

Measuring Populations and their Characteristics: Past, Present and Future

Office for National Statistics
Sir Ian Diamond



Corfe Castle

“From such returns great parochial advantages would be derived wheresoever they might be adopted, and if they were general great national benefit would result therefrom.”

William Pitt Morton



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Corfe Castle

- Examples of individuals from Corfe Castle Census
 - Jane Umby, aged 31, knitting in Back Street, earning a shilling and sizpence a week, and recorded in notes “Husband ran away”.
 - “Thomas Norman, foolish, Martha Norman a cancer on her face”

Censuses through the years

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The enumerated names are shown within the boundaries of the

Full Parish (or Township) of	City or Municipal District	Municipal Ward of	Parliamentary District of	House or Village or Hamlet of	Urban Sanitary District
1	South Shore				
No. of	SEXES	NAME and Residence of each Person	RELATION to Head of Family	AGE SEXES as to Marriage	Trade, Profession, or OCCUPATION
7	Male	Alfred Smith	Head	42	Shoemaker
	Female	Ann Smith	Wife	38	
		Alfred Smith	Son	12	General Labourer
		John Smith	Son	15	Shoemaker
		Ray Smith	Son	10	
		John Smith	Son	5	
		Alfred Thompson	Wife	45	Station Master
		Mary Thompson	Wife	40	
		James Hall	Wife	38	
		William Brown	Wife	40	General Labourer
		Ada Brown	Wife	35	
		George Brown	Son	28	Black
		Elizabeth Brown	Wife	30	
		William Brown	Son	8	Son
		William Brown	Son	8	Son
		Alfred Brown	Son	8	
		Elizabeth Brown	Son	8	
		James Brown	Son	2	
		Thomas Brown	Son	62	Blacksmith
		Henry Brown	Wife	61	
		Mary Brown	Son	72	
		John Brown	Son	8	
6	Total of Males			11	
				11	

Notes.—Draw the pen through each of the words of the headings so are suggested.

PUBLIC RECORDS OFFICE

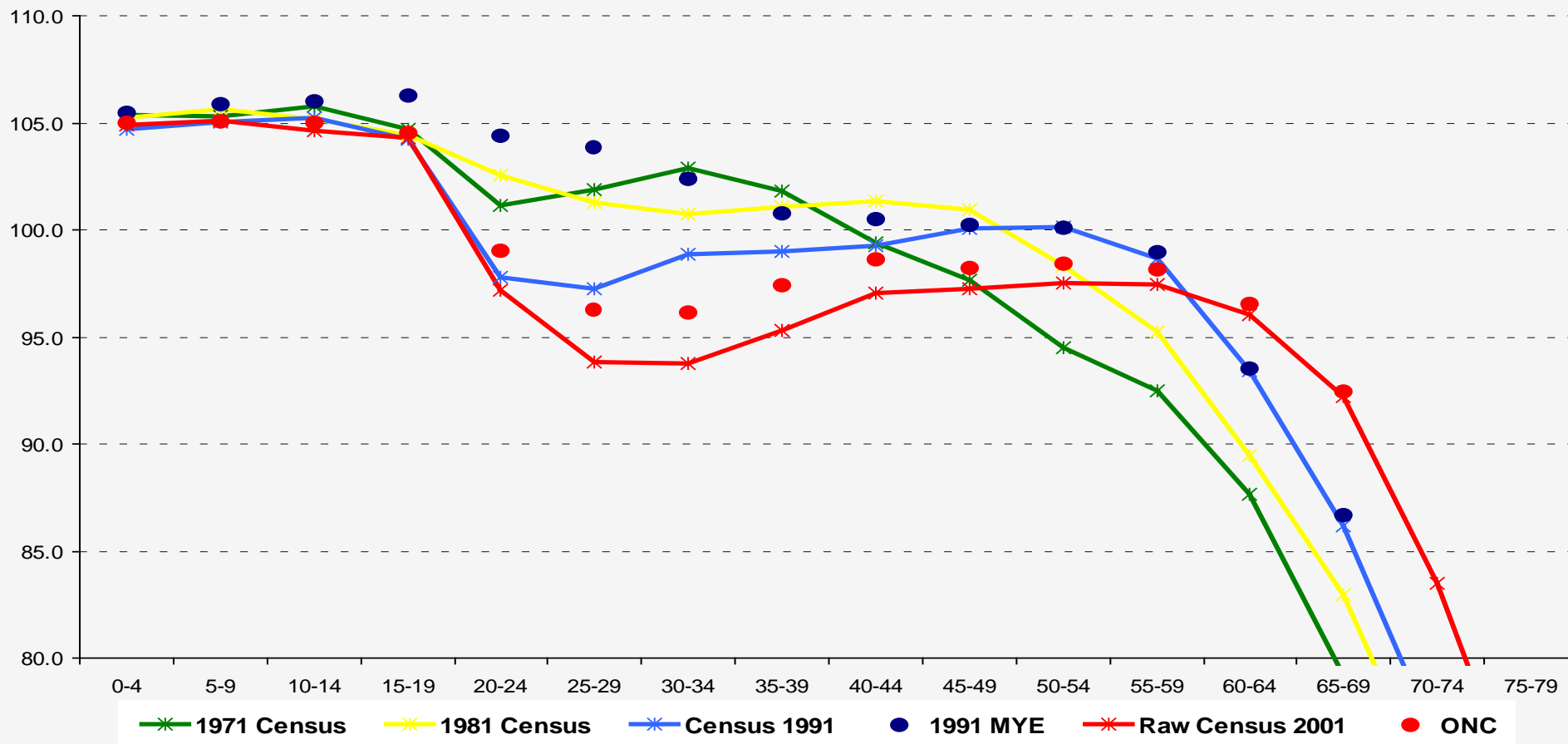
RC 11/1168

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Census Accuracy : 1991

A change in culture (Why?)

Sex Ratios by age-group, England and Wales, 1971 - 2001



2001 : First strategy for underenumeration

- Acceptance that underenumeration would exist
- Young (particularly men); hard to reach groups
- How to assess? – administrative records; follow up survey
- Survey then QA using Administrative Records
 - Interviewer based in sample of EDs with estimates at LAD level by age and sex; adjusting within LAD for ‘hard to count’ index; sample size for Population CI 0.2%
- Major exercise in matching Census v CCS

Brown, Buckner, Abbott, Chambers and Diamond (1999)

Estimation

- Use matched Census+CCS data
 - Note penalty for mismatching
- Combined ***Dual System*** and ***Ratio Estimates***
- Includes adjustment for those missed in both Census and CCS

		Counted By CCS		
		Yes	No	
Counted By Census	Yes	n_{11}	n_{10}	n_{1+}
	No	n_{01}	n_{00}	n_{0+}
		n_{+1}	n_{+0}	n_{++}

DSE count for a postcode:

