University of Southampton WorldPop

Using WorldPop Population data to strengthen Reproductive, Maternal, Newborn, Child, and Adolescent Health (RMNCAH) planning and outcomes

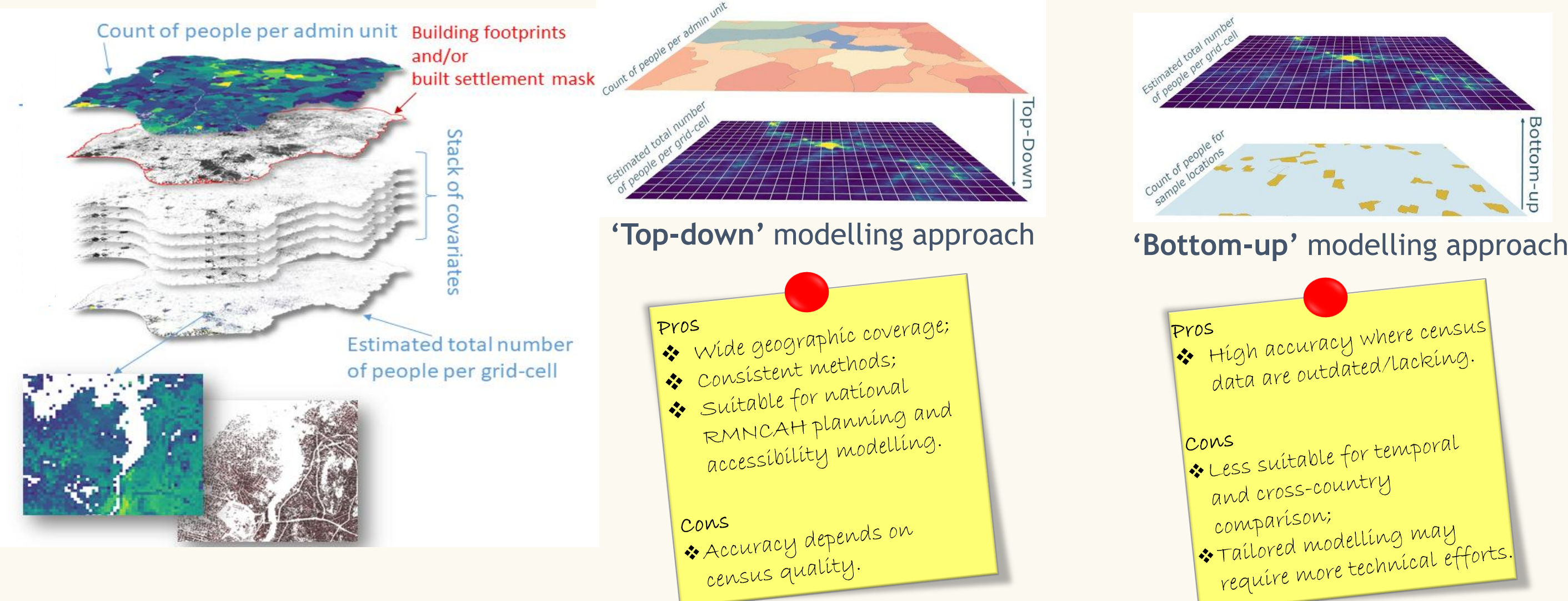**Countdown to 2030** — Women's, Children's & Adolescents' Health

GRIDDED POPULATION ESTIMATES

WorldPop's gridded population estimates are produced from the harmonisation of sub-national census-based or official population projection data, administrative boundaries, built settlement growth data, and covariates, aligned to a base grid, at approximately 100m at the equator.

These are either constrained to built settlements or unconstrained using two broad modelling approaches: '**Top-down**' disaggregation and '**Bottom-up**' estimation.

'Top-down' modelling approach

Pros
- Wide geographic coverage;
- Consistent methods;
- Suitable for national RMNCAH planning and accessibility modelling.

Cons
- Accuracy depends on census quality.

'Bottom-up' modelling approach

Pros
- High accuracy where census data are outdated/lacking.

Cons
- Less suitable for temporal and cross-country comparison;
- Tailored modelling may require more technical efforts.

Selecting the right population data and further modelling approach differences are explained in the resources linked via these QR codes:

What population estimates are available?
- Population counts obtained via https://bit.ly/Wpopcounts;
- 2015 estimates of numbers of pregnancies and numbers of live births per grid square.
- Age and sex structures available for 2000-2020 and 2015-2030 and adjusted to United Nations population projections, accessed via https://bit.ly/ageAndSex.

These are also available for specific RMNCAH groups, such as:

children <1 year — *Newborn and child health*

children <5, <10 years — *Adolescent health*

females of reproductive age (15-49 years) — *Reproductive and maternal health*

Creating Custom Population Layers with Tools and Plugins

Small-area population estimates can be generated by users for enumeration areas, catchments, or any administrative unit. WorldPop provides several tools and plugins that make this possible, including:

- **QGIS pypopRF** plugin – a simple interface for creating population within QGIS.
- **popRF** (R package) – an R framework for producing high-resolution population estimates using Random Forest models.
- **peanutButter** (R package and Web Application) – tools for extracting, summarising, and aggregating gridded population data, including a user-friendly, no-code interface for generating custom population estimates.

Scan the QR codes to access tutorials on producing estimates for census enumeration areas (EAs), administrative units, health catchments, and grid-cell-level estimates using both R and the QGIS pypopRF plugin.

DID YOU KNOW?

Free: All WorldPop datasets are open access, free, no registration required;
Flexible: Custom small-area estimates can be generated for any country or region;
Easy: No coding required if using the peanutButter web app or QGIS pypopRF plugin;
Ready to use: Outputs can be analysed in any GIS software or RMNCAH planning tool.

WHY DO THESE MATTER FOR RMNCAH?

All population data are available at the grid/pixel level and can be aggregated to any administrative level, census enumeration area, catchment area or any preferred boundaries.

