

# The operationalisation of a multi-dimensional measure of healthy ageing in the English Longitudinal Study of Ageing: Associations with inflammation, socioeconomic and health-related factors

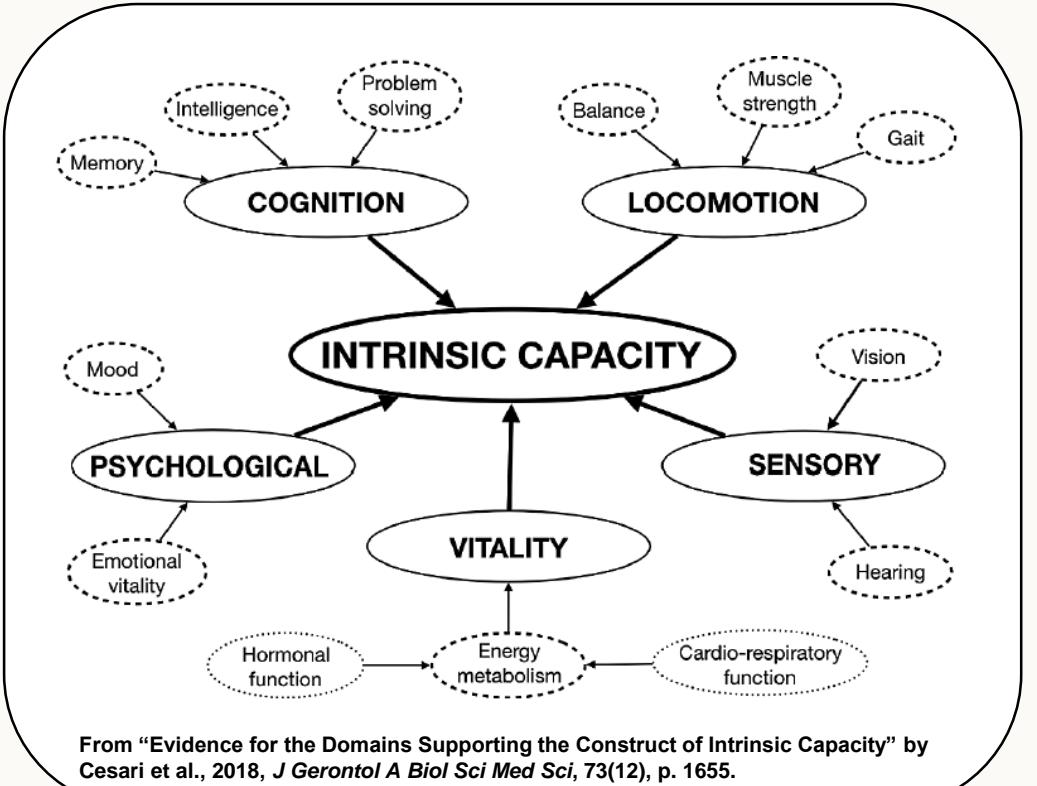
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## Background

- Intrinsic capacity is a novel measurement of healthy ageing that represents the "composite of all the physical and mental capacities of an individual"<sup>1</sup>, and is comprised of five domains of capacity<sup>2</sup>
- There is currently no consensus on the method to generate an intrinsic capacity score, and it has been rarely explored longitudinally
- Nevertheless, intrinsic capacity score is found to be associated with sociodemographic factors, health and functional ability
- Inflammation was included initially as an indicator of intrinsic capacity, but later removed as it was thought to be a driver of change, as opposed to an indicator<sup>3</sup>



**Aim:** To operationalise intrinsic capacity over 3 waves of ELSA and test the association with inflammation, alongside socioeconomic and health-related factors.