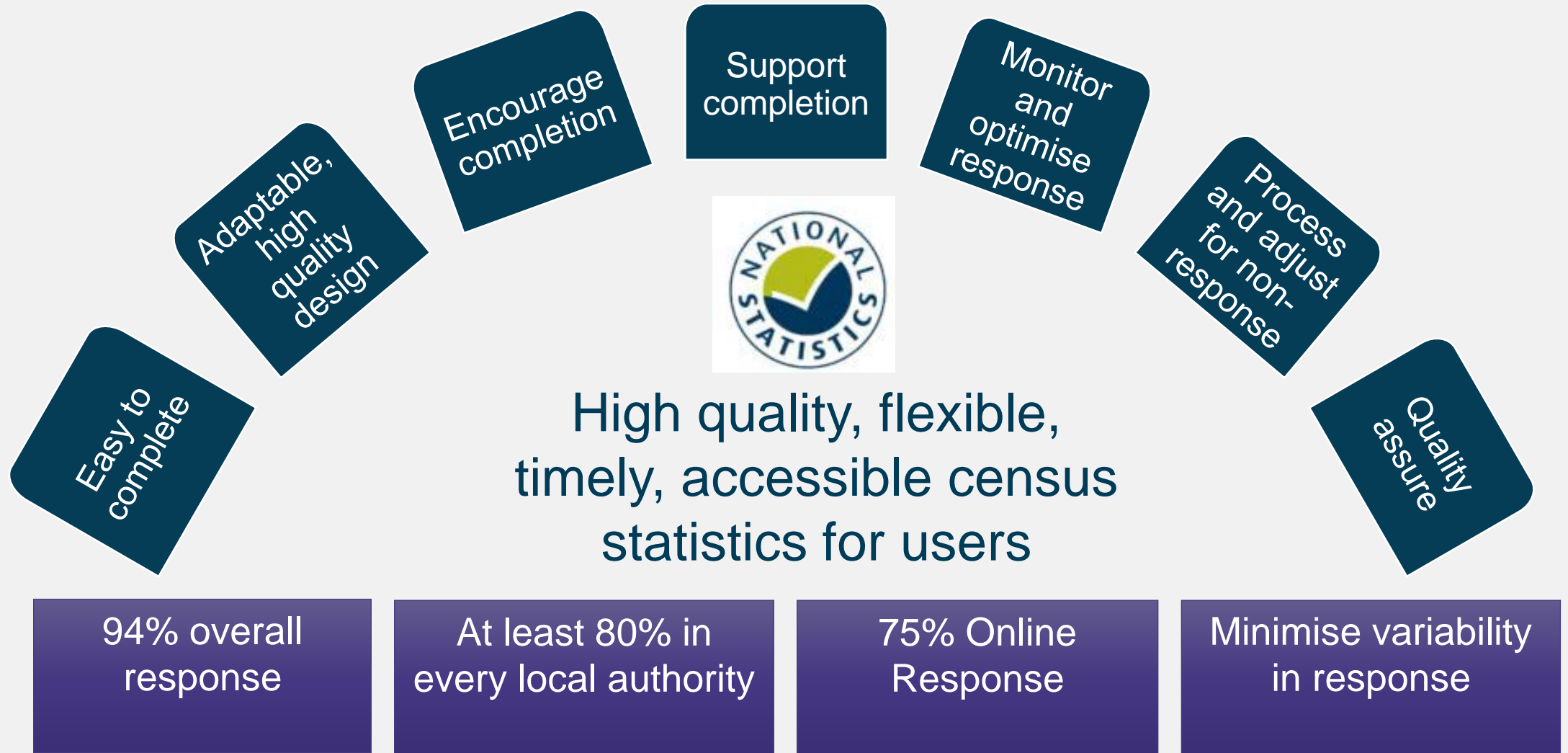
$$n_{++} = n_{1+} \times n_{+1} \div n_{11}$$

Dependence adjustments

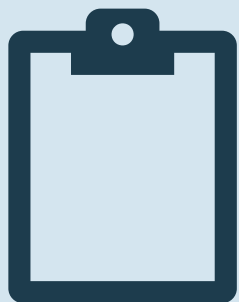
- Dual System assumes Odds Ratio = 1 (implausible)
- Estimated odds ratios based on PAF
- Added 230,000 persons nationally
 - spread across all LADs and age groups
- Outside Confidence Interval (for independence) so decision to adjust
- BUT the CIs on these odds ratios are non-linear

Brown, Abbott and Diamond (2006)

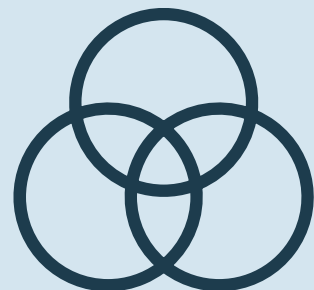
Census 2021 Quality Targets



Quality Assurance Approach



**Coverage
survey**



**Validation
against
comparators**



**Top quality
fieldwork**



**Community
and Local
Authority
Collaboration**

Census 2021 Successes

- Outstanding engagement and publicity
- Excellent management information (MI)
- Digital-first questionnaire
- Local Authority (LA) engagement

Census First Release 2021 – England and Wales



97%
response
rate

7th place
on Twitter
trending
(June 28)

