Using GIS to Estimate Non-standard Area Population

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Department of Health, Western Australia
Western Australia's public health system aims:

• To ensure healthier, longer and better lives for all Western Australians

• To protect the health of our community by providing a safe, high quality, accountable and sustainable health care system
Epidemiology Branch
Department of Health
Western Australia

Our Aim:
To monitor, assess and report on health profiles and service utilisation for the WA population.

We provide information to:
- Guide policy development
- Identify emerging issues
- Prioritise service delivery
- Evaluate health system performance

For more info visit: http://www.public.health.wa.gov.au
Email: epi@health.wa.gov.au
GIS in WA Health Department

- Epidemiology Branch within Public Health and Clinical Services Division
- 3 FTE + 0.4 contractor positions
- Historically MapInfo domain, changed to ESRI suite due to increased spatial analysis requirement
USA

- ~3,790,000 sq mi
- 313,900,000 people
- ~82 ppl/sq mi
- Spend 13.5% GDP on Health
- Life expectancy ~78

Australia

- ~3,000,000 sq mi
- 23,500,000 people
- ~7 ppl/sq mi
- Spend 8.5% of GDP on Health
- Life expectancy ~82
Overview

• Background

• Population Estimate

• Concordance files

• Evaluation
Background

Measuring the size and distribution of human population and projection is fundamental to services

- Health, education, political, transportation and urban planning

Users - government and non-government agencies

- Areal levels population (Suburbs and Postcode)
- Administrative boundaries (Health District, Health Regions & Service Areas) for reporting and funding allocating purposes
- Detailed demography information, such as ethical groups, age and gender, family income, structure etc
Background

Australian Bureau of Statistics (ABS)

- Census every 5 years
- Population projection for whole state and major capital cities (Greater Perth Area)
- ABS standard geography
  - Mash Block, SA1 – SA4, Yearly population estimate by SA2
  - Preserve the confidentiality of original respondents
  - Administrative convenience

WA Department of Planning (Planning)

- Population projection every 5 years by Local Government Areas (LGA)
- ABS Statistic Area 2 for Health Department
Background

Aboriginal Population

- 3% population are Aboriginal and Torres Strait Islanders
- Most disadvantaged and poor health
- Life expectancy at the end of last year:

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Background

Aboriginal Population

• “Closing the gap” strategies
• Accurate population is needed at all geographical levels for evidence to inform health service planning and delivery
• But due to the privacy issues, ABS only releases age-sex population at state level and total population at SA2 level

So there is a strong demand to develop a methodology to estimate non-standard area (postcode or suburb) population and SA2 level Aboriginal population, and also to assess the estimation errors
Population Estimate Method

• Non-standard area population

  – ABS SA2 population as the base

• Optimised for demographic data (ERP) – freely available yearly
• Census and non-census data available
• Based on gazetted suburb/locality
• Average population 10,000
• Optimal range 3,000 – 25,000
Population Estimate Method

• Non – standard area population
  – ABS SA2 population as the base
  – Use Property Street Address (PSA) as the weight
    • PSA spatial data from Western Australia Landgate (authority dataset)
    • Update daily with new building approval and subdivision info
    • Over 1.2 millions records, 96% are houses
    • Good indicator of where people are
Suburb: Coolbellup
PSA: 2746
Ratio: 2746/3893 = 0.705

Suburb: North Lake
PSA: 290
Ratio: 290/3893 = 0.075

SA2: Coolbellup
PSA: 3893

Suburb: Bibra Lake
PSA: 857
Ratio: 857/3893 = 0.22
Population Estimate Method

- Non-standard area population
  - ABS SA2 population as the base
  - Use Property Street Address (PSA) as the weight
  - If no PSA in the area, using the area split
Population Estimate Method

• Non – standard area population
  – ABS SA2 population as the base
  – Use Property Street Address (PSA) as the weight
  – If no PSA in the area, using the area split
  – Use ArcGIS Model Builder
Population Estimate Method

• Non–standard area population continue

  – Use the ratio to calculate the suburb or postcode area population for the census year
  – Adjust the rounding errors
  – Assess / validate the results to the ABS census State Suburb (SSC) or Postal Area (POA)
  – If the two datasets are similar (most of the cases), then use the derived ratio to produce spatially explicit population for subsequent suburb or postcode area for the year using the relevant SA2 data
  – The method can be used to estimate population at all geographic levels
Population Estimate Method

• Concordance file between Suburb, postcode or any user defined geography to ABS SA2s
  – ABS SA2 population as the base
  – Use Property Street Address (PSA) as the weight
  – If no PSA in the area, using the area split
  – Use ArcGIS Model Builder
  – Can produce the split ratios if there is/are split(s) or
  – Assign the area to the SA2 has most PSA (one to many relationship)
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Aboriginal Population Estimate

- Estimate aboriginal population from Health District to SA2

Data available
- ABS SA2 total aboriginal population for the census year
- Commissioned ABS to provide age/sex aboriginal population by Health District
- Use Health District population to derive the ratio for age and sex for that district
- Apply the ratio to SA2 total in the district to get the estimate of the SA2 population by age/sex
- Round and check the errors
Aboriginal Population Estimate

- Check and make sure the SA2 aboriginal population for any age group is less than total population
- Assess and validate the results with the Department of Indigenous community population
- This is only for census year aboriginal population
- This forms the base, then use the standard cohort method to derive the future years population after census. That is add births, subtract deaths and assume zero migration and age population one year.
Evaluation

– Use the PSA as the weight for non-standard area population estimate is reliable
– Use the PSA as the weight for creating concordance file between ABS standard geography to any administration boundary is accurate and reliable
– The method for aboriginal population estimate is the only way for us to get the results needed
– It is not an absolutely accurate estimation, but best available for Health planning and delivery
Thankyou and questions

Grace.Yun@health.wa.gov.au