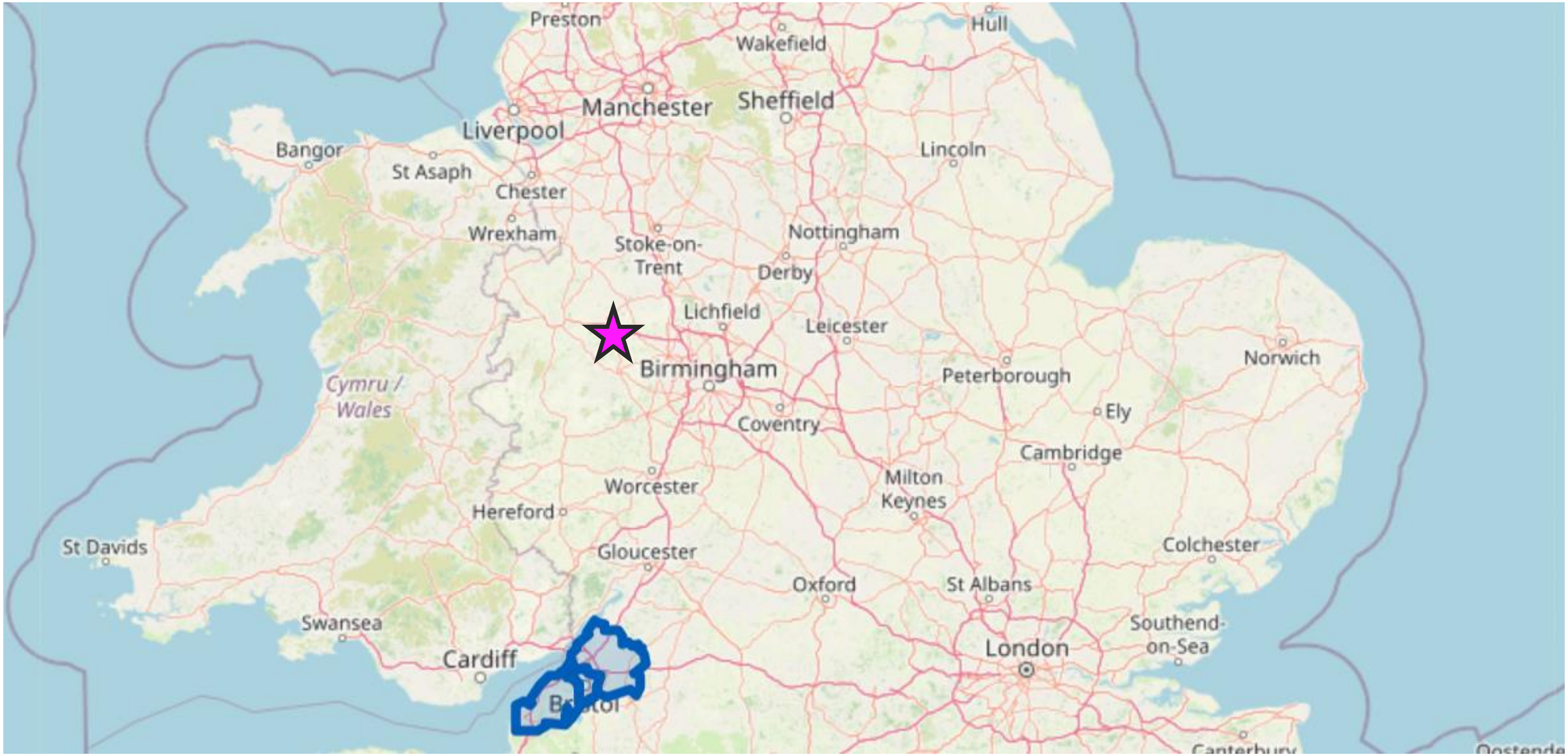
HEALTH AND CARE ANALYTICS
Conference 2024

Modelling long-term changes in population health state and associated healthcare resource requirements: applications in BNSSG ICS