3.5 million

Population growth
in England & Wales
since 2011

18.6%

65 years and
over

+6.1%
households
(1.4 million)
since 2011

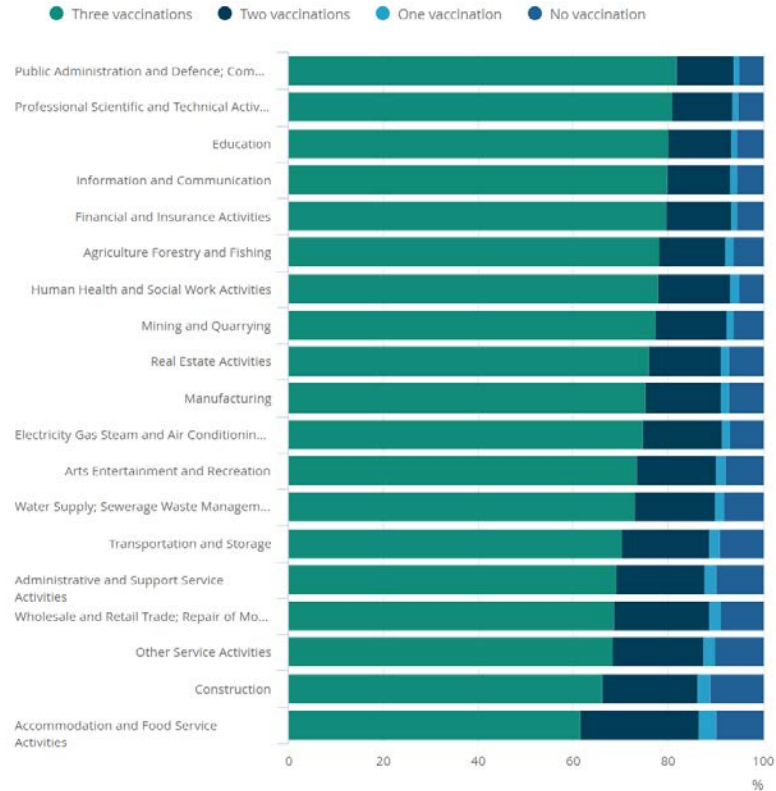
2150 pieces
of media
coverage

104.1m
social media
users reached

> 10,000
stakeholders
engaged

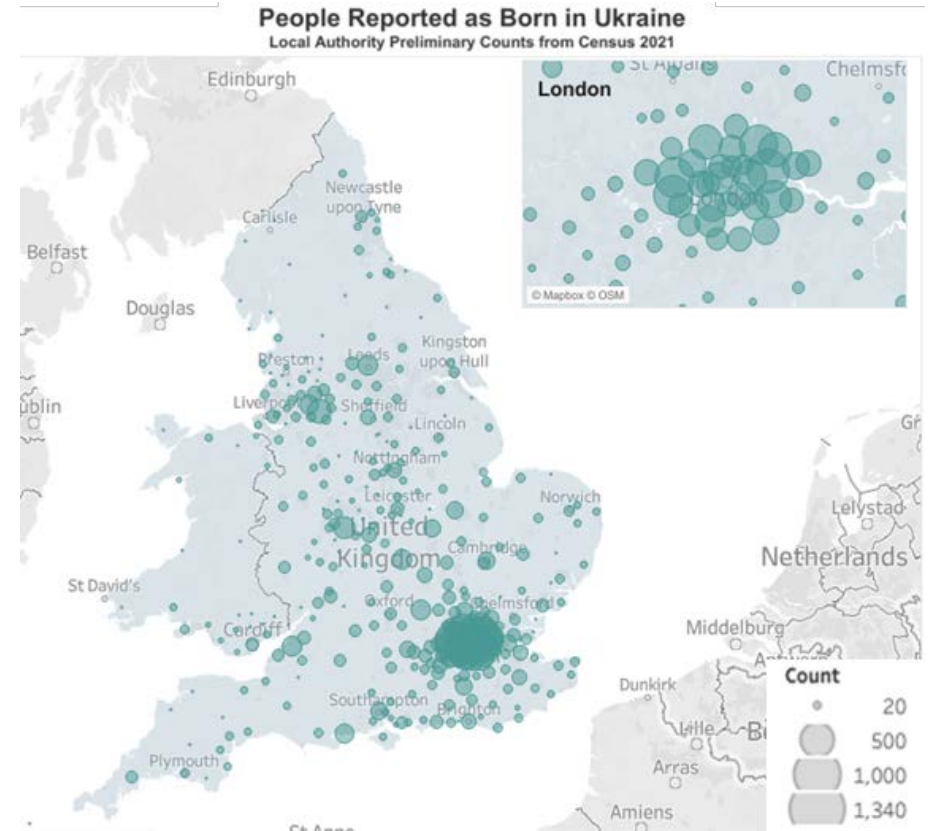
Early policy impact of Census

Covid-19 Vaccination coverage by Industry



Third coronavirus (COVID-19) vaccination coverage was highest in the public administration and defence; compulsory social security industry section. Crude vaccination rate by industry section and vaccine number in people aged 18 to 64 years, England, 28 February 2022. **Source:** [Office for National Statistics - Public Health Data Asset](#), [NHS England - National Immunisation Management Service](#).

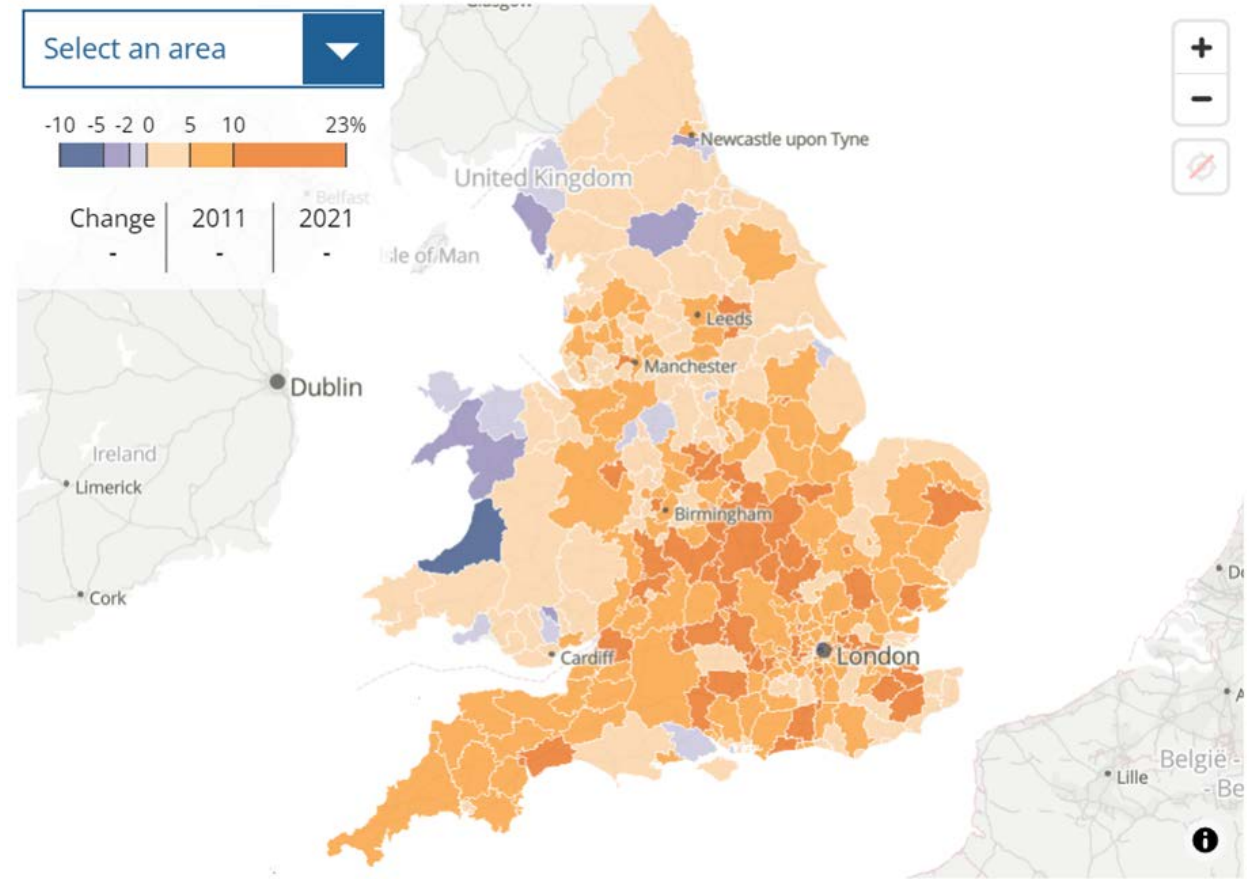
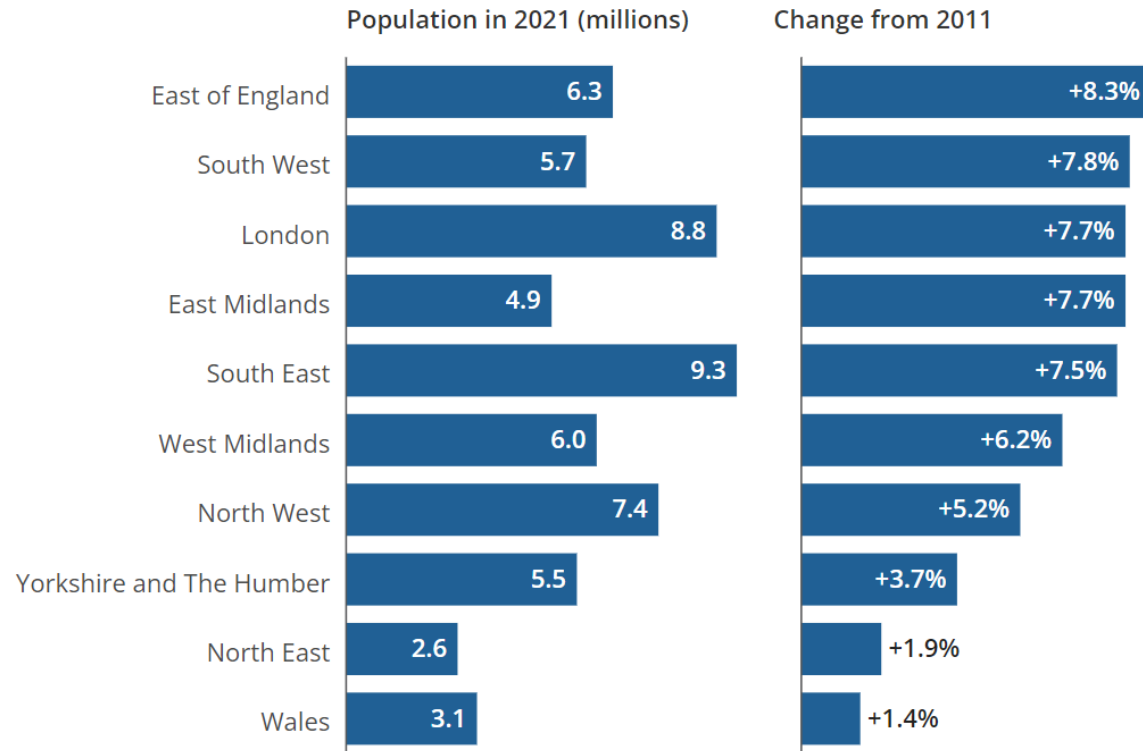
Ukrainian Diaspora in England and Wales



