



UCL

Socioeconomic determinants of inflammation and neuroendocrine activity: A longitudinal analysis of compositional and contextual effects



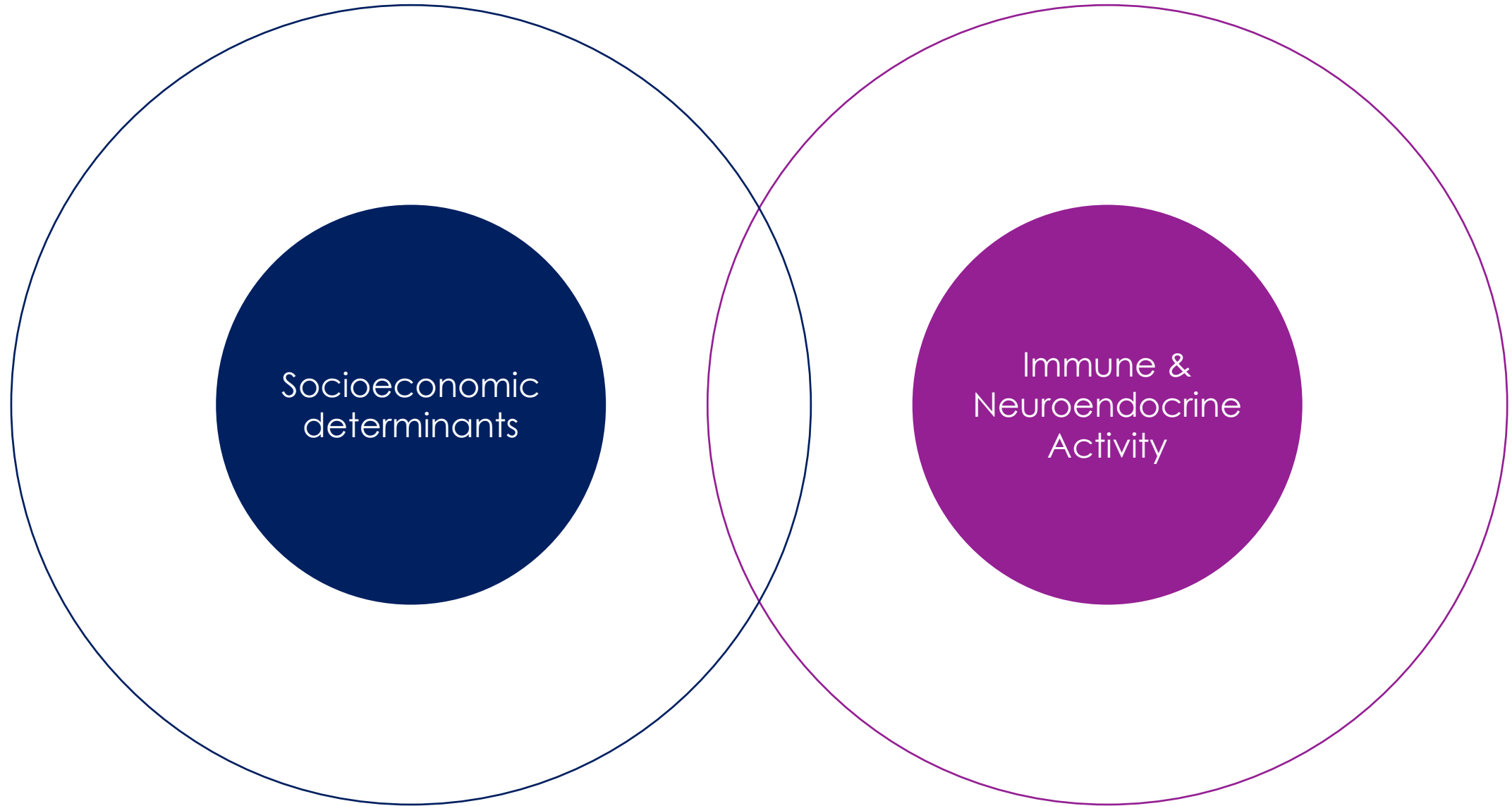
Odessa S. Hamilton, MSc | **Prof Andrew Steptoe, DSc**