Luke Shaw
Modelling & Analytics
BNSSG ICB

@BNSSGAnalytics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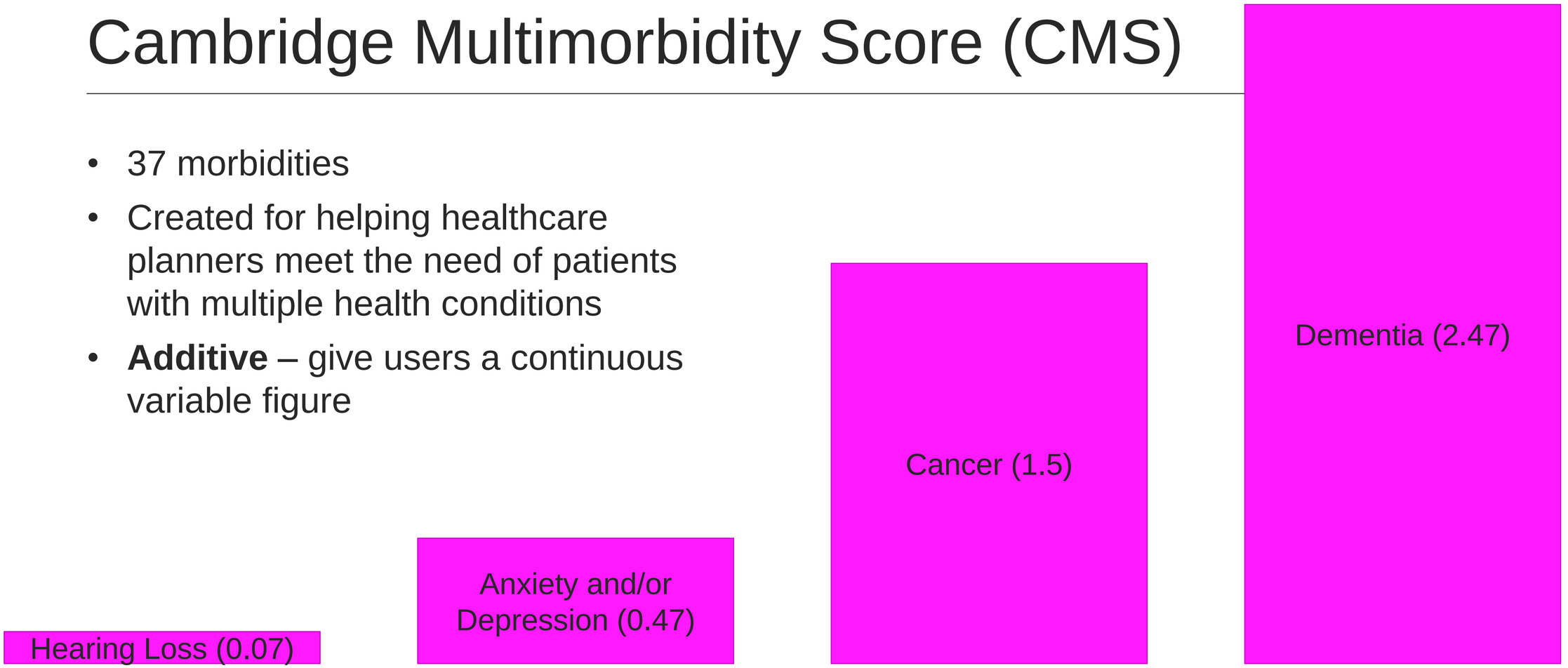
Cambridge Multimorbidity Score (CMS)

- 37 morbidities
- Created for helping healthcare planners meet the need of patients with multiple health conditions
- **Additive** – give users a continuous variable figure



doi: 10.1503/cmaj.190757

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Persona: Christopher

- Age 39
- No conditions

- Cambridge Multimorbidity Score: **0**

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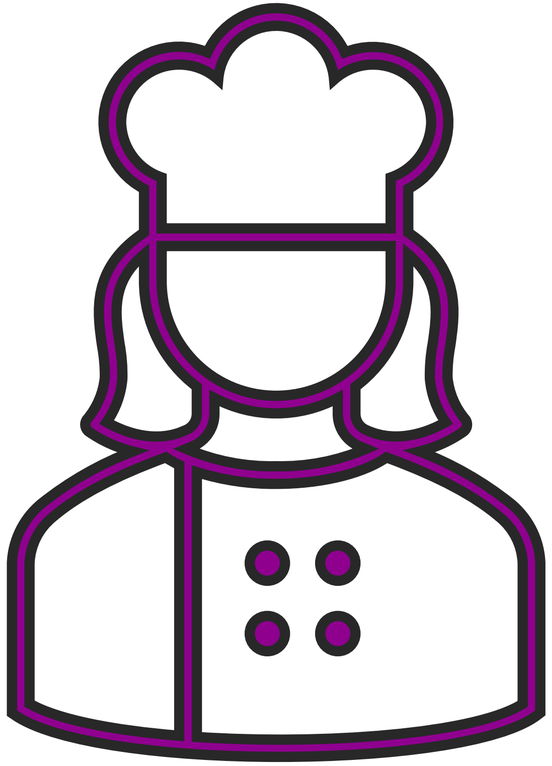
Persona: Susan

- Age 71
- Hypertension
- Asthma
- IBS
- Liver disease



- Hypertension: 0.09
- Asthma: 0.18
- IBS: 0.18
- Liver Disease: 0.72

- Cambridge Multimorbidity Score: **1.19**

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Persona: Isaac

- Age 45
- Liver Disease
- Painful Conditions
- Bowel Cancer

- Liver Disease: 0.73
- Painful Conditions: 0.87
- (Bowel) Cancer: 1.5

- Cambridge Multimorbidity Score: **3.1**

BNSSG Core Segmentation

Core Segment	Cambridge Multimorbidity Score	Proportion of population	Mean annual spend per person
CS1	<0.09	52%	£300
CS2	[0.09, 0.69)	25%	£700
CS3	[0.69, 1.59)	13%	£1500
CS4	[1.59, 2.96]	7%	£2900
CS5	>2.94	3%	£5600