The table and map show persons recorded as born in Ukraine organised by regions **using preliminary 2021 Census data** as above. These are not official Census estimates, but preliminary census response counts of usual residents that responded to Census 2021 and listed Ukraine as their country of birth. Data available [here](#).

Areas of population growth and decline

Population change, 2011 to 2021, Wales and regions of England



Source: Office for National Statistics - Census 2021

So far so good...but...

- We need more **timely** estimates
 - Subnational challenges arise as intercensal period grows
- We need greater **granularity**
- We need to think about the **costs** involved with a full Census

Timeliness

1. LA estimates
2. Sub LA estimates

1. ONS Annual Estimates by LA

- Balancing Equation (cohort component model) has been used to establish annual estimates
- Since 1961, our International Migration statistics have come from the International Passenger Survey (IPS)
- Internal Migration statistics come from health records/electoral records

2. LAs to sub LAs

- Crowd sourced LA data
- Worked with LAs
- Qualitative estimates of accuracy
- The use of administrative data and local knowledge was effective

Simpson, Diamond, Tye, & Tonkin (1996), and Simpson, Lunn, Diamond, & Middleton (1998)

Moving to the Future (1): Admin-based migration statistics

Non-EU = Home Office visa data



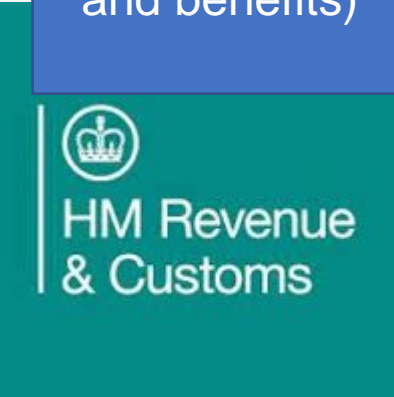
EU = RAPID (DWP taxes and benefits)



British nationals = Modelled estimates using trends from IPS



Immigration
Emigration
Net Migration
EU, Non-EU and
GB



Moving to the Future (2):

What do we mean by migration and movement in 2022?

Moving to the Future (3): Admin-based migration statistics Advanced passenger information



- Contains detailed information on passengers arriving and departing UK

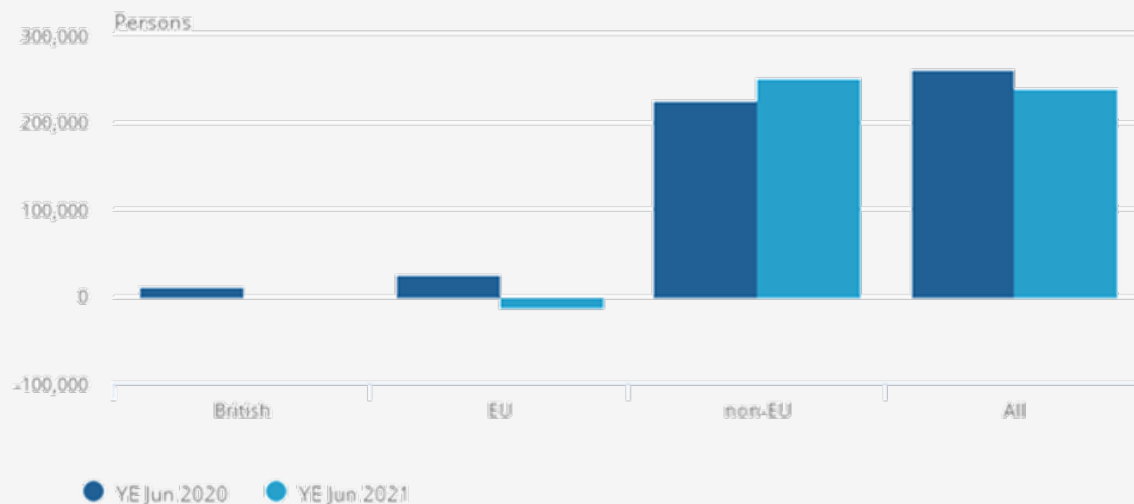
Feasibility research in 2022 demonstrated:

- Aggregate figures can show changes in travel patterns helping produce timely migration statistics
- With high quality matching techniques, linking to other information such as visas or tax and benefit data can improve immigration and emigration estimates.
- Likely benefits of improving coverage of migration, particularly UK nationals emigrating or returning.
- However, its extremely complex and success is dependent on HO collaboration – we are working with the Data Science Campus to progress operational use of API over the coming months

What can we say about international migration?