HEALTH

Inflammation &
Neuroendocrine
Activity

DISEASE



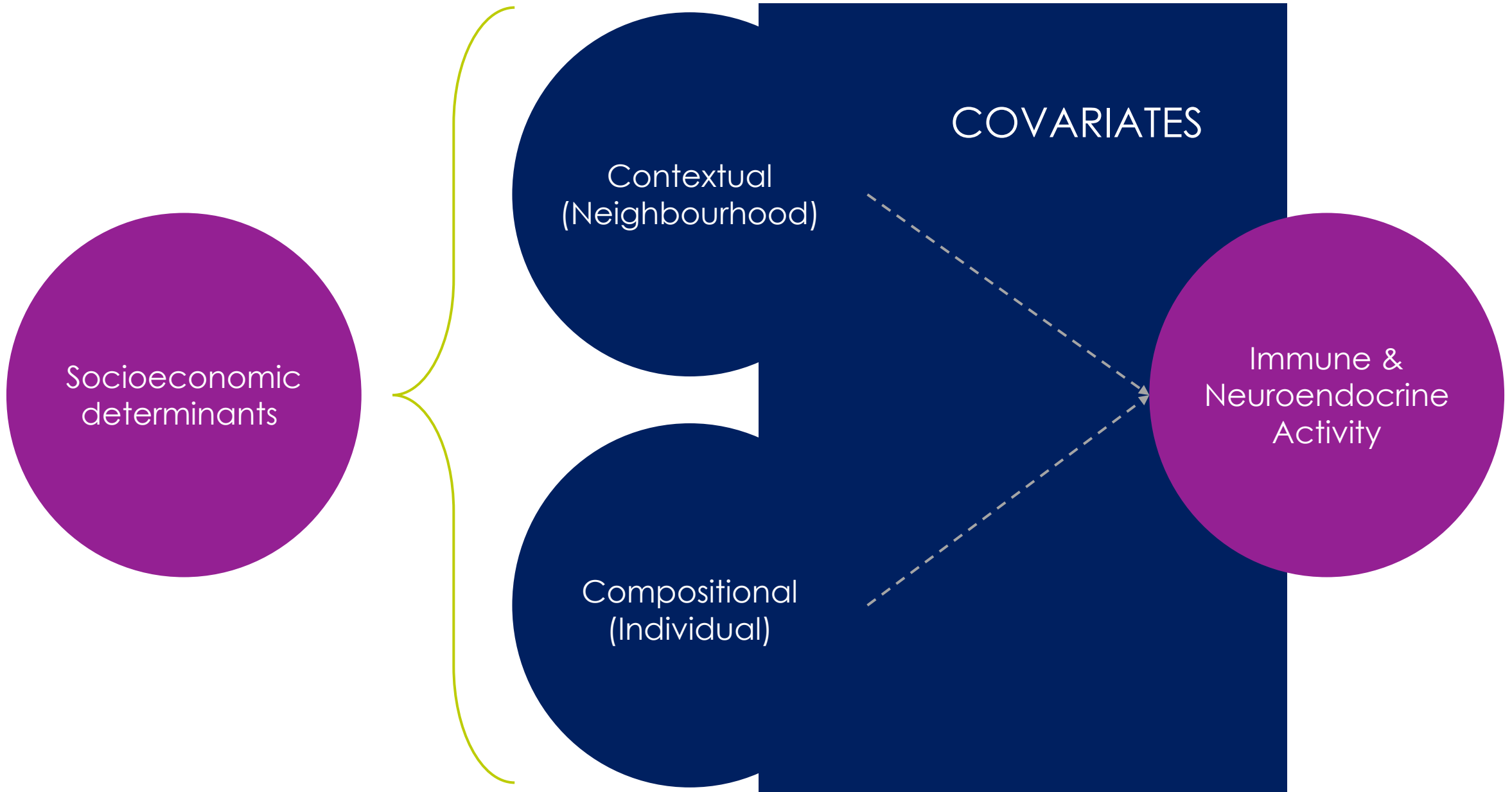
Socioeconomic
determinants

Immune &
Neuroendocrine
Activity



7.8
million





characteristics of the place that people live



characteristics of individuals

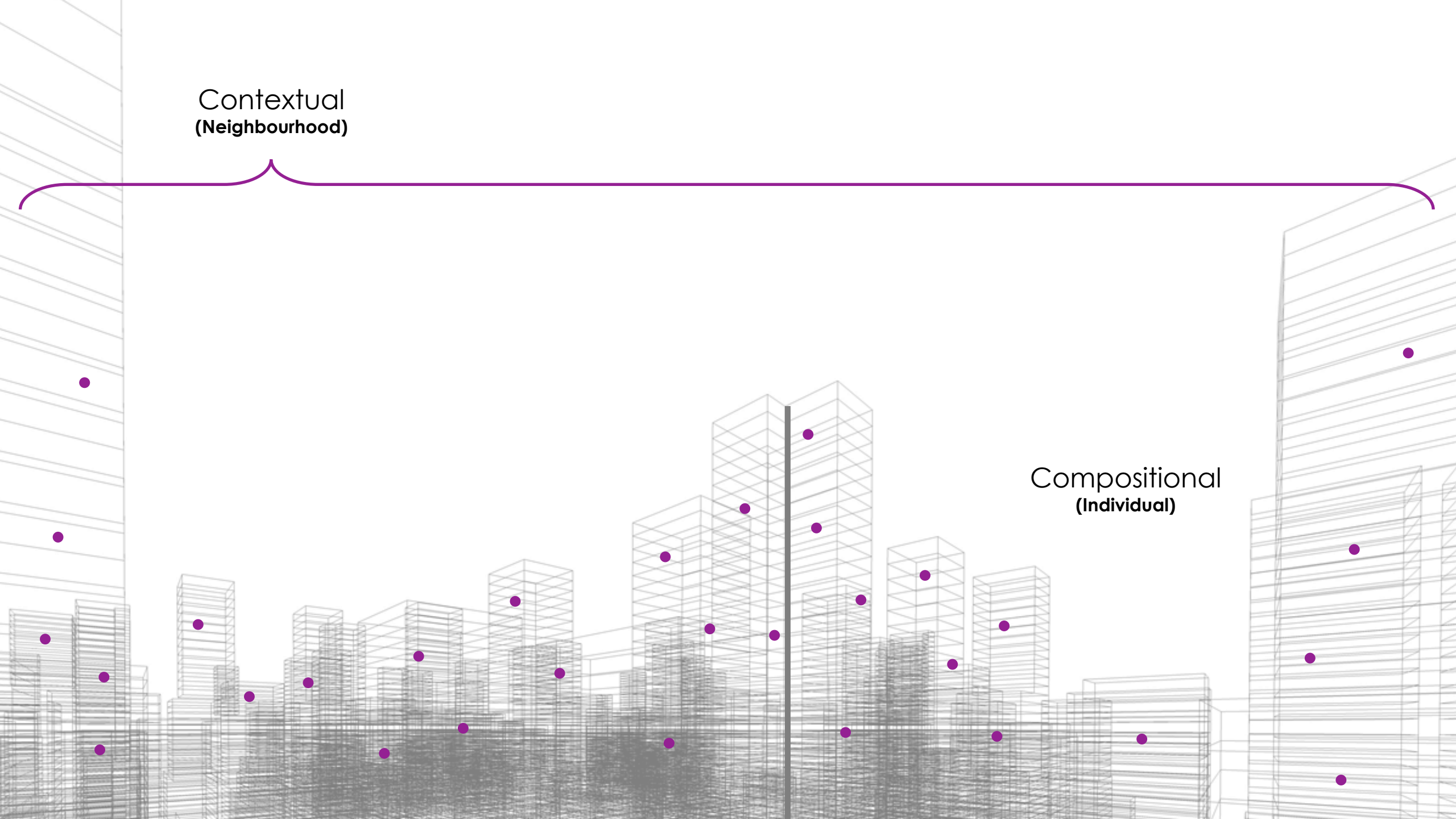
Contextual
(Neighbourhood)