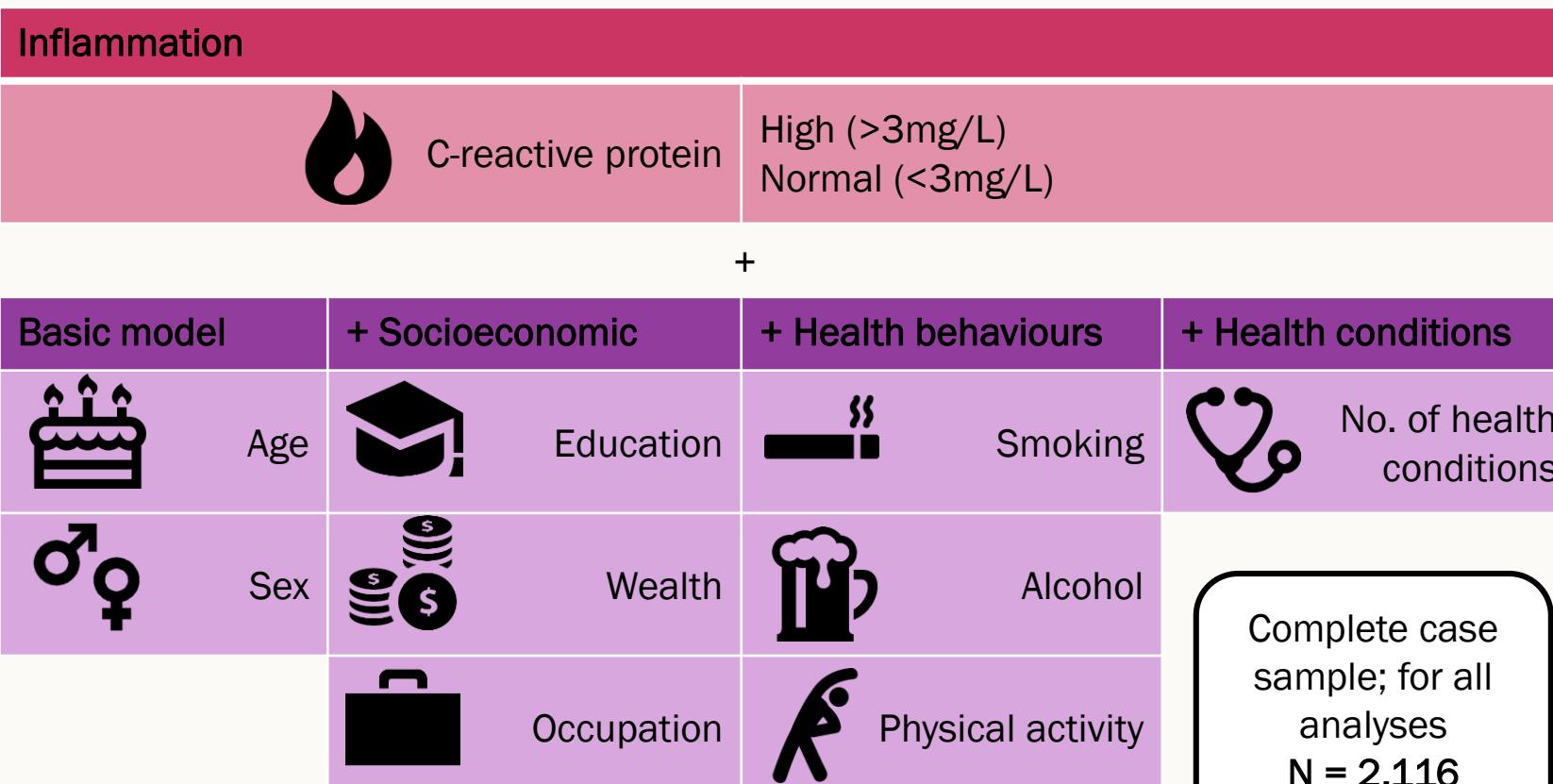
## Measuring intrinsic capacity

- The current intrinsic capacity model was based on the ICOPE intrinsic capacity screening tool, developed for primary assessment of impairment in key domains<sup>4</sup>.
- The current model includes two pass/fail indicators for each of the five domains (scored: fail = 0, pass = 1), with 'passes' adding up to a maximum score of 10
- All of these indicators were measured in participants aged  $\geq 60$  years in three waves of ELSA (waves 2, 4 & 6)

Wave 2  
2004/5 → Wave 4  
2008/9 → Wave 6  
2012/13

	Indicator	W2 N=2,116	W4 N=1,139	W6 N=918
Cognition	Recall			
	Pass: top 2 tertiles Fail: bottom tertile	59.05 40.95	60.49 39.51	59.80 40.20
Locomotion	Orientation			
	Pass: all correct Fail: $\geq 1$ incorrect answer	79.46 20.54	81.74 18.26	79.96 20.04
Sensory function	Balance			
	Pass: score of 4 Fail: score $< 4$	82.32 17.68	81.21 18.79	80.39 19.61
Vitality	Chair rise			
	Pass: 5 rises within 16.7s Fail: 5 rises in $> 16.7s$	89.10 10.90	89.73 10.27	89.98 10.02
Psychological well-being	Eyesight			
	Pass: rated good-excellent Fail: rated fair-poor	90.07 9.93	90.61 9.39	89.98 10.02
Vitality	Hearing			
	Pass: rated good-excellent Fail: rated fair-poor	78.81 21.19	79.19 20.81	75.05 24.95
Psychological well-being	Grip			
	Pass: $\geq 26kg$ (men) or $\geq 18kg$ (women) Fail: $< 26kg$ (men) or $< 18kg$ (women)	90.72 9.28	88.50 11.50	85.73 14.27
Psychological well-being	BMI			
	Pass: BMI $\geq 18.5$ and $< 30$ Fail: BMI $< 18.5$ or $\geq 30$	93.26 6.74	99.21 0.79	99.02 0.98
Psychological well-being	CESD			
	Pass: score $< 4$ Fail: score $\geq 4$	89.98 10.02	91.75 8.25	92.92 7.08
Psychological well-being	SWLS			
	Pass: score $\geq 20$ Fail: score $< 20$	88.83 11.17	87.97 12.03	88.34 11.66
<b>Intrinsic capacity total score</b>	<b>Mean (SD)</b>	<b>8.42 (1.44)</b>	<b>8.50 (1.38)</b>	<b>8.41 (1.45)</b>