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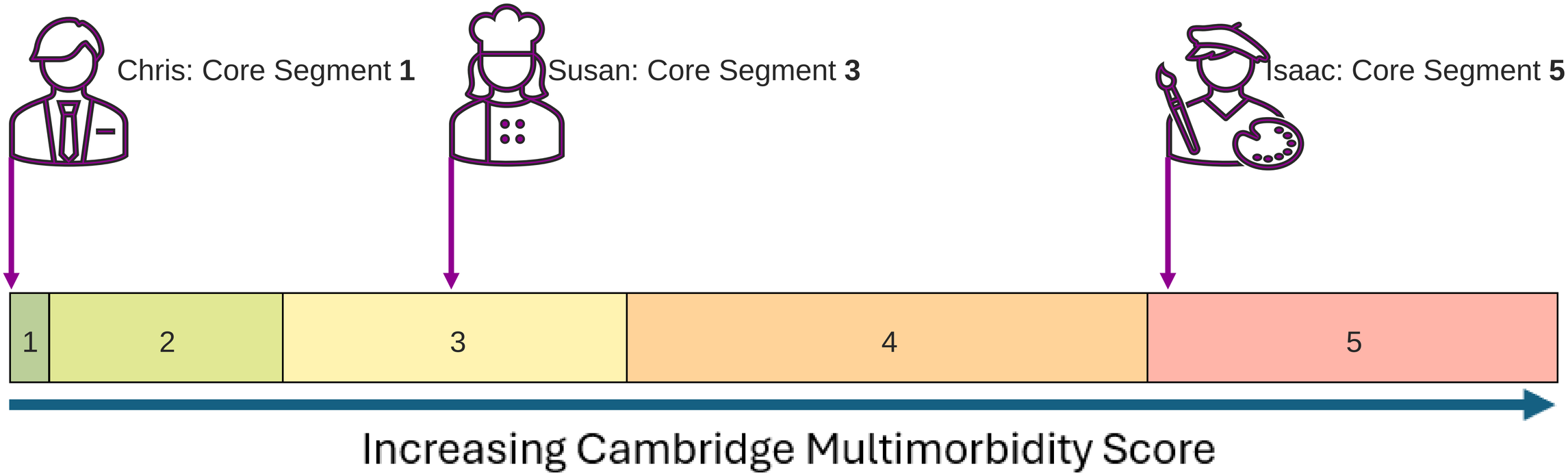
Applying Core Segmentation



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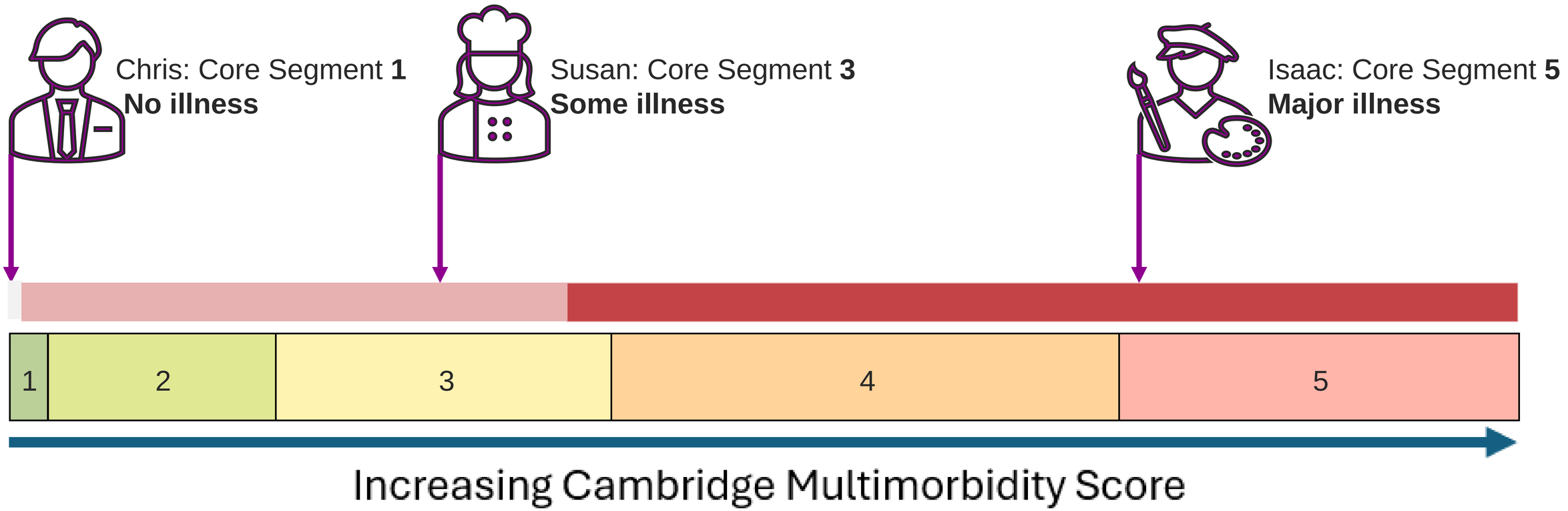
Wait a second…

Keynote: Anita Charlesworth, *Health in 2024*.

source:
Health Foundation
Health in 2040
https://www.health.org.uk/publications/health-in-2040

Applying Core Segmentation



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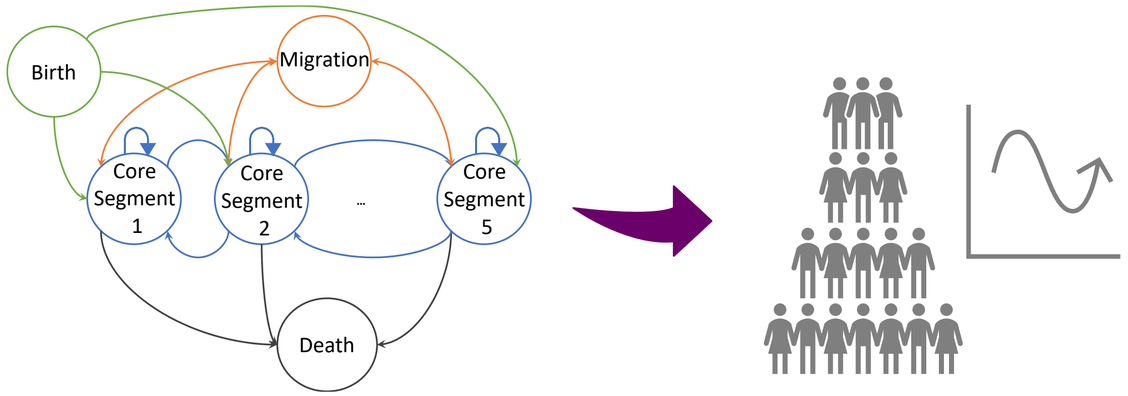
Dynamic Population Model