IMMUNE &
NEUROENDOCRINE
ACTIVITY

Compositional
(Individual)

Contextual
(Neighbourhood)

Compositional
(Individual)





DEMOGRAPHIC



LIFESTYLE

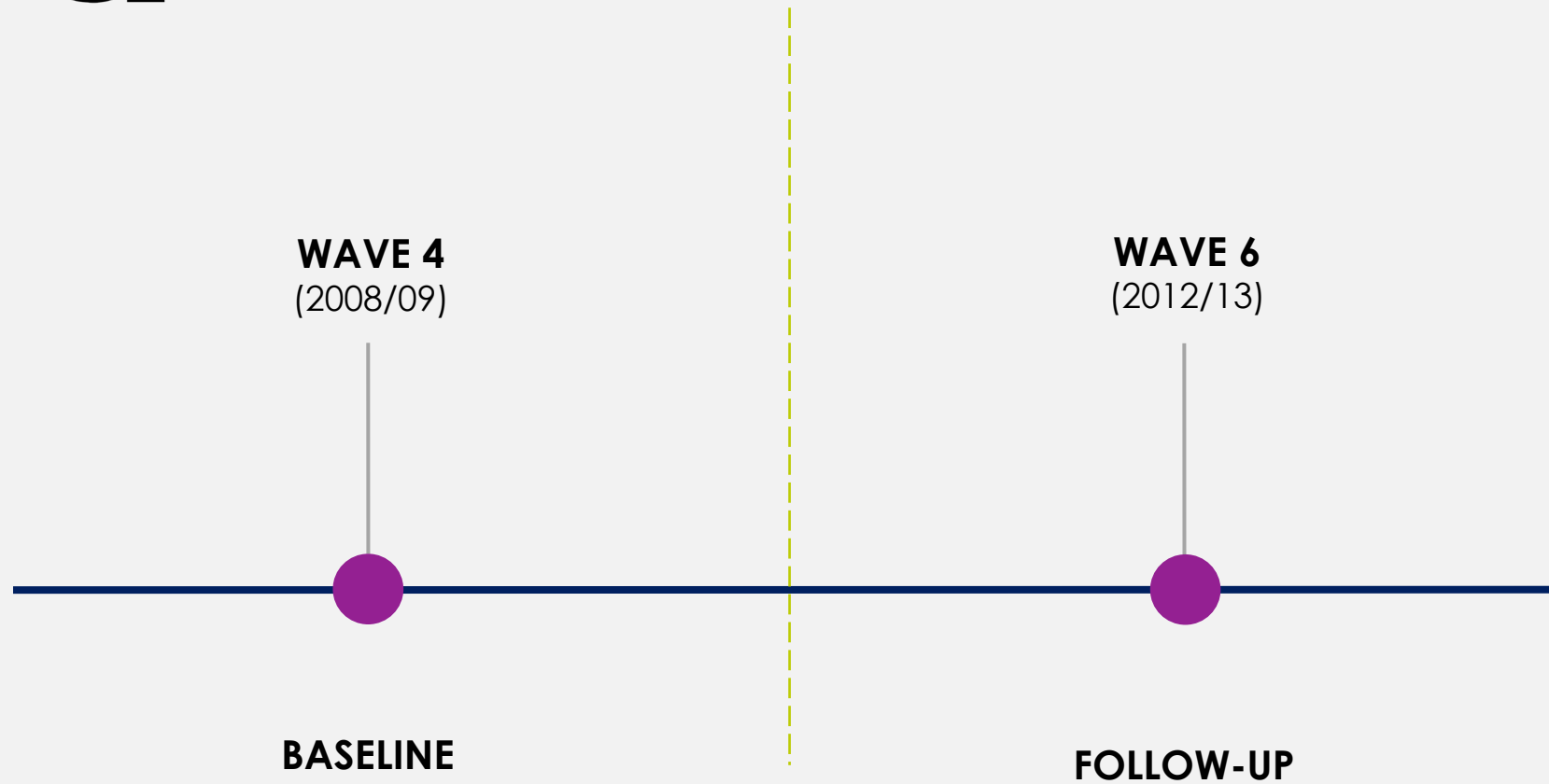


CLINICAL

elsa

English
Longitudinal
Study of
Ageing

elsa



Inflammation &
Neuroendocrine
Activity

CRP

Fb

WBCC

IGF-1



Contextual
(Neighbourhood)