Estimates of total number of women of child-bearing age (15 - 49 years old) per grid square in 2015 for Ethiopia

Estimates of total number of women of child-bearing age (15 - 49 years old) per district in 2015 for Ethiopia (source: GADM)
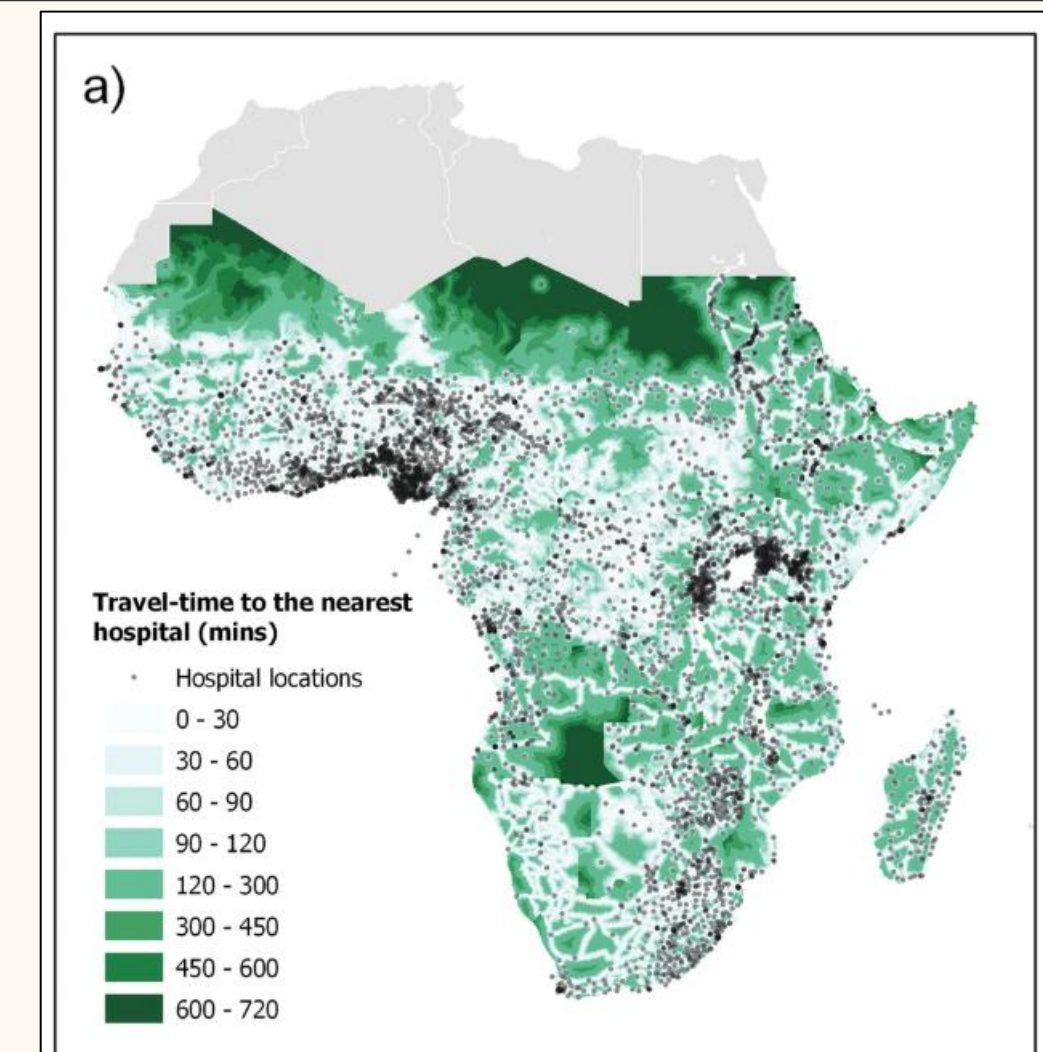
Population Data Use Cases for RMNCAH

This flexibility allows RMNCAH programs to identify underserved areas, calculate accurate population counts, estimate coverage and plan interventions at the level where decisions should be made. These analyses include:
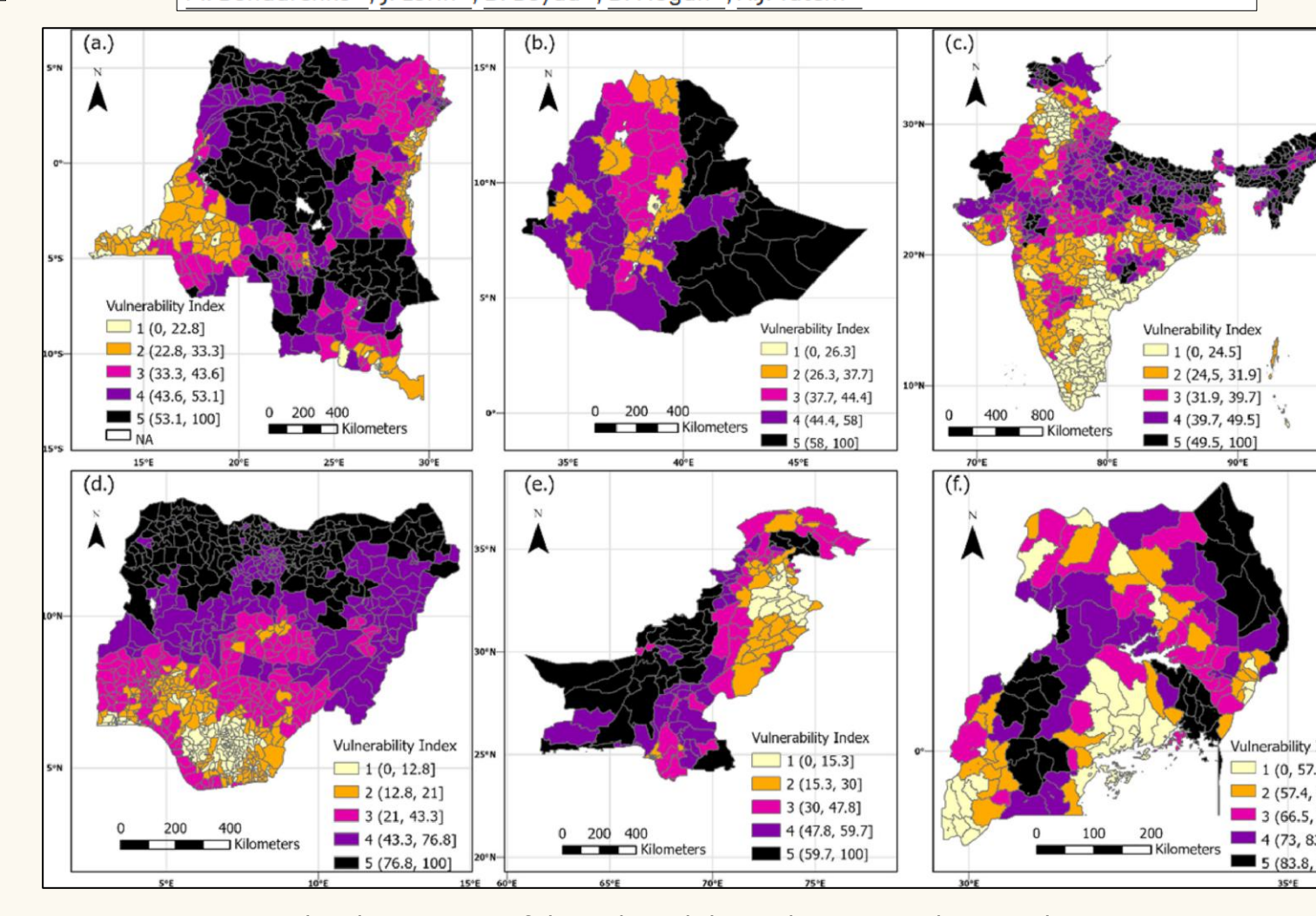
■ Enhanced accessibility and equity analysis:

Measuring the availability and geographical accessibility of maternal health services across sub-Saharan Africa
A. S. Wigley, N. Tejedor-Garavito, V. Alegana, A. Carioli, C. W. Ruktanonchai, C. Pezzulo, Z. Matthews, A. J. Tatem and K. Nilsen

Map showing travel-time to the nearest hospital in Sub-Saharan Africa

A zero-dose vulnerability index for equity assessment and spatial prioritization in low- and middle-income countries
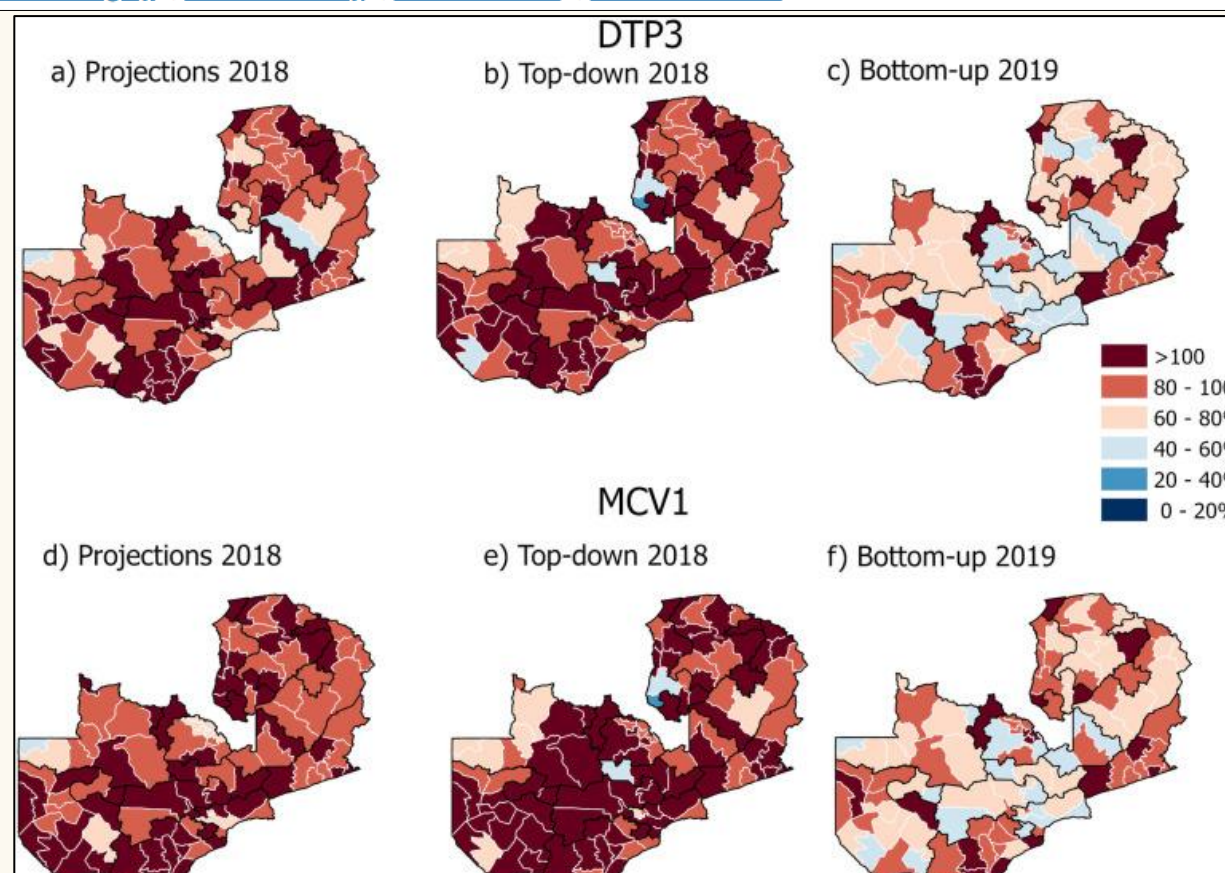C.E. Utazi, H.M.T. Chan, I. Olowe, A. Wigley, N. Tejedor-Garavito, A. Cunningham, M. Bondarenko, J. Lorin, D. Boyda, D. Hogan, A.J. Tatem

District-level estimates of the vulnerability index grouped into 5 classes ranging from the least vulnerable (class 1) to the most vulnerable (class 5) areas.

■ Estimating RMNCAH indicators at sub-national levels:

A review of geospatial methods for population estimation and their use in constructing reproductive, maternal, newborn, child and adolescent health service indicators
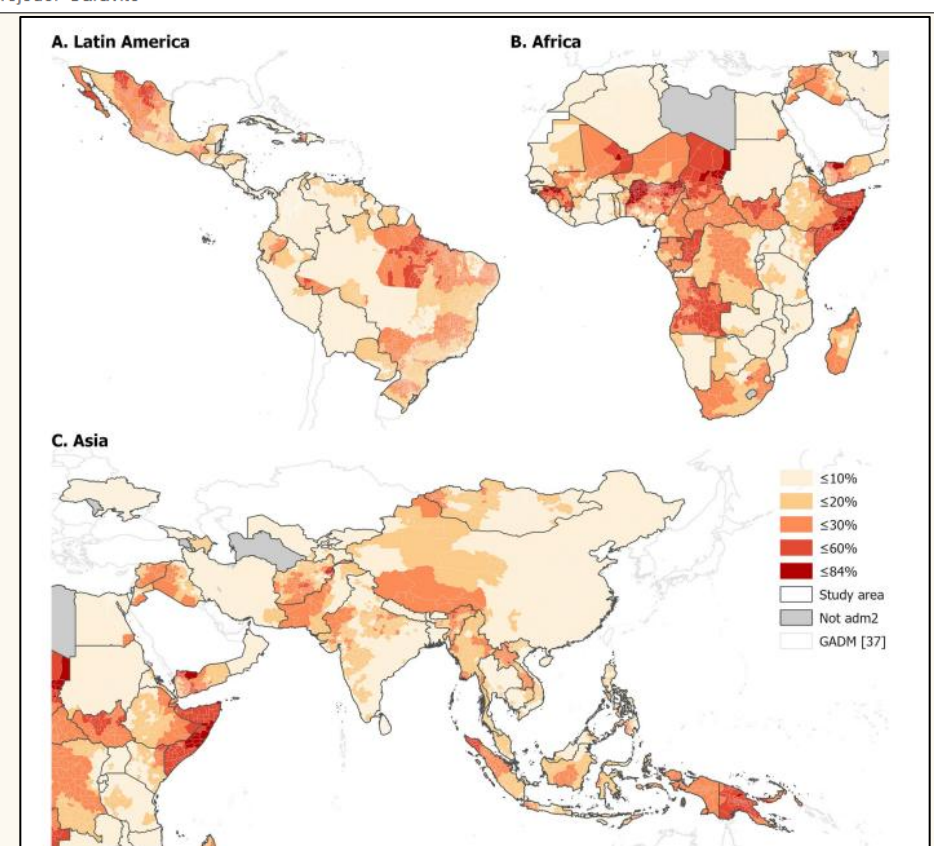Kristine Nilsen, Natalia Tejedor-Garavito, Douglas R Leasure, C Edson Utazi, Corrine W Ruktanonchai, Adelle S Wigley, Claire A Dooley, Zoe Matthews, Andrew J Tatem

District-level DTP3 and MCV1 vaccination coverage in Zambia, calculated using DHMIS doses with census, WorldPop, and GRID3 population estimates to show how denominator choice affects coverage.

Geospatial Analyses of Recent Household Surveys to Assess Changes in the Distribution of Zero-Dose Children and Their Associated Factors before and during the COVID-19 Pandemic in Nigeria
by Justice Moses K. Aheto, Iyanuloluwa Deborah Olowe, Ho Man Theophilus Chan, Adachi Ekeh, Boubacar Dieng, Biyi Fafunmi, Hamidreza Setayesh, Brian Atuhaire, Jessica Crawford, Andrew J. Tatem and Chigozie Edson Utazi

District-level estimates of numbers of DTP, MCV, and composite (i.e., BCG, OPV, DTP, and MCV) zero-dose children during the pre-pandemic period in 2018 (top panels) and the pandemic period in 2021 (bottom panels)

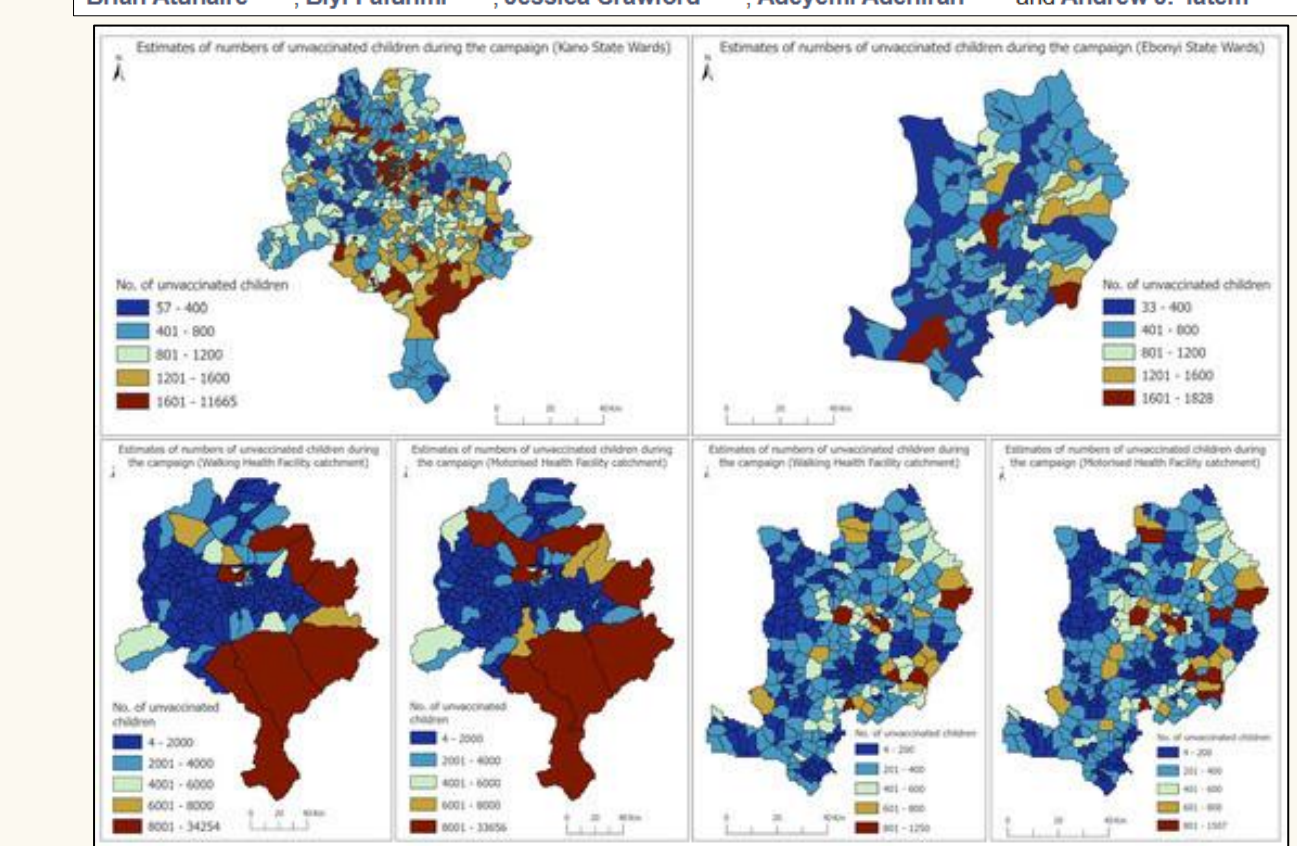### ■ Identifying underserved and high-need population such as zero-dose or under-vaccinated children:

Estimates of the number and distribution of zero-dose and under-immunised children across remote-rural, urban, and conflict-affected settings in low and remote middle-income countries
Adelle Wigley, Josh Lorin, Dan Hogan, C. Edson Utazi, Brittany Hagedorn, Emily Dansereau, Andrew J. Tatem, Natalia Tejedor-Garavito

Proportion of children under 1 year of age estimated to have not received the first dose of the DTP vaccine in 2019 at GADM administrative level 2 [31, 37] for Latin America (A), Africa (B), and Asia (C).