DPM

Model Approach

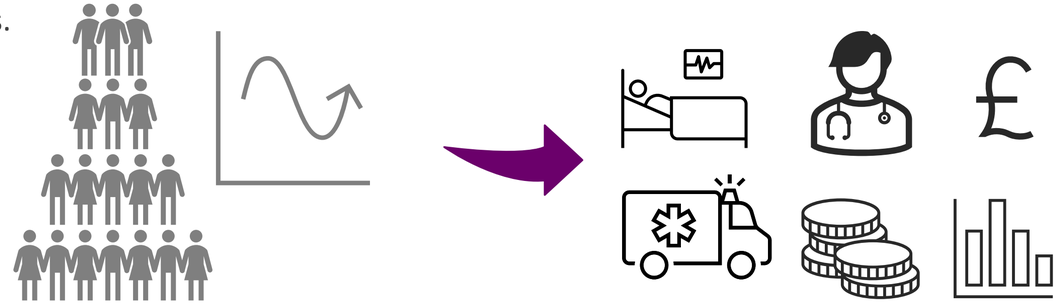
Step 1: Project forward the number of patients in each health state (Core Segment) for each year in future.



Deterministic: formulated as Difference Equations.
Stochastic: formulated as microsimulation (in progress)

Essentially, projects forward current transitions between Core Segments, anchored on ONS population projections.

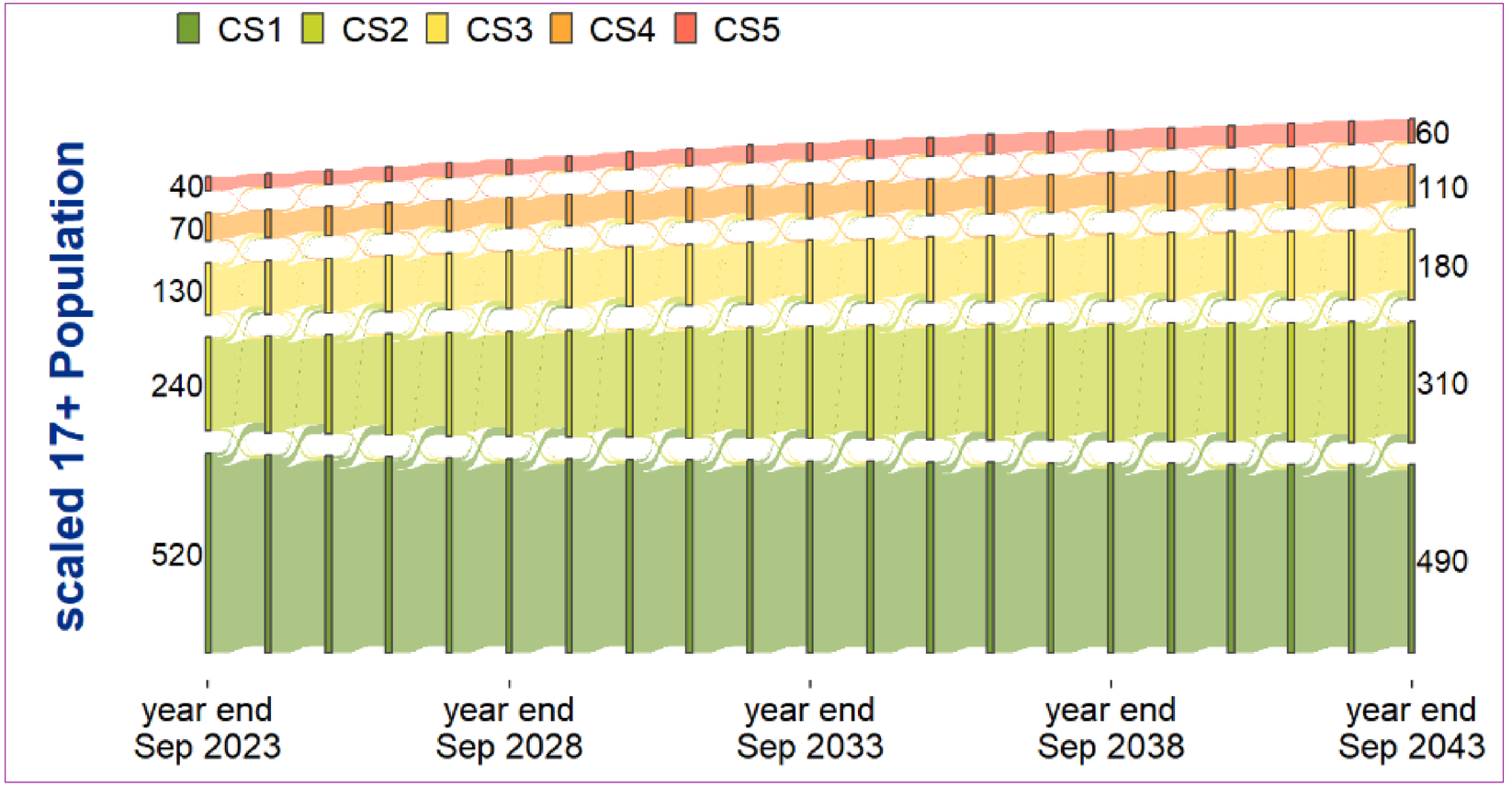
Step 2: Calculate total resources (activity and costs) based on Core Segment per-patient cost; split to PODs.



