produced them.
- You have drawn data from all types of sources and you have chosen the source with regard to quality, timeliness, costs and burden on respondents
- Individual data hasn't been collected. The data sourced is being used exclusively for statistical purposes.
- You operate under laws, regulations and measures which are transparent and available to those wishing to read them.
- You are coordinating within your country to achieve consistency and efficiency in the statistical system.
- You are using international concepts, classifications and methods to promote consistency and efficiency. The newly endorsed Global Statistical Geospatial Framework was endorsed just recently at the 51st session of the UN Statistical Commission: https://unstats.un.org/unsd/statcom/51st-session/documents/The_GSGF-E.pdf.
- You are cooperating bilaterally and multilaterally and contributing to the improvement of systems of official statistics in all countries.

Annex 1: Esri COVID-19 resources

- Esri announcement about type of resources
- Link to disaster response program site to apply to get free access (Countries/Agencies can apply to this if they need resources – including free access to online, hubs and templates/solutions, data and more): https://disasterresponse.maps.arcgis.com/home/index.html
- COVID-19 Hub includes many links, whitepapers, some interesting apps being published as well as links to view Global, Country and US applications
- Esri COVID-19 Hub site resources page- this includes CHIME model for Hospital impact – developed by University of Pennsylvania, implemented in ArcGIS
- Business continuity and COVID: https://coronavirus-business-continuity-arcgishub.hub.arcgis.com/
- Coronavirus solutions for business continuity: https://solutions.arcgis.com/shared/help/coronavirus-business-continuity/
- Learn lessons for COVID – these will help you walk through step by step on setting things up such as the dashboard
- GeoNet site for COVID-19: https://community.esri.com/community/coronavirus-disease-2019-covid-19
- Esri Solution templates: https://solutions.arcgis.com/local-government/help/coronavirus-response/

This site includes applications that you can just pick up and use including:

Community Impact Dashboard	An application used by public health staff to monitor key coronavirus response metrics and share this information with the public.
Community Impact Mobile Dashboard	An application, optimized for mobile devices, used by public health staff to visualize coronavirus cases in their community.
Coronavirus Case Dashboard	An application used by public health staff to visualize coronavirus cases in their community.
Coronavirus Case Mobile Dashboard	An application, optimized for mobile devices, used by public health staff to visualize coronavirus cases in their community.
Case Reporter	A survey used by public health staff to tabulate coronavirus cases in their community.
Public Place Manager	An application used by public health or emergency response staff to manage the status of public gathering places (for example, schools, common places).
School Closings	An application used by the public to obtain school closing information.
Medical Facilities Locator	An application used by the public to locate the nearest hospital or healthcare clinic.
Community Closings	An application used by the public to obtain information about gathering places (for example, government buildings, public places) in the community.
Testing Sites Manager	An application used by public health or emergency response staff to inventory coronavirus testing locations.
Testing Sites Locator	An application used by the public to locate the nearest coronavirus testing location.

Meal Sites Manager	An application used by school district or emergency response staff to inventory meal pickup locations.
Meal Site Report	A survey used by school district staff or volunteers to tabulate meals served at a site.
Meal Sites Locator	An application used by the public to locate the nearest meal site pickup location.
Meal Sites Dashboard	An application used by school district or emergency response staff to monitor meal programs.
Getting Started with the Coronavirus Response Solution	A link to documentation where you can learn more about the capabilities provide in the Coronavirus Response Solution.
Coronavirus Response	An application used to access the Coronavirus Response maps and applications.

Please find below some interesting applications. Note the data feed from John Hopkins which has the up to date numbers of cases being reported, is running on Esri technology. You can configure apps to that data.

- John Hopkins data and hub/dashboards https://coronavirus.jhu.edu/map.html
- WHO announcement - note we also are working with GOARN
- https://news.un.org/en/story/2020/03/1060222
- UN-DESA announcement and Hub https://unsd-coronavirus-response-undesa.hub.arcgis.com/ - UNSD is looking to federate COVID data just like with SDG data in the FIS4SDGs
- Interesting survey developed by WFP and FAO on food security – survey here https://survey123.arcgis.com/share/d748d0f9394a4dd8993c09fa6bd6dccf this was implemented for Caribbean but I imagine could be done in other regions – and dashboard here http://unwfp.maps.arcgis.com/apps/opsdashboard/index.html#/761eed1a539640dcaeaefcec4c5b5a5b

Examples from across the globe:

- Example hub from Americas https://americas-covid-19-hub-esridistributor.hub.arcgis.com/
- Story map of Americas (note examples here from Caribbean are starting to populate as well – including small island states)
- Australia dashboard
- Australia (ABS) is also publishing interesting stats on employment and at risk pop.
- Canada health dashboard and mental health maps
- Mexico hub is here https://covid-19-mexico-sigsamx.hub.arcgis.com/#Opmex.
  - link showing INEGI data from 2010 census configured
  - and COVID dashboard bringing it all together
- RCRMD dashboard
- MapAction dashboard is also interesting.

For more information regarding ESCAP's work in statistics development please visit: http://www.unescap.org/our-work/statistics

Previous issues of Stats Brief: http://www.unescap.org/resource-series/stats-brief

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