Figure 1: Total net international migration was mainly driven by non-EU nationals in year ending June 2021

Breakdown of net migration by nationality, year ending June 2020 and year ending June 2021

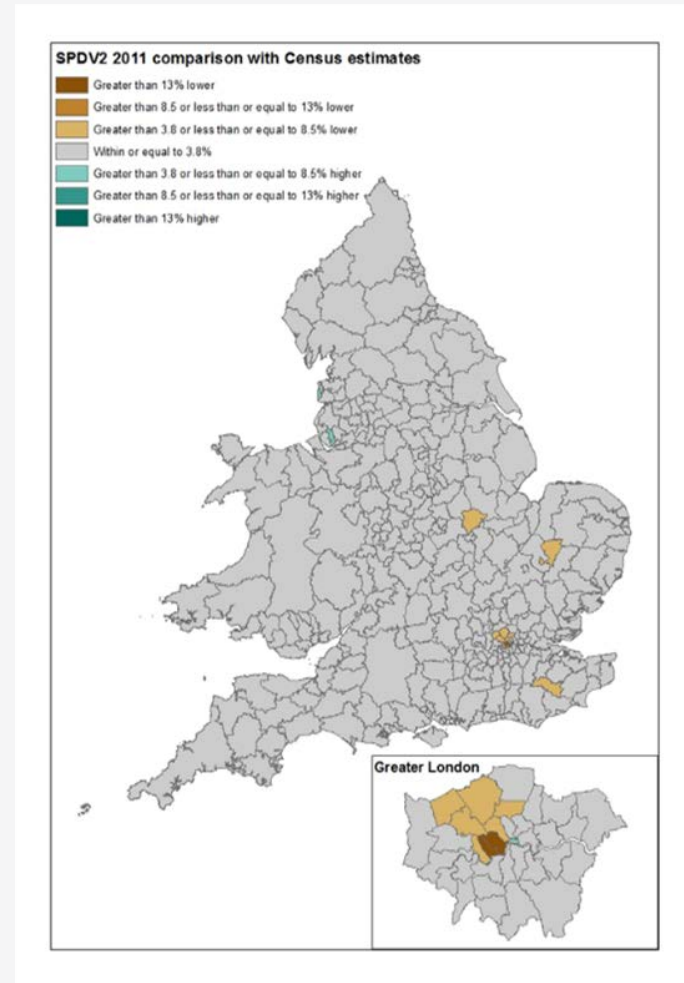
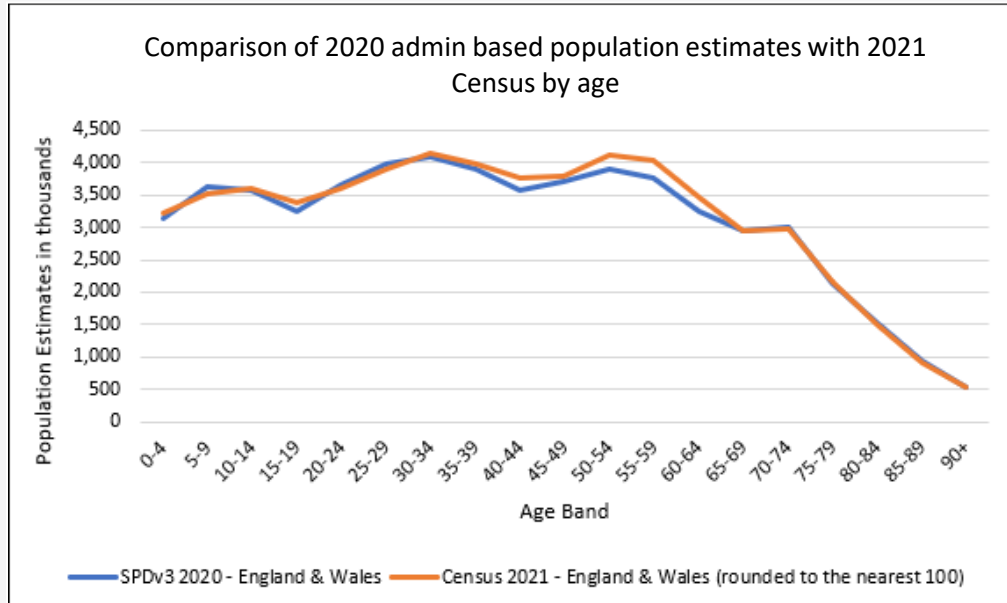


Source: Office for National Statistics; Department for Work and Pensions – Registration and Population Interaction Database (RAPID); Home Office

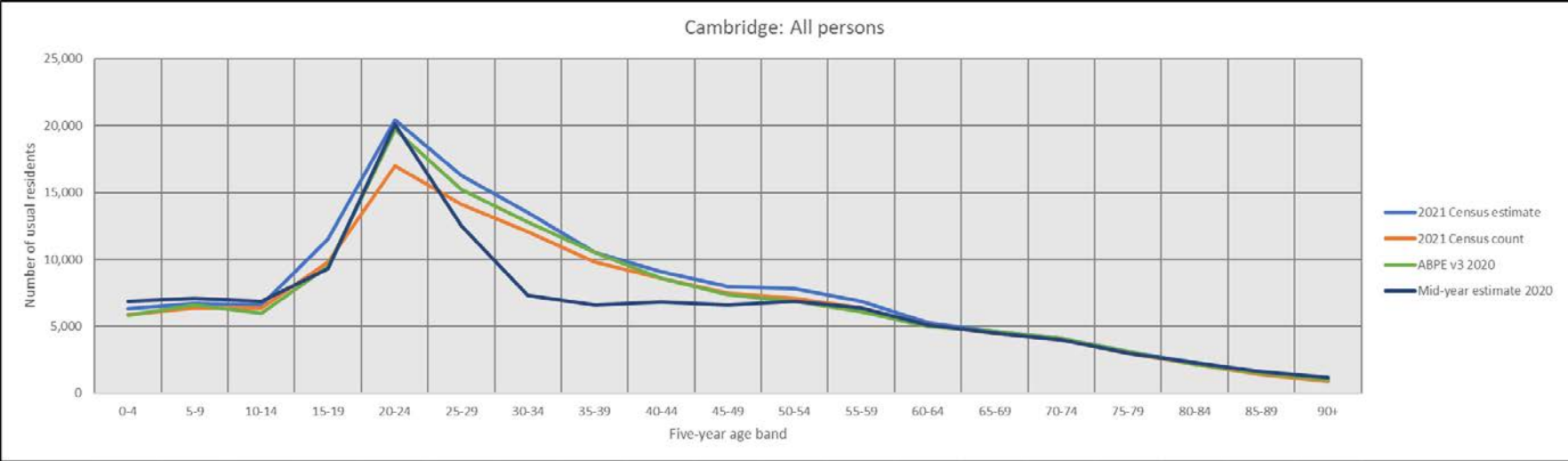
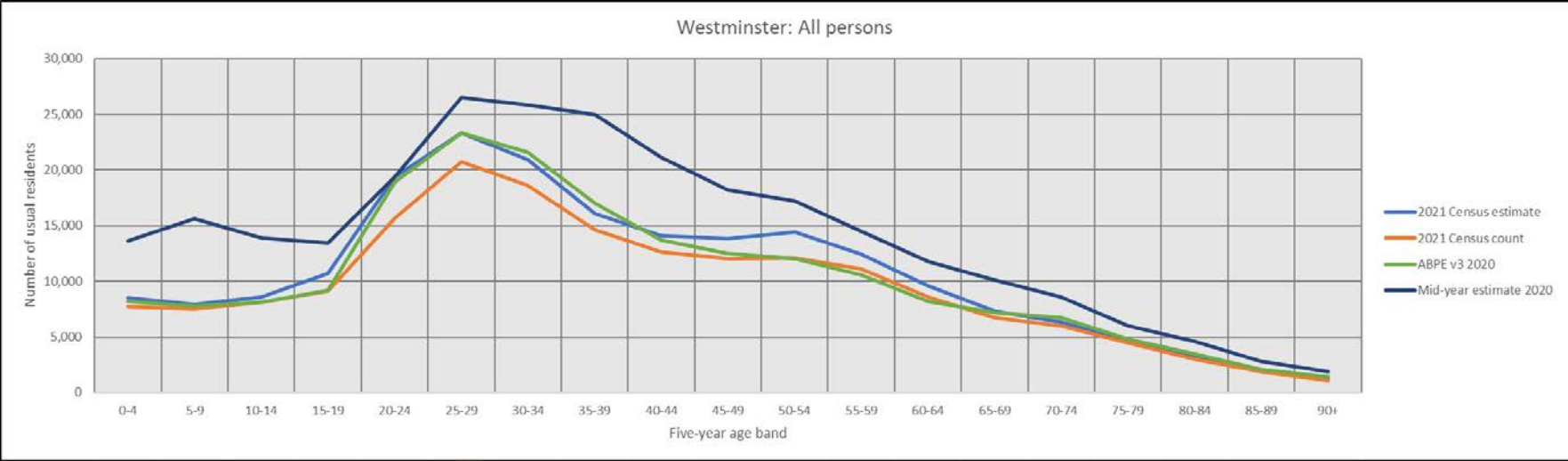
- Total net migration was estimated to be in the region of 239,000 in the year ending June 2021 and around 260,000 in the year ending June 2020.
- Non-EU net migration remained positive at around 251,000 in the year ending June 2021.
- Both British and EU net migration are estimated to be close to zero in year ending June 2021.