As a ‘baseline’, uses current average costs per Core Segment.

Population Forecast

- CS1 to decrease in size
- All other CS due to increase, not just due to aging
- CS5 to increase proportionally the most



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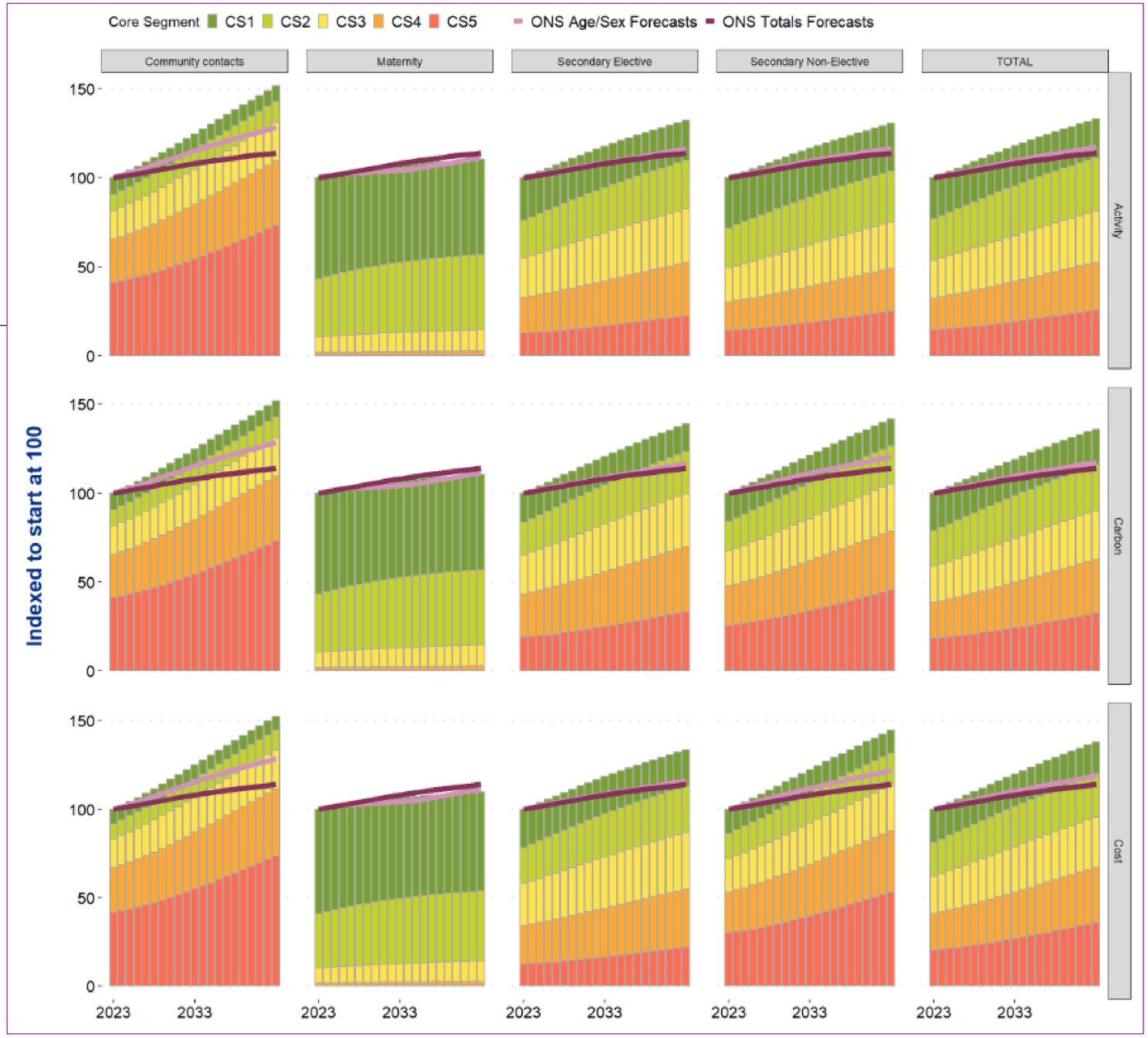
Point of Delivery