## Baseline predictors of intrinsic capacity

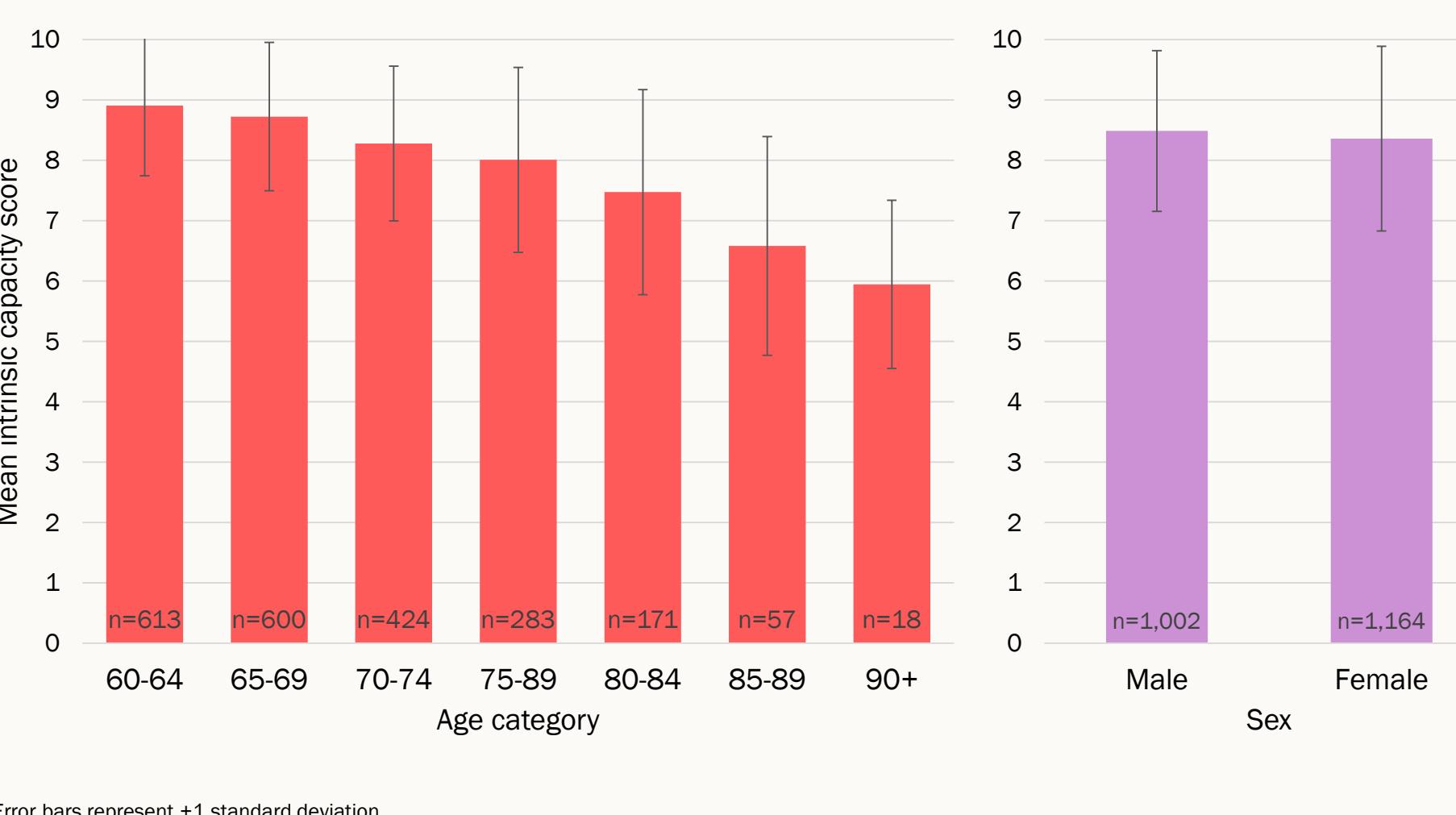


### Hypotheses:

- High levels of inflammation will be associated with lower intrinsic capacity scores.
- Intrinsic capacity scores will follow the social gradient in health, with those in more disadvantaged conditions experiencing poorer intrinsic capacity score.
- More 'unhealthy' health behaviours and poorer health will be associated with lower intrinsic capacity score.