Moving on to Internal Migration

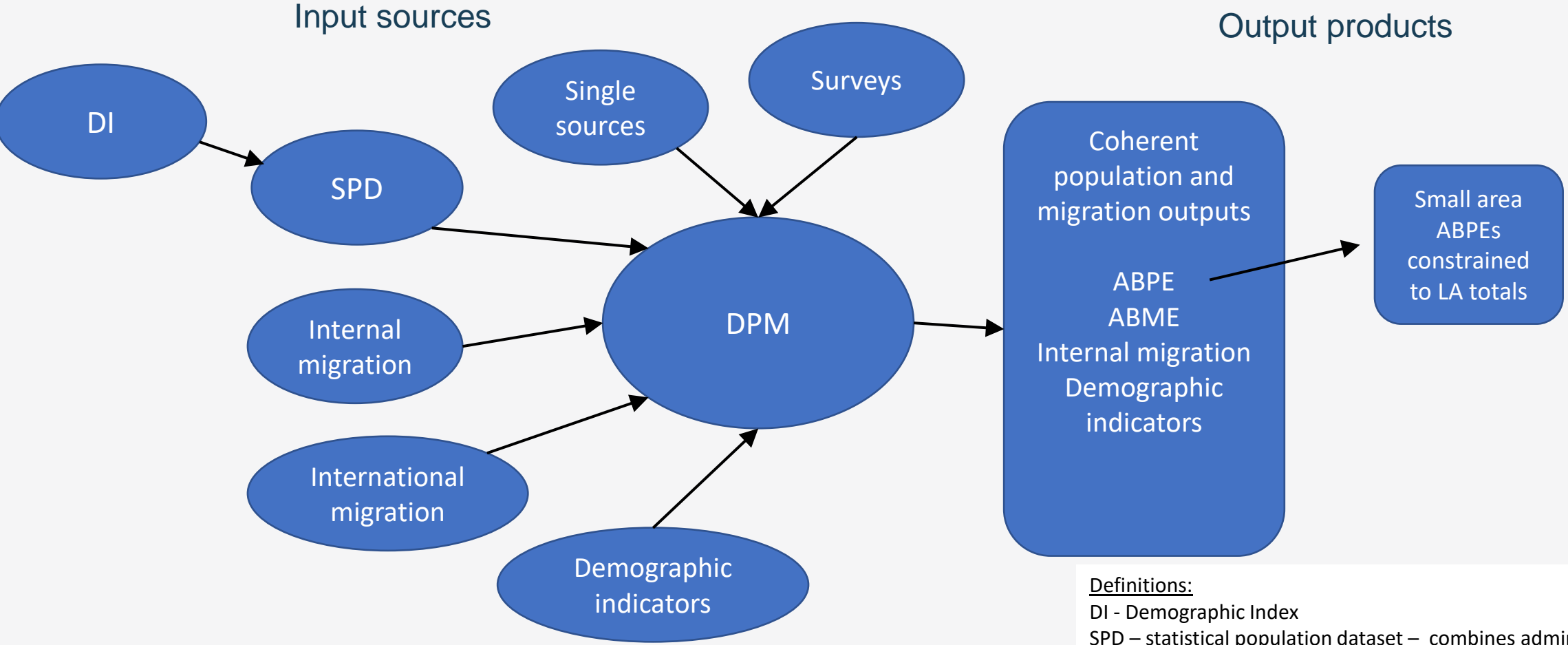
Transformed population and migration statistics



LA level comparison of 2021 Census estimate and 2020 mid-year estimate and admin based population estimate



Dynamic Population Model – input sources to produce more timely, frequent and coherent population estimates



Definitions:
 DI - Demographic Index
 SPD – statistical population dataset – combines admin data to produce a record level dataset akin to the usually resident population
 DPM – dynamic population model – modelling framework that allows us to produce best-available coherent and timely population statistics using best-available sources
 ABPE – admin based population estimate – the collective name for our official population estimates based on admin data