Index of Multiple Deprivation (IMD)

1. education
2. employment
3. income
4. skills and training
5. health and disability
6. barriers to housing and services
7. living environment and crime

7

domains

38 indicators

Compositional (Individual)

WEALTH

net wealth, excluding
net debt and pension:

- property
- possessions
- housing
- liquid asset
- cash
- savings
- investments
- jewelry
- artwork

EDUCATION

level of education
obtained or equivalent:

- higher education
- primary & secondary
qualifications
- no qualifications

OCCUPATION

National Statistics Socio-
Economic Classification:

- managerial &
professional
- intermediate
- routine & manual

1

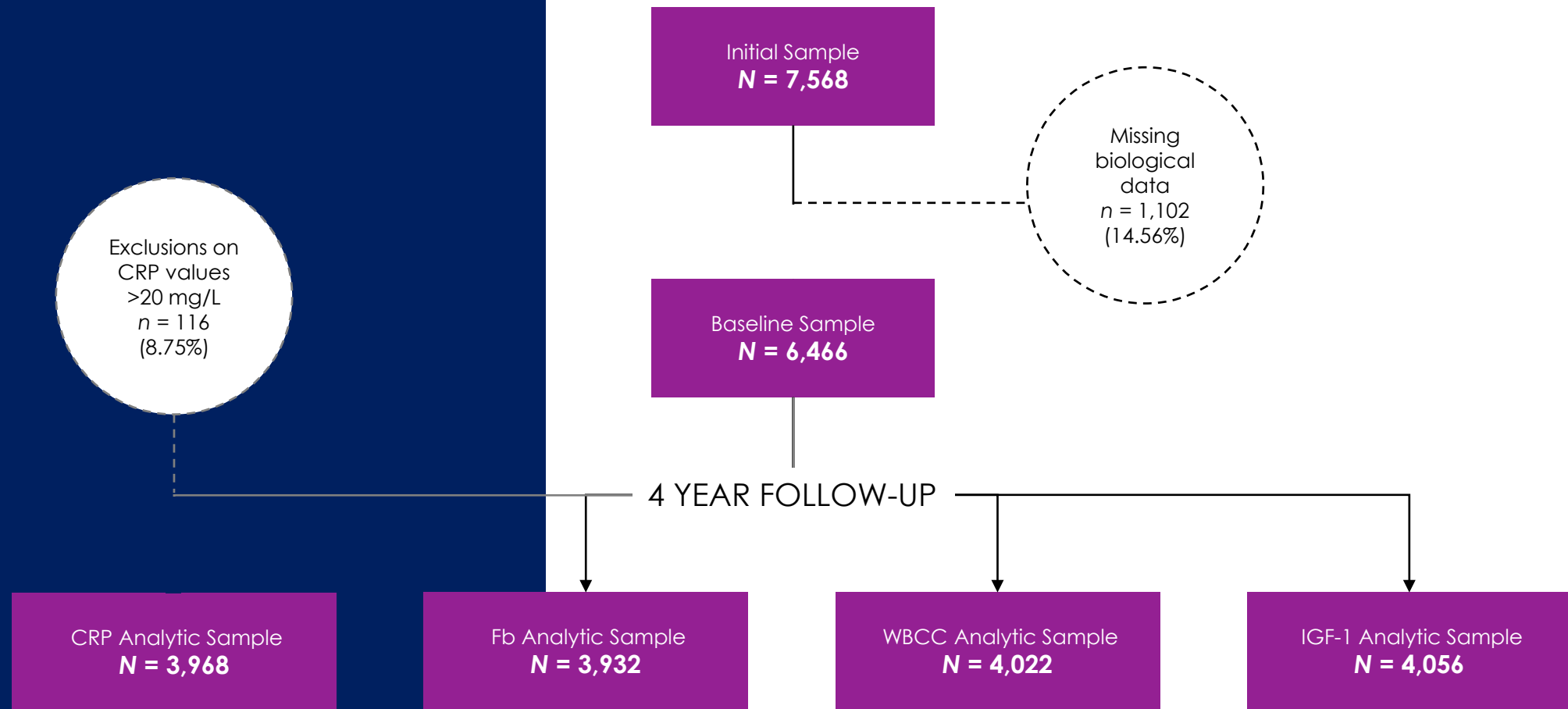
MOST DEPRIVED

2

3

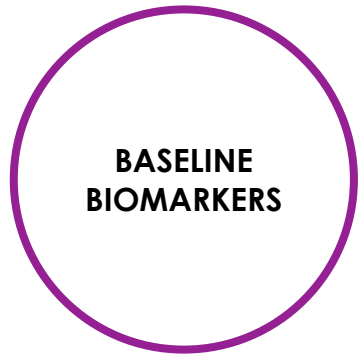