Geospatial Variation in Vaccination Coverage and Zero-Dose Prevalence at the District, Ward and Health Facility Levels Before and After a Measles Vaccination Campaign in Nigeria
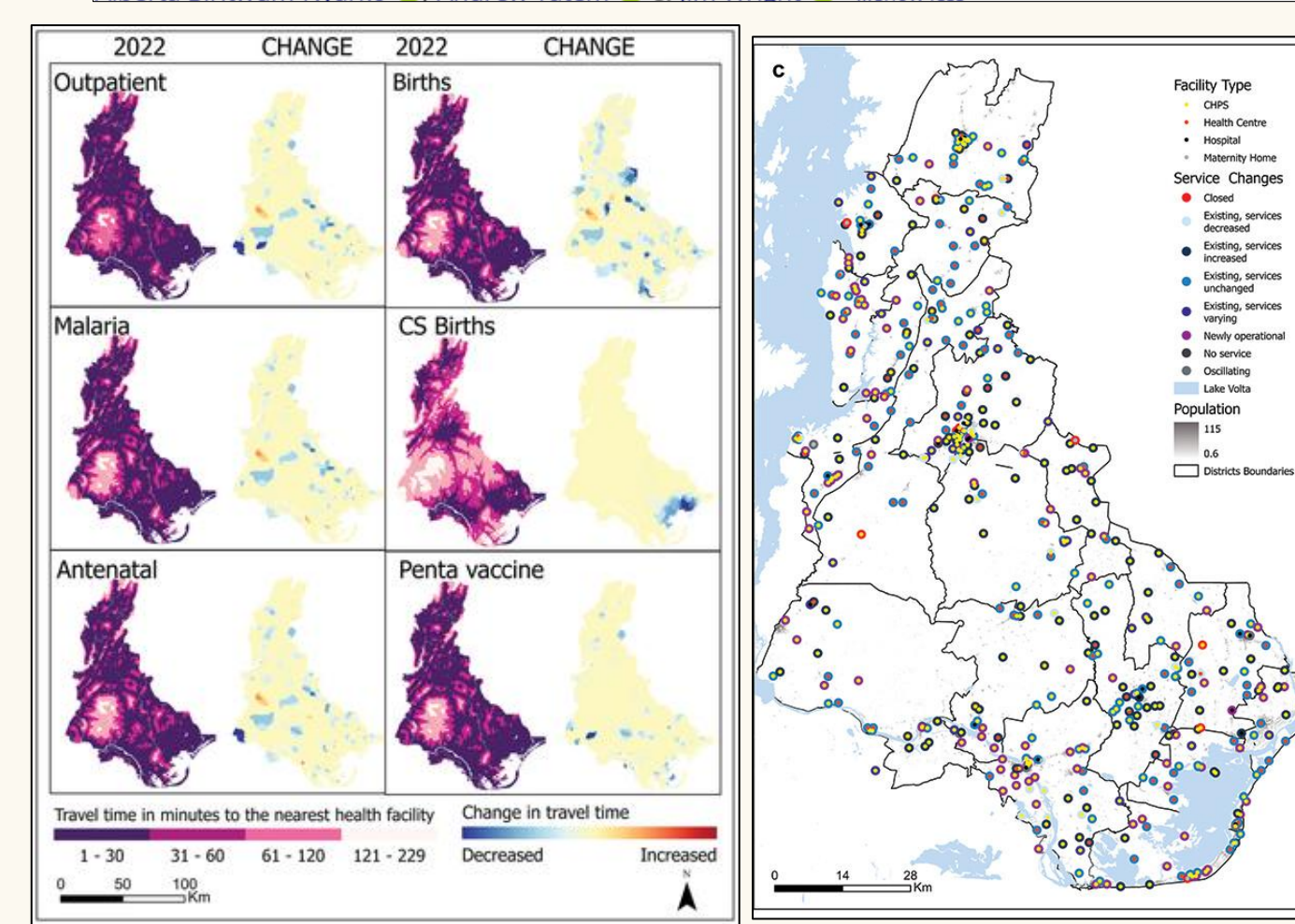by C. Edson Utazi, Iyanuloluwa D. Olowe, H. M. Theophilus Chan, Winfred Dotse-Gborgbortsi, John Wagai, Sulaiman Etamesor, Brian Atuhaire, Biyi Fafunmi, Jessica Crawford, Adeyemi Adeniran, and Andrew J. Tatem

Estimates of numbers of unvaccinated children aged 12-59 months at the ward and health facility catchment area levels during the campaign

■ Improved health service delivery across catchment areas:

Spatio-temporal patterns of health service delivery and access to maternal, child, and outpatient healthcare in Volta region, Ghana: a repeated cross-sectional ecological study using health facility data
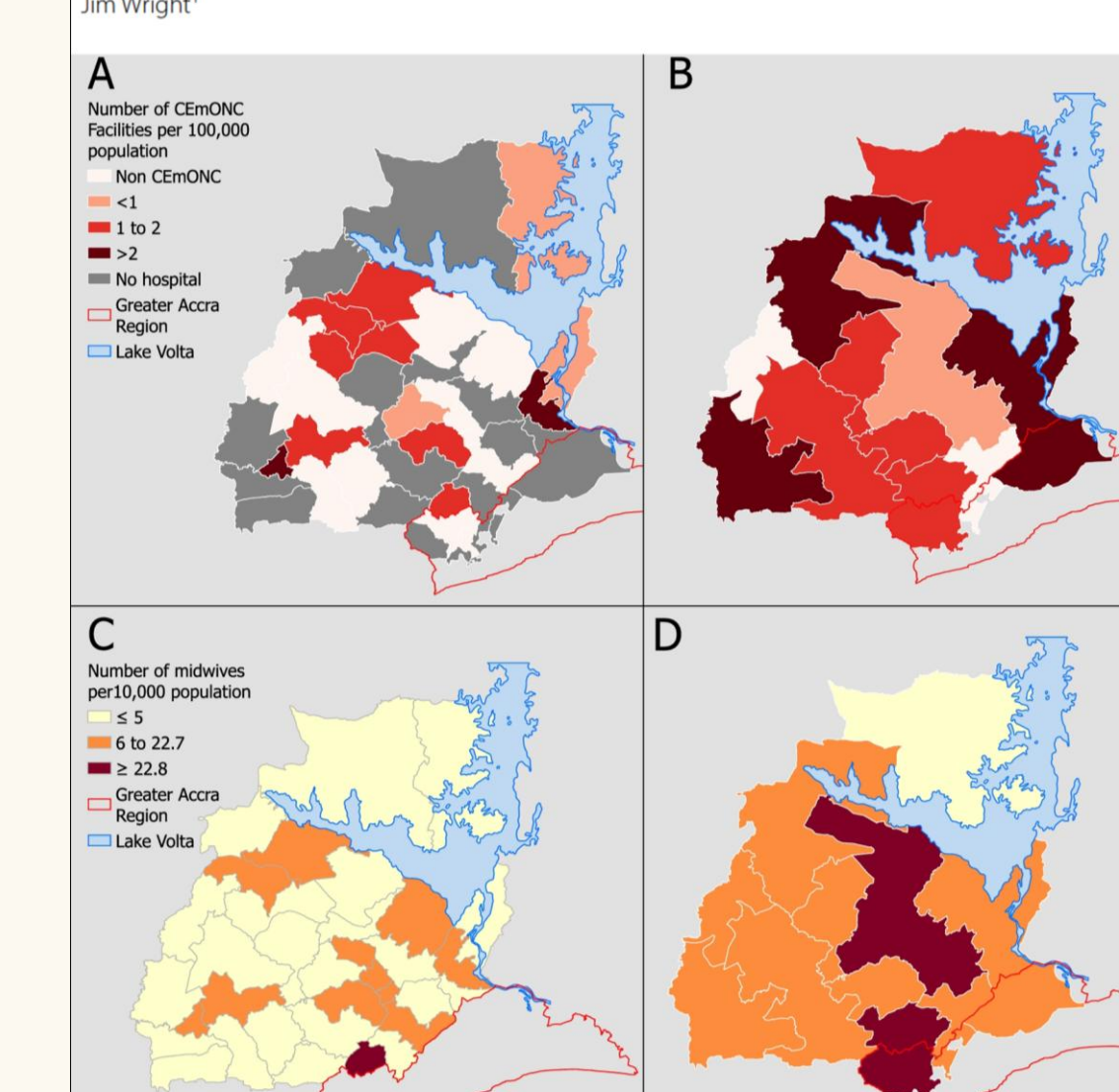Winfred Dotse-Gborgbortsi, Kristine Nilsen, Ortis Yankey, Anthony Ofosu, Thomas Ankomah, Eric Tweneboah, Ignatius Aklikpe, Chrysantus Kubio, Alberta Biritwum-Nyarko, Andrew Tatem & Jim Wright

Change in travel time between 2016 and 2022 for facilities reporting outpatient, malaria, antenatal, birth, caesarean, and childhood vaccination care, Volta Region.