Moving beyond Censuses: Individual and Household Characteristics

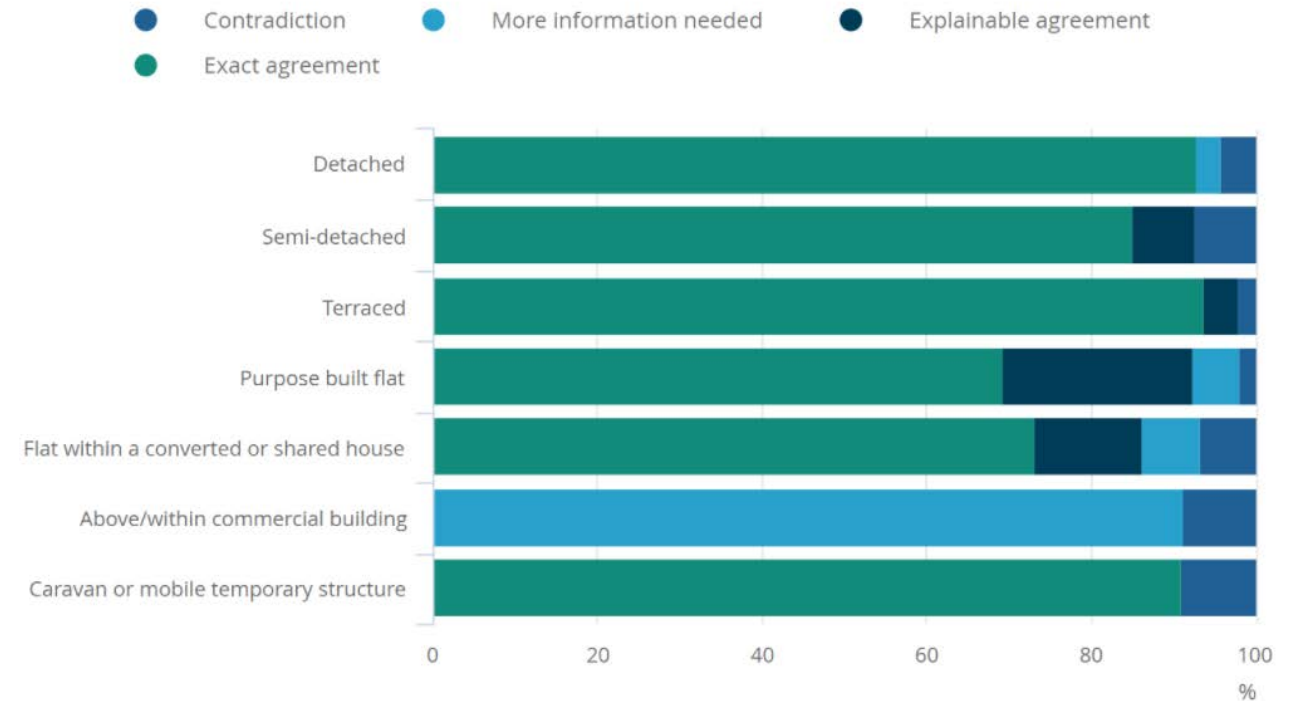
Admin-based successes: Housing stock

Admin-based housing stock characteristics

Property type, number of (bed)rooms, floor area

- Exploring the use of administrative data on housing as a replacement for collecting this information in censuses and surveys.
- Comparison of property type data recorded by the Valuation Office Agency (VOA) with data collected by the 2011 Census in England and Wales.
- Exact agreement between the VOA property type variable and the Census accommodation type variable for 86% of linked addresses

Agreement between census accommodation type and VOA property type



Source: Admin-based statistics for property type, feasibility research: England and Wales

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Admin-based successes: Ethnicity, Income, Labour Market

Admin based income statistics (ABIS)

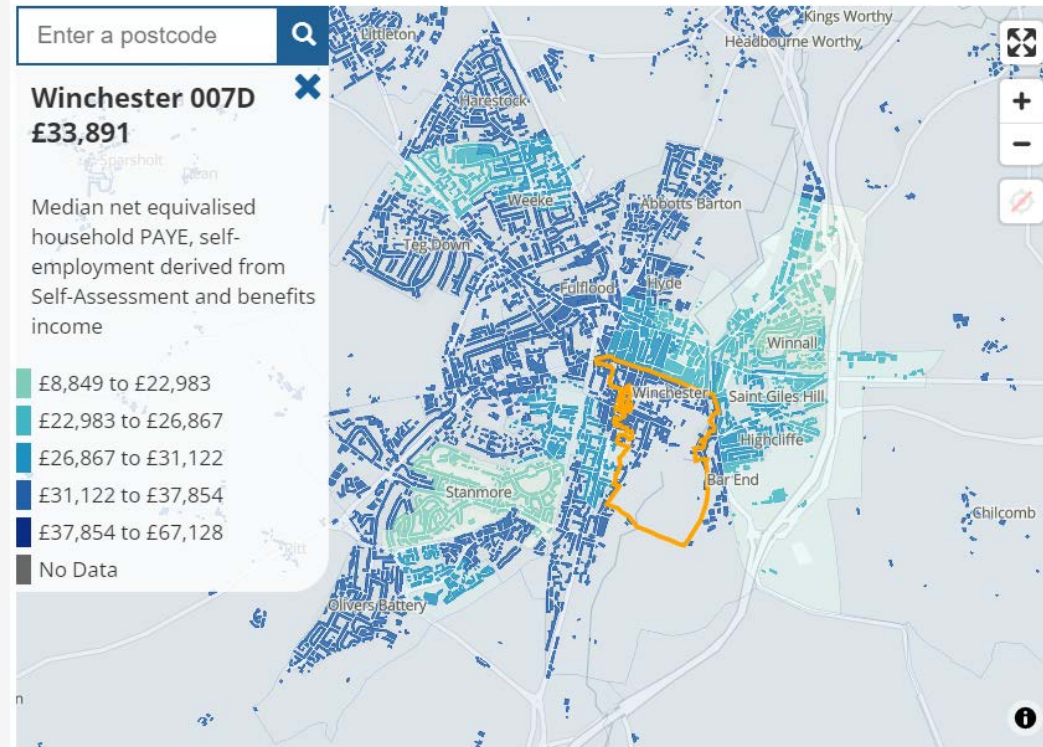
Combine HMRC + DWP data, link to admin-based population and household estimates.

Individual and household net income estimates at LSOA (lower than ONS' survey-based outputs).

98.4% of occupied addresses (households) have income information from one source.

Figure 9: Median net equivalised household PAYE, self-employment derived from Self-Assessment and benefits income