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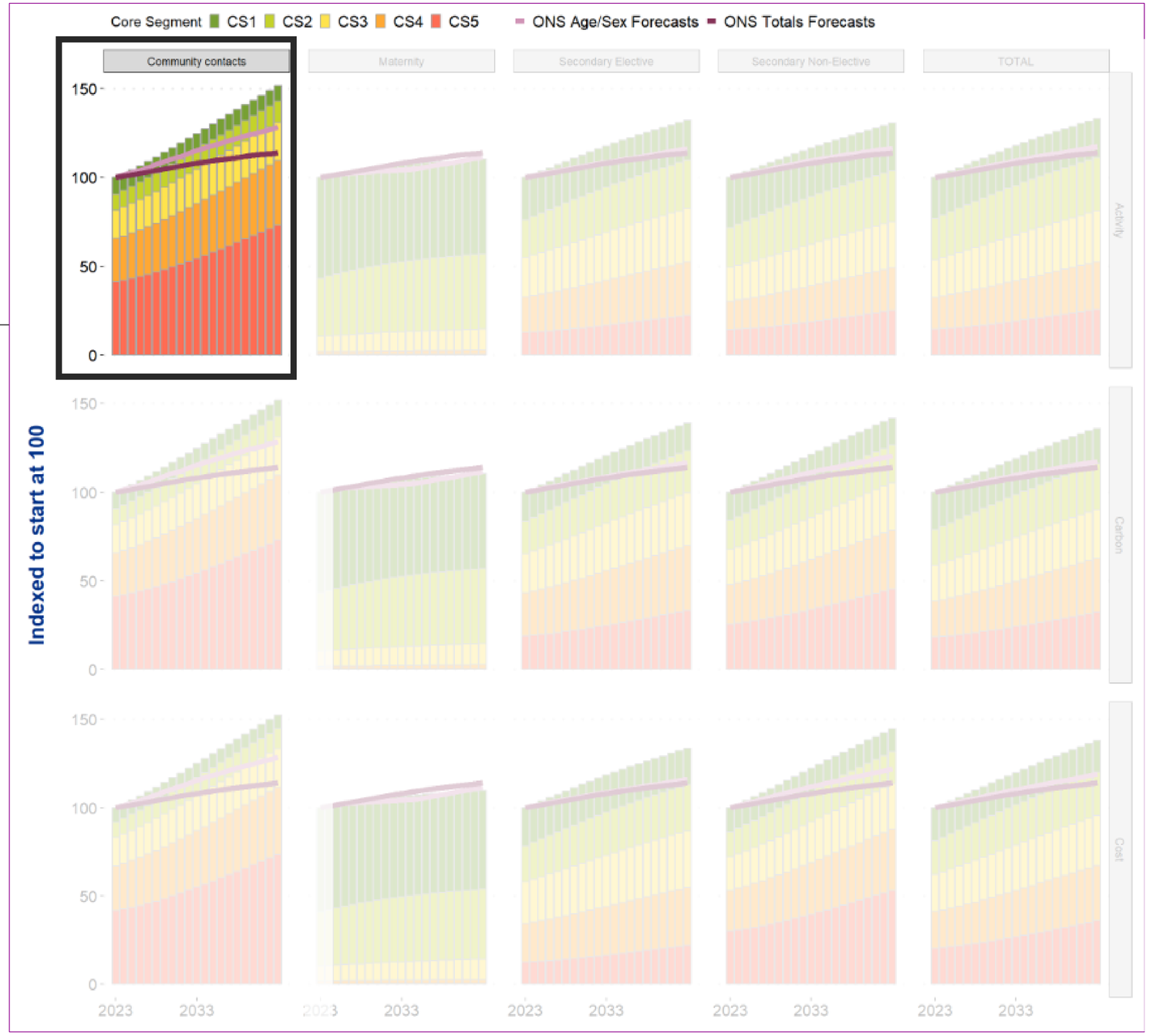
Point of Delivery

- Community highest increase, driven by Core Segment 5 population



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Point of Delivery

Community highest increase, driven by Core Segment 5 population

Maternity only POD not forecast to increase

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Point of Delivery

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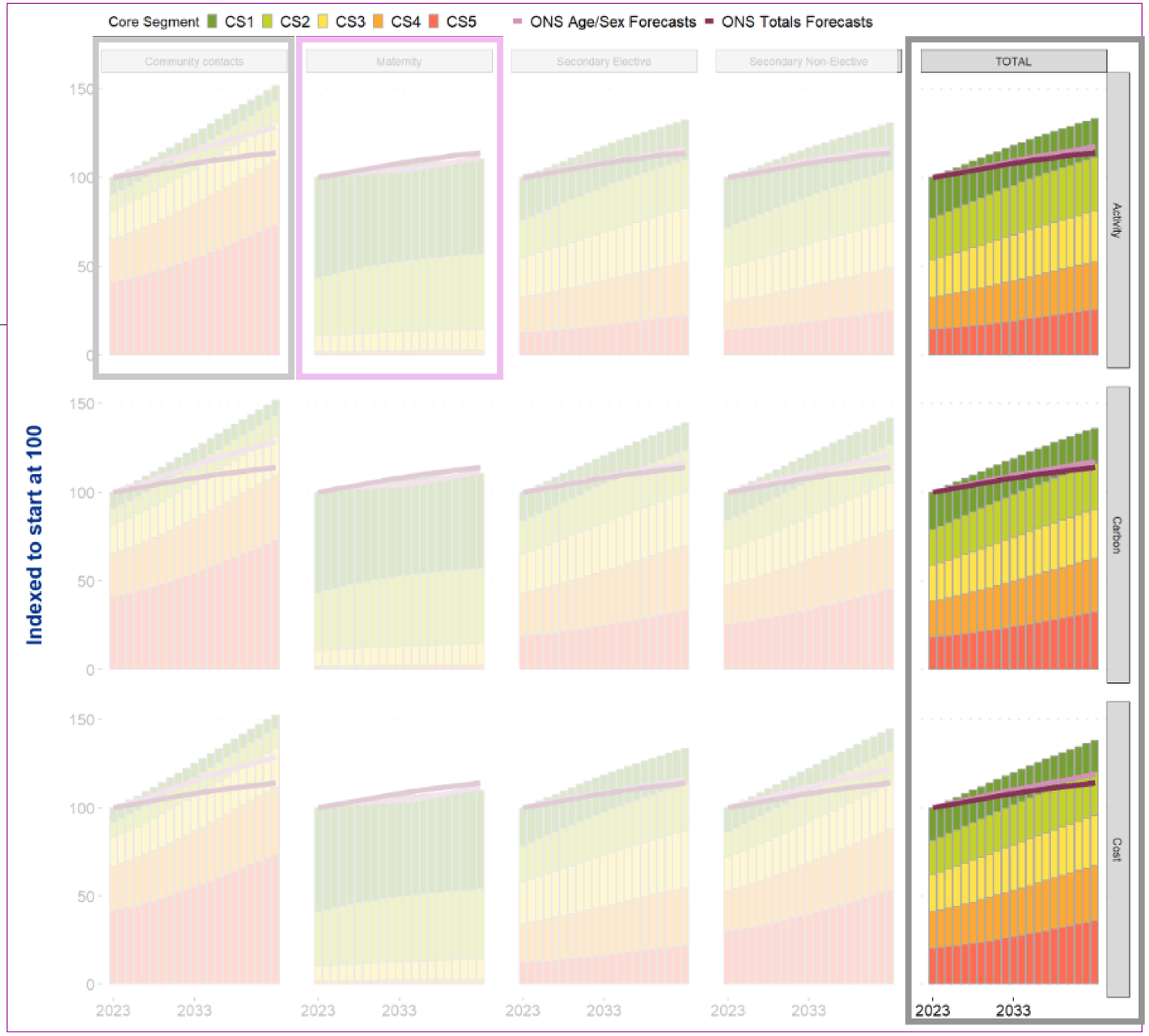
Maternity only POD not forecast to increase