## Intrinsic capacity score at baseline

Average intrinsic capacity score tended to decline with increasing age, but was similar across men and women. Mean age at baseline = 69.72 years (sd = 7.42).



## References

- Araujo de Carvalho, I. et al. (2017). Operationalising the concept of intrinsic capacity in clinical settings. WHO: Geneva.
- Beard, J.R. et al. (2019). The structure and predictive value of intrinsic capacity in a longitudinal study of ageing. *BMJ Open*, 9(11).
- Cesari, M. et al. (2018). Evidence for the domains supporting the construct of intrinsic capacity. *J Gerontol A Biol Sci Med Sci*, 73(12):1653-1660
- WHO (2015). World report on ageing and health. WHO: Geneva.
- WHO (2019). Integrated care for older people (ICOPE): Guidance in person-centred assessment and pathways in primary care. WHO: Geneva. (WHO/FWC/ALC/19.1)

	Basic	(1)	(2)	(3)	Full
Wave	-0.09**	-0.09**	-0.09**	-0.09**	-0.10**
CRP (High vs Normal)	-0.27**	-0.14*	-0.16*	-0.23**	-0.07
Age	-0.09**	-0.08**	-0.08**	-0.08**	-0.07**
Sex (Female vs male)	-0.09	-0.07	-0.04	-0.06	-0.02
Education (Ref= College)					
Compulsory school leavers		-0.41**			-0.36**
A Level			-0.07		-0.05
Wealth quintile (Ref= 5 <sup>th</sup> , highest)					
1 <sup>st</sup>		-0.73**			-0.57**
2 <sup>nd</sup>			-0.47**		-0.37**
3 <sup>rd</sup>				-0.27**	-0.22*
4 <sup>th</sup>				-0.10	-0.08
Occupation (Ref= Paid employment)					
Retired		-0.13			-0.05
Unable to work			-1.02*		-0.49
Not in paid employment			-0.52		-0.55
Other		-0.53			-0.43
Looking after home/family		-0.06			-0.05
Smoking (Ref= Never smoked)					
Ex-smoker			-0.16*		-0.10
Current smoker				-0.31**	-0.16
Physical activity (Ref= High)					
Sedentary				-1.33**	-0.99**
Low				-0.57**	-0.38**
Moderate			-0.24**		-0.17*
Alcohol (Ref= Less than daily consumption)					
Daily (5/7 week)			0.30**		0.11*
No. of health conditions					-0.32** -0.24**
ICC	0.63	0.60	0.60	0.60	0.80

\* p<0.05 \*\* p<0.01

## Statistical analysis

Four mixed effects models were used, with intrinsic capacity score as the dependent variable and inflammation as a fixed predictor. Random intercepts and random slopes over time were generated for each individual.

The most basic model included fixed effects for age and sex. The next three models included the basic model plus baseline (1) socioeconomic factors or (2) health behaviours or (3) health conditions. The final model included all predictors

This table displays the coefficients for the association between each predictor and intrinsic capacity. Each column displays one model; the coefficients presented are mutually adjusted for all the other variables included in that model.

## Key results

The main results from the mixed models show an effect of time and age in all models, with intrinsic capacity score decreasing over time and with older age. There was no effect of sex in any model.

An effect of CRP group was found in all models, except the fully adjusted, with high CRP at baseline associated with lower intrinsic capacity score.

Lower levels of education, wealth and physical activity and a greater number of health conditions predicted lower intrinsic capacity scores. Increased alcohol consumption predicted higher intrinsic capacity scores.

## Conclusions

- Intrinsic capacity score, generated by a novel model, tends to decrease over time and with increased age, acting in accordance with other models of healthy ageing. It was also associated with socioeconomic and health-related factors in an expected way, with lower education and wealth as well as less favourable health behaviours associated with lower intrinsic capacity.
- High levels of inflammation at baseline were associated with decreased intrinsic capacity score, except when accounting for all other predictors. This highlights how although inflammation plays a role in predicting intrinsic capacity, these other predictors all together are more important.

## Future steps

Next steps involve further validating this model of intrinsic capacity by testing whether it can predict future adverse outcomes and functional ability, as well as assessing the impact of chronic inflammation with repeated measurements of CRP.