LEAST DEPRIVED
reference category

Socioeconomic
Determinants

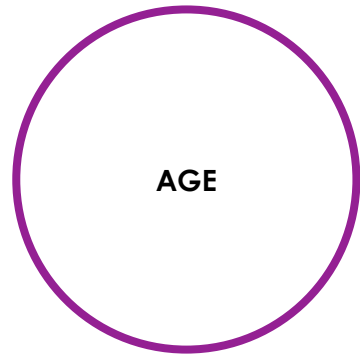


COVARIATES

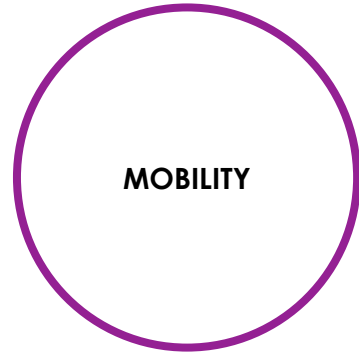
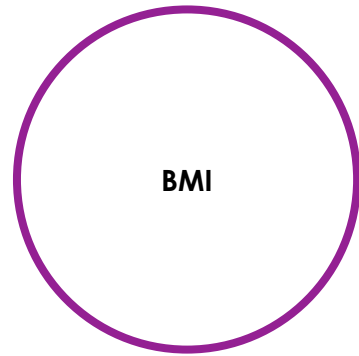
1



2



3



4

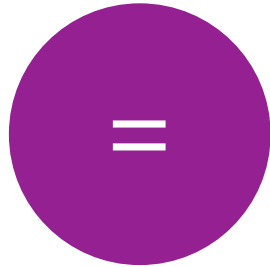


5

Full Adjustment

predicted value of the outcome

\hat{Y}_i



estimated regression coefficients

$$B_0 + B_1 X_{1i} + B_2 X_{2i} \dots B_\infty X_{\infty i} + U_i$$

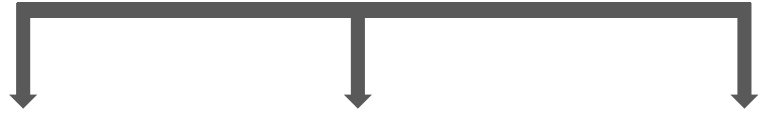
error term



value of \hat{Y} when exposures equal zero

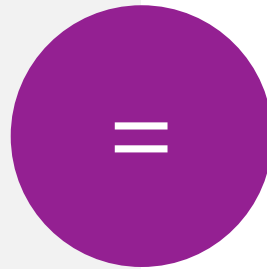


distinct covariates



PERCENTAGE OF THE PROTECTIVE ASSOCIATION EXPLAINED

PPAE

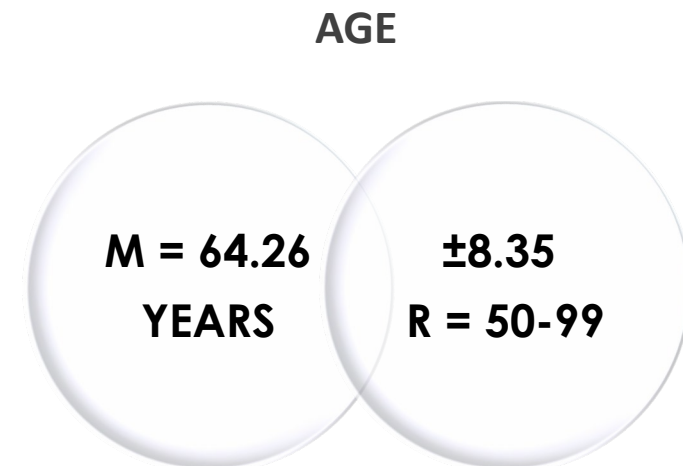
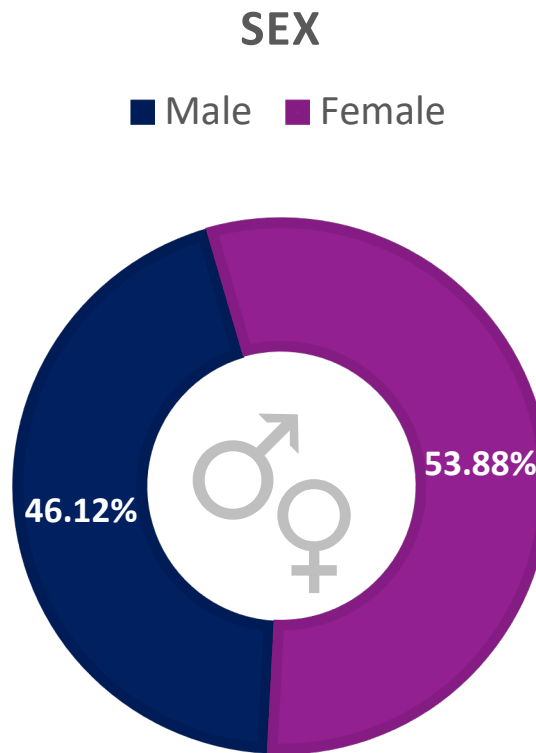
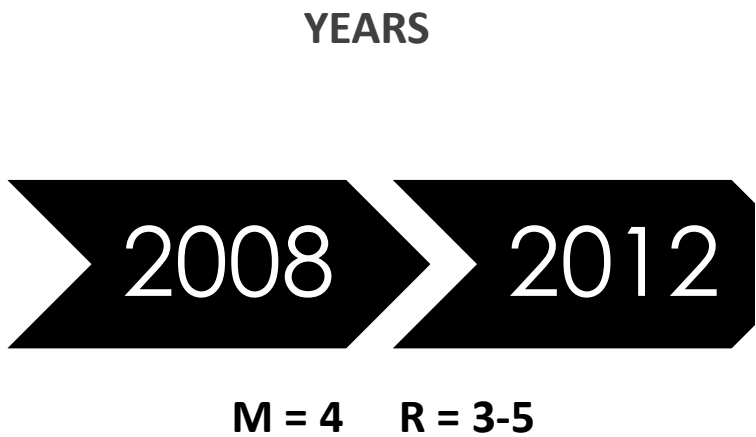