Total exceeds ONS forecasts for Activity, Carbon, and Cost



Use Cases

- ICB financial forecasting, medium term (5 years)
- Carbon Forecasts – Net 2040 goals
- Trust-level baseline for POD activity for site planning

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Summary

- Framework for long-term forecasting
- Accounting for population demographic change and health status change
- Informative outputs useful in resource planning at POD level

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What Next?

- Compare other model approaches in collaboration (Health Foundation, Strategy Unit)
- Scenario planning – changes to transition probabilities and activity profiles
- Further utilisation within BNSSG (long-term planning, strategic decisions)

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Thank You ☺

Accompanying Blog

luke.shaw4@nhs.net

https://realworlddatascience.net/case-studies/posts/2024/05/08/dpm.html

Annex: Data Sources

Model Input	Description	Data Source
initial population	The starting number of people in each Core Segment	SWD
inner transition matrix	The yearly proportions of people moving from one Core Segment to another	SWD
births, net migration, deaths - numbers	The yearly number of people moving in and out of the area	ONS
births, net migration, deaths - proportions	The proportion of births/migrations/deaths that come from each Core Segment group	SWD

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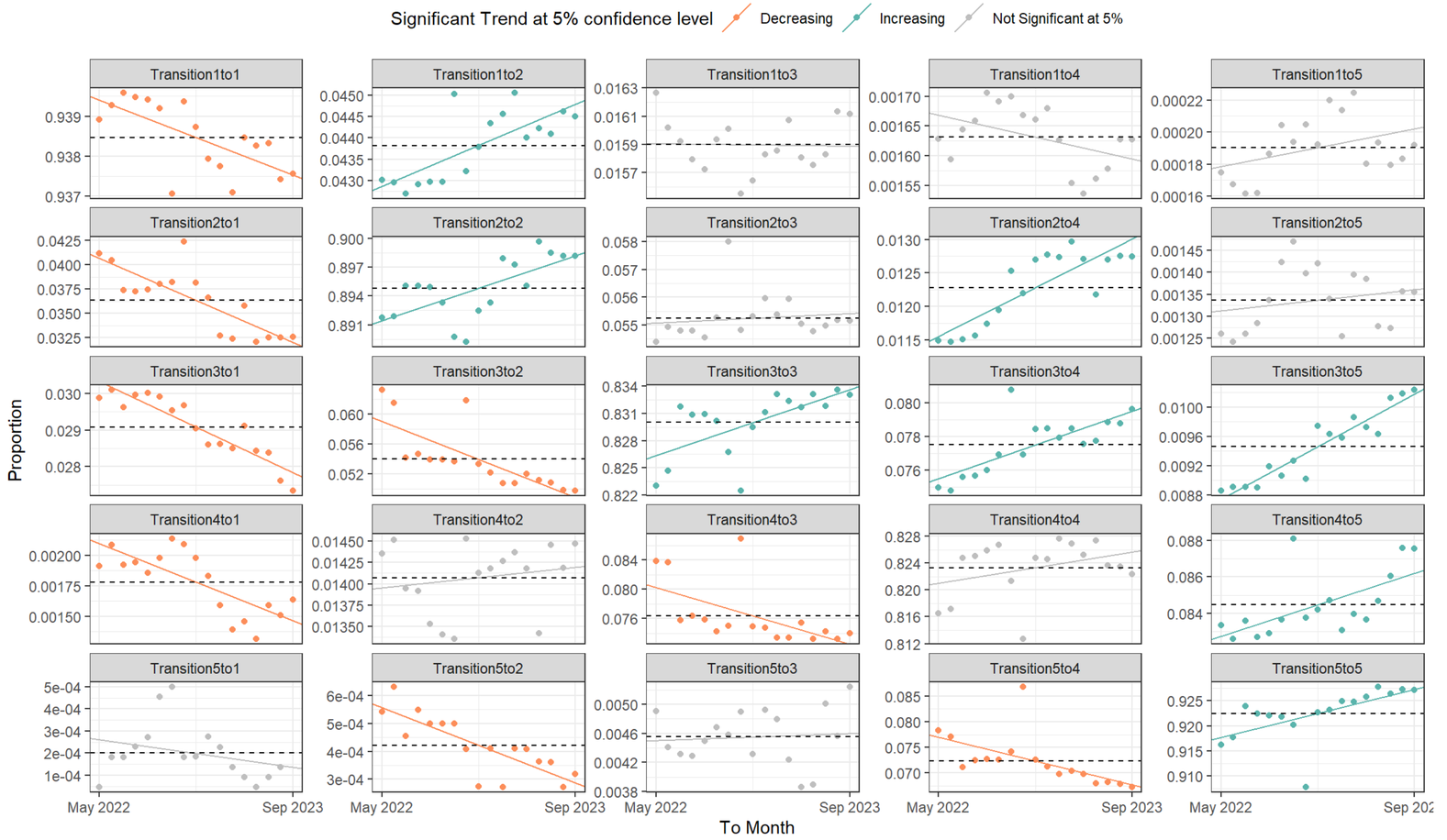
Deteriorating Transition Probabilities