By LSOA, England and Wales, tax year ending 2016



Source: Office for National Statistics

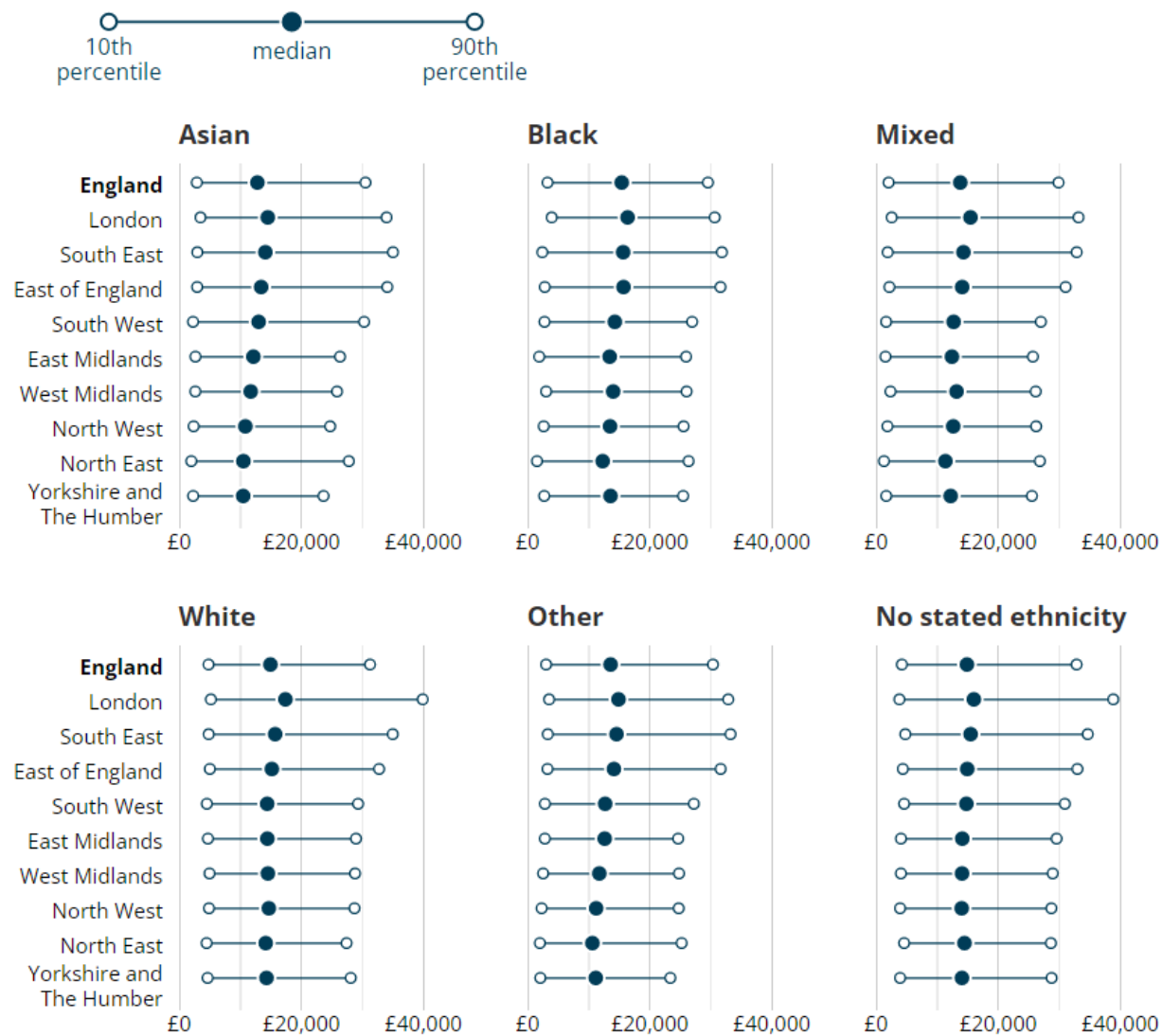
Admin-based successes: Multivariate statistics

Developing subnational multivariate income by ethnicity statistics from administrative data, England: tax year ending 2016

Income by ethnic group initial findings

N.B. This is unpublished research which we are quality assuring and understanding in the context of other published alternative estimates.

We will publish once that work is complete, so these results are subject to change.



Source: Office for National Statistics

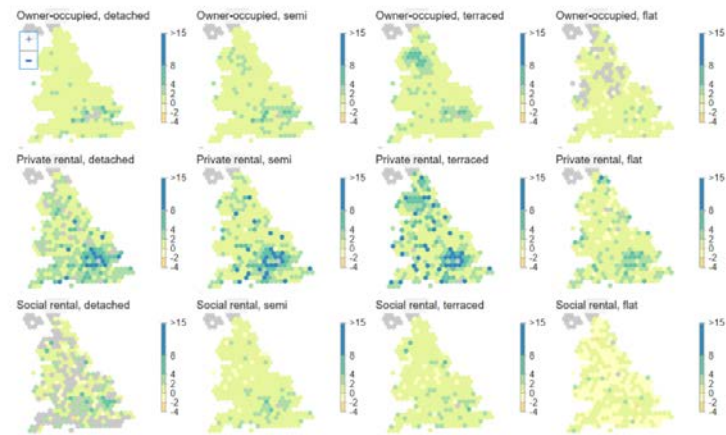
Admin-based successes: Overcrowding, Qualifications

Admin-based levels of overcrowding feasibility research

Assessed impact of replacing number of rooms question on Census 2021 by comparing sub-regional levels of overcrowding

Percentage point (pp) differences in the levels of overcrowding at LA level for 2011 Census number of bedrooms and VOA number of bedrooms using the bedroom standard by tenure and accommodation type, England & Wales

Households are identified as overcrowded if they have a bedroom occupancy rating of “-1 or less” using the bedrooms standard.



Source: Admin-based levels of overcrowding (using the bedroom standard and Valuation Office Agency number of bedrooms), feasibility research: England and Wales: January 2021

Office for National Statistics

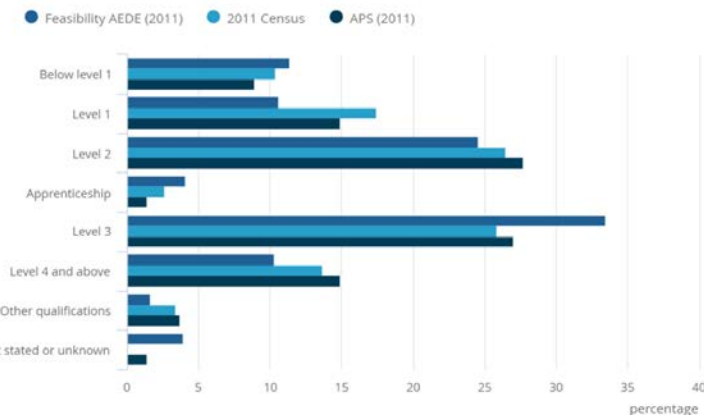
Admin-based highest level of qualifications feasibility research

Comparing admin and 2011 Census data, highest level of qualification was the same on both sources for 57% of people.

For 84% of people, highest qualification level from admin data either agreed with, or was within one level of that recorded by the census.

Administrative data recorded a lower percentage of individuals with “Level 1” and “Level 4 and above” qualifications but a higher percentage with “Level 3”

Highest level of qualification in 2011 for usual residents aged 16 to 24 years, from the feasibility AEDE, 2011 Census and APS (percent distribution), England



Source: Admin-based qualification statistics, feasibility research: England

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Looking to the future...

- We will use **the best** information to produce more **frequent, timely and inclusive statistics about the population** and its characteristics.
- We will provide insights that are **coherent and flexible** to evolving user needs.

What will this look like?

- We want to provide quicker and more frequent population and migration statistics



In Summary

- The need for governments, at all levels, to understand the spatial patterns of their populations, together with their demographic and socioeconomic characteristics, has **never been greater**
- Through greater use of **administrative data** we will provide **accurate, frequent and timely statistics**

In Summary

- *“From such returns great parochial advantages would be derived wheresoever they might be adopted, and if they were general great national benefit would result therefrom.”*

William Pitt Morton