Spatial distribution of health facility types and changes in services provided overlayed on 2022 population in Volta region, Ghana
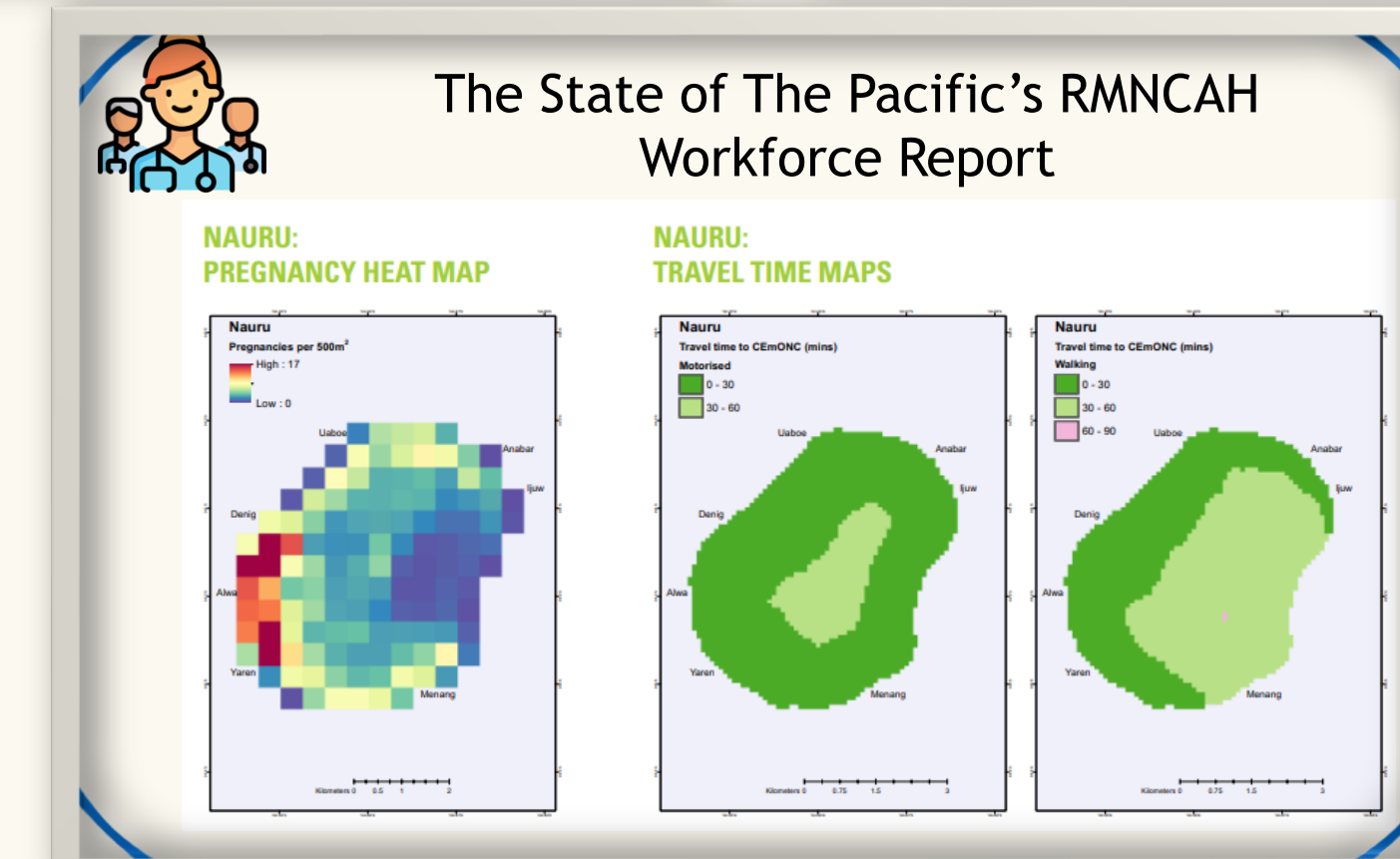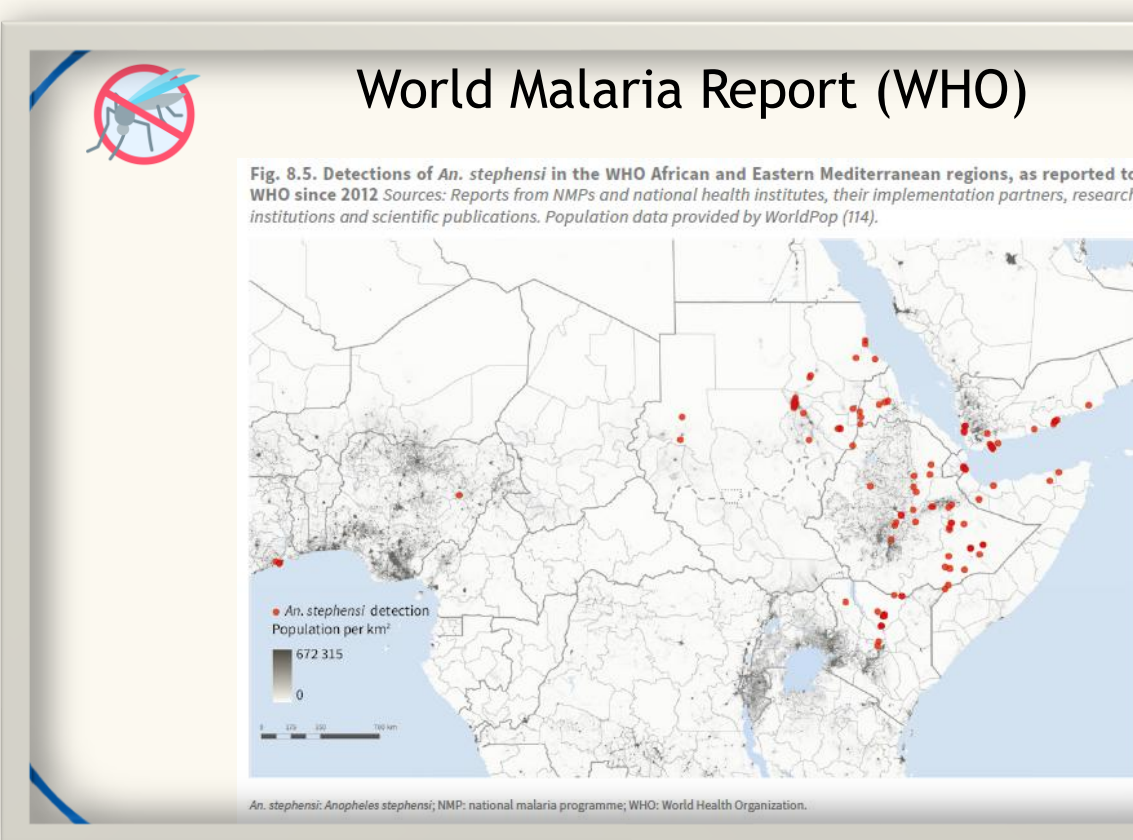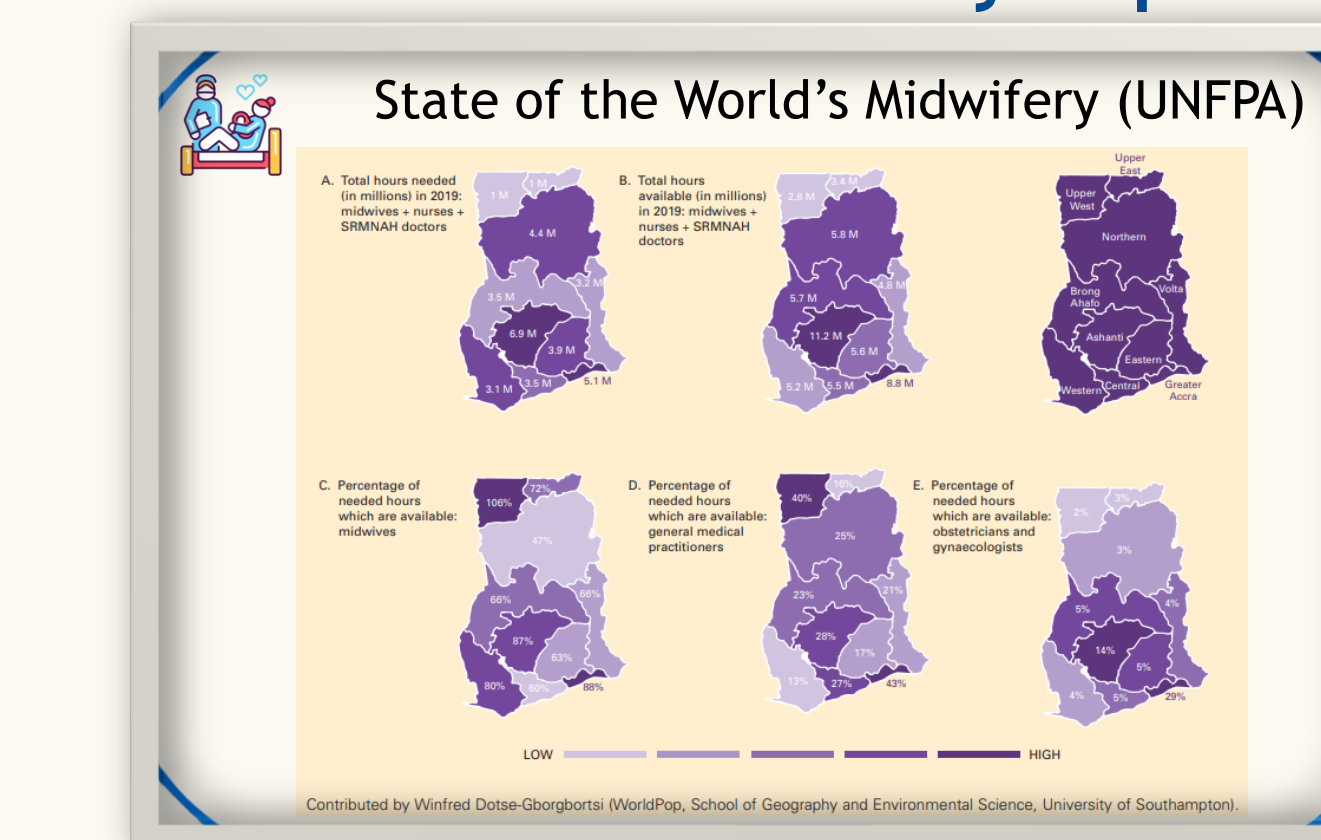
Delineating natural catchment health districts with routinely collected health data from women's travel to give birth in Ghana
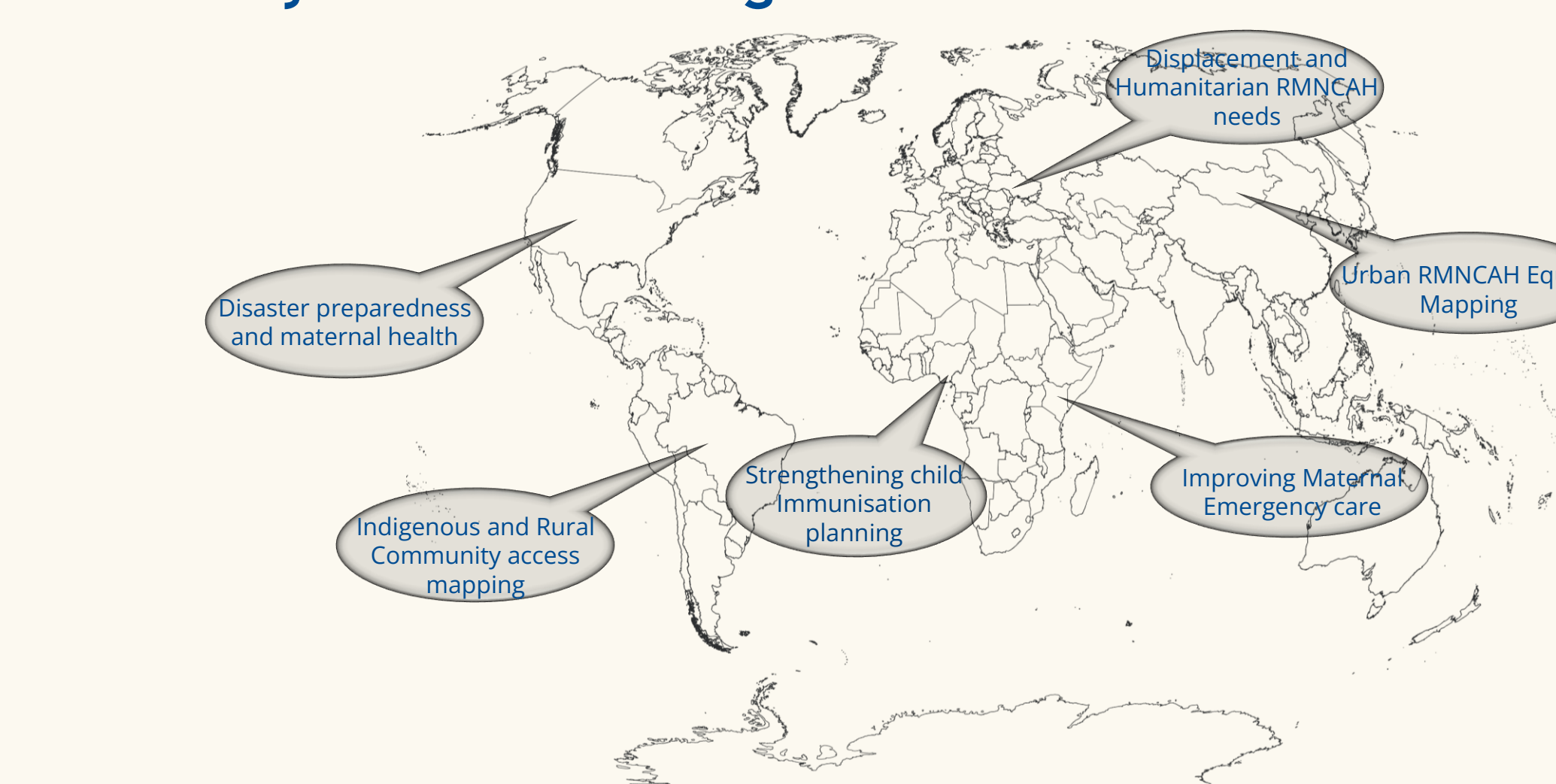Winfred Dotse-Gborgbortsi, Andrew J Tatem, Zoë Matthews, Victor Alegana, Anthony Ofosu and Jim Wright

Geographic access to birthing care services and human resource availability to provide birthing care in Ghana

WORLDPOP POPULATION DATA IN RMNCAH POLICY MAKING

➤ Used in Global Policy Reports

State of the World's Midwifery (UNFPA)

Contributed by Winfred Dotse-Gborgbortsi (WorldPop, School of Geography and Environmental Science, University of Southampton)

World Malaria Report (WHO)

The State of The Pacific's RMNCAH Workforce Report

NAURU: PREGNANCY HEAT MAP   NAURU: TRAVEL TIME MAPS

➤ Policy Uses Across Regions and Countries

- Displacement and Humanitarian RMNCAH needs
- Urban RMNCAH Equity Mapping
- Disaster preparedness and maternal health
- Strengthening child immunisation planning
- Improving Maternal Emergency Care
- Indigenous and Rural Community access mapping

When countries leverage high-resolution population, such as WorldPop data, RMNCAH policies can be made more precise, equitable, and effective, enabling better targeting of resources, improved planning, and more informed decision-making.

Acknowledgement