[crude model 1 and model X]

$$\downarrow$$
$$(B - B / (1 - B))$$

↑

[crude model 1]





overweight (**72.38%**)



moderately to vigorously active (**75.77%**)



non-smokers (**87.73%**)



consumed alcohol (**63.42%**)



no limiting longstanding illness (**72.18%**)



Biomarkers were stable on average from baseline to follow-up

CROSS-SECTIONAL RELATIONSHIPS



Adjustments		CRP (N = 3,968)			Fb (N = 3,932)			WBCC (N = 4,022)			IGF-1 (N = 4,056)			
		β (SE)	95% CI	p	β (SE)	95% CI	p	β (SE)	95% CI	p	β (SE)	95% CI	p	
Contextual Indicators	IMD													
	Model 1: Crude model	0.131 (0.027)	0.078-0.183	<0.001	0.084 (0.023)	0.038-0.130	<0.001	0.038 (0.012)	-0.013-0.062	0.002	-0.060 (0.015)	-0.089--0.031	<0.001	
	Model 5: Fully Adjusted ^d	0.026 (0.025)	-0.023-0.075	0.303	0.001 (0.023)	-0.044-0.045	0.972	-0.011 (0.012)	-0.034-0.012	0.358	-0.055 (0.015)	-0.084--0.026	<0.001	
Compositional Indicators	Wealth													
	Model 1: Crude model	0.285 (0.026)	0.233-0.336	<0.001	0.230 (0.023)	0.185-0.275	<0.001	0.101 (0.012)	0.078-0.125	<0.001	-0.091 (0.015)	-0.12--0.062	<0.001	
		Model 5: Fully Adjusted ^d	0.104 (0.026)	0.054-0.155	<0.001	0.086 (0.023)	0.040-0.132	<0.001	0.032 (0.012)	0.008-0.056	0.01	-0.065 (0.015)	-0.095--0.035	<0.001
	Education													
		Model 1: Crude model	0.114 (0.024)	0.067-0.161	<0.001	0.117 (0.021)	0.076-0.158	<0.001	0.049 (0.011)	0.027-0.071	<0.001	-0.067 (0.014)	-0.094--0.041	<0.001
		Model 5: Fully Adjusted ^d	0.050 (0.022)	0.006-0.094	0.025	0.069 (0.020)	-0.03-0.109	<0.001	0.030 (0.011)	0.010-0.051	0.004	-0.012 (0.014)	-0.04-0.015	0.375
	Occupational Social Class													
	Model 1: Crude model	0.171 (0.023)	0.126-0.216	<0.001	0.139 (0.020)	0.099-0.178	<0.001	0.047 (0.011)	0.026-0.068	<0.001	-0.057 (0.014)	-0.085--0.03	<0.001	
	Model 5: Fully Adjusted ^d	0.061 (0.022)	0.018-0.103	0.006	0.041 (0.020)	0.002-0.080	0.037	0.010 (0.010)	-0.01-0.028	0.341	-0.031 (0.013)	-0.056--0.005	0.018	