source: MODELLING_SQL_AREA.dbo.New_Cambridge_Score

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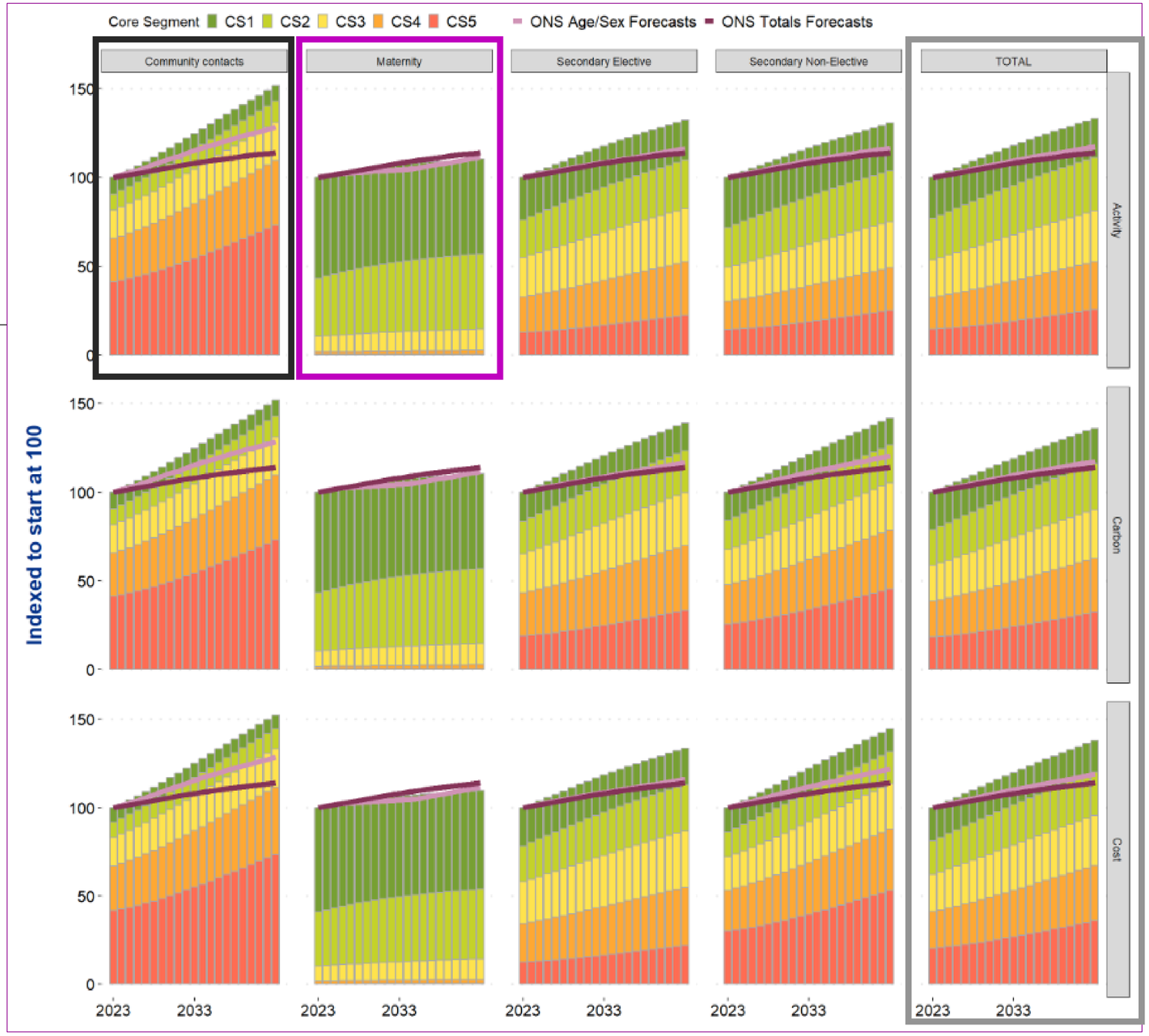
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