LONGITUDINAL RELATIONSHIPS



Adjustments		CRP (N = 3,968)			Fb (N = 3,932)			WBCC (N = 4,022)			IGF-1 (N = 4,056)		
		β (SE)	95% CI	p	β (SE)	95% CI	p	β (SE)	95% CI	p	β (SE)	95% CI	p
Contextual Indicators	IMD												
	Model 1: Crude model ^a	0.068 (0.020)	0.028-0.108	0.001	0.053 (0.019)	0.016-0.091	0.005	0.034 (0.009)	0.015-0.052	<0.001	-0.017 (0.009)	-0.034--0.001	0.05
	Model 5: Fully Adjusted ^b	0.042 (0.021)	0.002-0.082	0.039	0.029 (0.019)	-0.009-0.067	0.135	0.023 (0.010)	0.005-0.042	0.014	-0.015 (0.009)	-0.032-0.003	0.095
Compositional Indicators	Wealth												
	Model 1: Crude model ^a	0.076 (0.020)	0.037-0.116	<0.001	0.076 (0.019)	0.038-0.113	<0.001	0.050 (0.009)	0.032-0.069	<0.001	-0.029 (0.009)	-0.046--0.011	0.001
	Model 5: Fully Adjusted ^b	0.028 (0.021)	-0.014-0.07	0.194	0.031 (0.020)	-0.017-0.052	0.119	0.035 (0.010)	0.016-0.055	<0.001	-0.015 (0.009)	-0.034--0.003	0.099
	Education												
	Model 1: Crude model ^a	0.058 (0.018)	0.022-0.094	0.002	0.078 (0.017)	0.044-0.112	<0.001	0.030 (0.009)	0.013-0.047	<0.001	-0.026 (0.008)	-0.042--0.011	0.001
	Model 5: Fully Adjusted ^b	0.020 (0.019)	-0.018-0.058	0.298	0.034 (0.018)	0.001-0.070	0.05	0.020 (0.009)	0.002-0.037	0.029	0.002 (0.008)	-0.014-0.019	0.777
	Occupational Social Class												
	Model 1: Crude model ^a	0.056 (0.018)	0.022-0.091	0.001	0.064 (0.016)	0.032-0.097	<0.001	0.033 (0.008)	0.017-0.049	<0.001	-0.021 (0.008)	-0.037--0.006	0.006
	Model 5: Fully Adjusted ^b	0.028 (0.018)	-0.007-0.063	0.118	0.034 (0.017)	0.001-0.067	0.045	0.024 (0.008)	0.008-0.041	0.003	-0.006 (0.008)	-0.021-0.009	0.449

CONTEXTUAL - COMPOSITIONAL



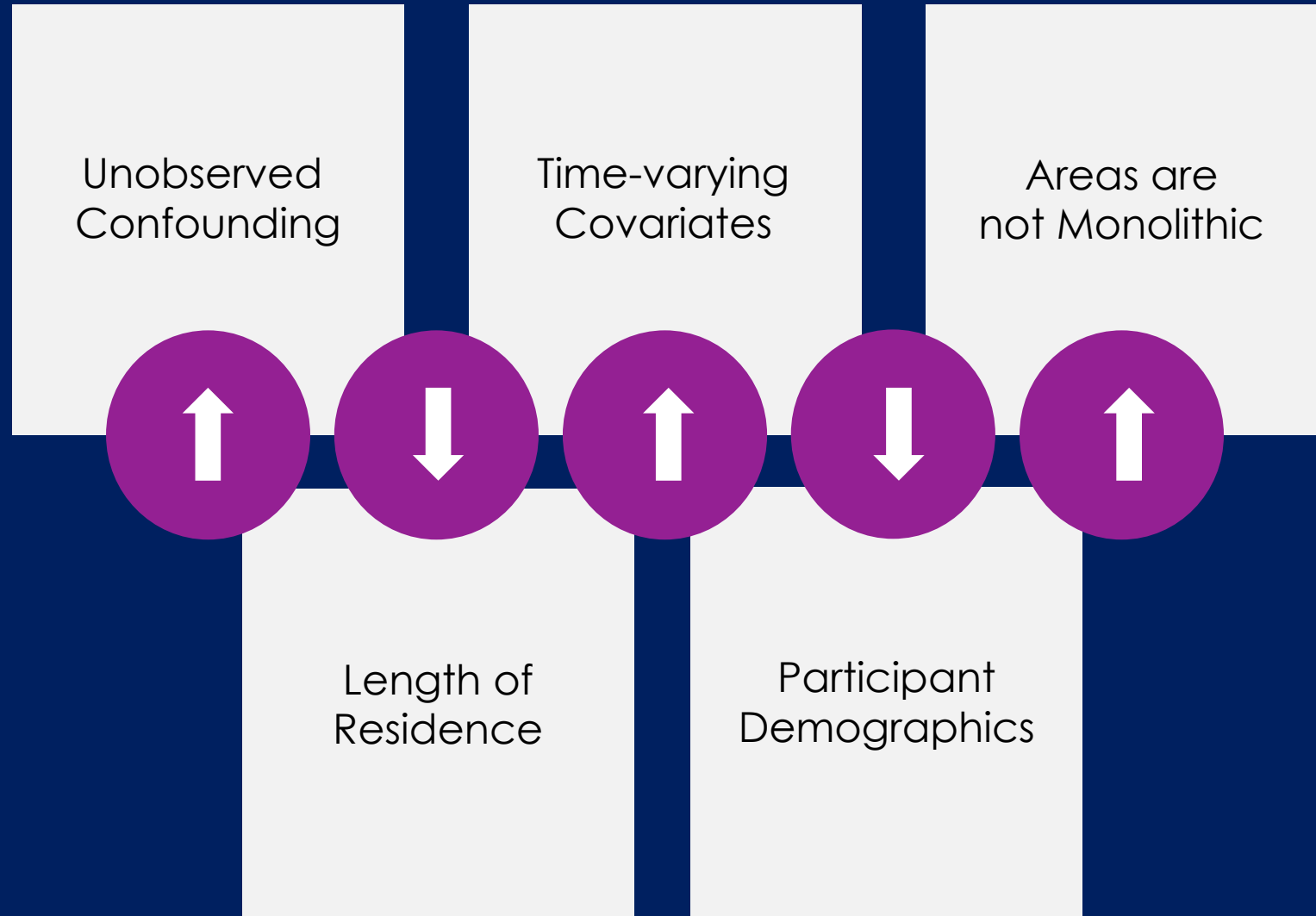
Adjustments	CRP (N = 3,968)			Fb (N = 3,932)			WBCC (N = 4,022)			IGF-1 (N = 4,056)		
	β (SE)	95% CI	p	β (SE)	95% CI	p	β (SE)	95% CI	p	β (SE)	95% CI	p
IMD												
Model 1: Crude model ^a	0.068 (0.020)	0.028-0.108	0.001	0.053 (0.019)	0.016-0.091	0.005	0.034 (0.009)	0.015-0.052	<0.001	-0.017 (0.009)	-0.034--0.001	0.05
Model 5: Fully Adjusted ^b	0.042 (0.021)	0.002-0.082	0.039	0.029 (0.019)	-0.009-0.067	0.135	0.023 (0.010)	0.005-0.042	0.014	-0.015 (0.009)	-0.032-0.003	0.095
IMD Wealth												
Model 1: Crude model + Wealth ^a	0.047 (0.022)	0.004-0.090	0.031	0.028 (0.021)	-0.012-0.068	0.174	0.019 (0.010)	-0.001-0.039	0.067	-0.005 (0.010)	-0.024-0.014	0.612
Model 5: Fully Adjusted + Wealth ^b	0.039 (0.022)	-0.004-0.082	0.073	0.022 (0.020)	-0.019-0.062	0.294	0.015 (0.010)	-0.005-0.035	0.146	-0.010 (0.009)	-0.028-0.009	0.314
IMD Education												
Model 1: Crude model + Education ^a	0.059 (0.021)	0.019-0.100	0.004	0.040 (0.019)	0.002-0.077	0.04	0.029 (0.010)	0.010-0.048	0.003	-0.012 (0.009)	-0.03-0.006	0.182
Model 5: Fully Adjusted + Education ^b	0.041 (0.021)	0.000-0.081	0.049	0.024 (0.019)	-0.014-0.062	0.216	0.021 (0.010)	0.002-0.040	0.03	-0.016 (0.009)	-0.033-0.002	0.085
IMD Occupational Social Class												
Model 1: Crude model + OSC ^a	0.060 (0.021)	0.019-0.100	0.004	0.039 (0.019)	0.000-0.077	0.047	0.027 (0.010)	0.008-0.046	0.005	-0.014 (0.009)	-0.032-0.004	0.128
Model 5: Fully Adjusted + OSC ^b	0.040 (0.021)	0.000-0.081	0.05	0.022 (0.020)	-0.017-0.06	0.27	0.020 (0.010)	0.001-0.039	0.043	-0.015 (0.009)	-0.033-0.003	0.102

percentage of the protective association explained

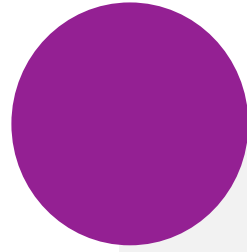


Adjustments		CRP* (N = 3,968)	Fb (N = 3,932)	WBCC* (N = 4,022)	IGF-1* (N = 4,056)
Contextual Indicators	IMD				
	Model 1: Crude model ^a	-	-	-	-
	Model 2: Model 1 + demographic ^b	-2.94	-5.66	-2.94	-17.65
	Model 3: Model 1 + clinical ^c	20.59	18.87	11.76	35.29
	Model 4: Model 1 + lifestyle ^d	26.47	39.62	23.53	29.41
	Model 5: Fully Adjusted ^e	38.24	45.28	32.35	11.76
Compositional Indicators	Wealth				
	Model 1: Crude model ^a	-	-	-	-
	Model 2: Model 1 + demographic ^b	3.95	2.63	2.00	24.14
	Model 3: Model 1 + clinical ^c	31.58	19.74	10.00	34.48
	Model 4: Model 1 + lifestyle ^d	38.16	42.11	18.00	31.03
	Model 5: Fully Adjusted ^e	63.16	59.21	30.00	48.28
	Education				
	Model 1: Crude model ^a	-	-	-	-
	Model 2: Model 1 + demographic ^b	17.24	19.23	0.00	88.46
	Model 3: Model 1 + clinical ^c	29.31	16.67	13.33	23.08
	Model 4: Model 1 + lifestyle ^d	32.76	29.49	20.00	26.92
	Model 5: Fully Adjusted ^e	65.52	56.41	33.33	92.31
	Occupational Social Class				
	Model 1: Crude model ^a	-	-	-	-
	Model 2: Model 1 + demographic ^b	7.14	10.94	-3.03	47.62
Model 3: Model 1 + clinical ^c	23.21	14.06	9.09	23.81	
Model 4: Model 1 + lifestyle ^d	30.36	31.25	18.18	28.57	
Model 5: Fully Adjusted ^e	50.00	46.88	27.27	71.43	

LIMITATIONS



CONCLUSIONS



1. Contextual factors were weaker drivers of immune and neuroendocrine activity
2. Material deprivation can lead to adverse immune-neuroendocrine activity in non-clinical populations
3. Socioeconomic differences in immune and neuroendocrine expression over time
4. Lifestyle accounted for a greater proportion of the variance with inflammation. While demographics accounted for a greater proportion of the variance with IGF-1



WITH THANKS