

### **Abstract**

Reproductive histories put a burden on women's health. This is possibly even more so in high fertility and low resource settings where maternal mortality and morbidity is higher. So far, the evidence on the cumulative impact of fertility on general health later in life is unclear. There is a lack of studies in low resource countries that take into account adverse reproductive events such as pregnancies not ending in live births and generally in settings with low levels of maternal health care. With a fast ageing population, we need to understand how decades of high fertility and high maternal morbidity and mortality in a low-income setting might have affected women's health. Using latent class models to analyse the first five waves of the Indonesian Family life Survey (IFLS) the aim of this study is to analyse the impact of cumulative reproductive histories on ageing, as indicated by grip strength later in life. Preliminary results show a negative impact of early age at first birth and generally no effect of parity and terminations. This study is set within the greater need to understand how high fertility might affect the ageing process of women in a low-income setting.

### **Extended abstract**

The attention on women in Low- and Middle-Income Countries (LMICs) in the last three decades has been prominently focused around reproductive health and mainly around the reproductive period. However, we do not have a clear picture of what impact this might have on the ageing process.

In High Income Countries (HICs) the relationship between fertility histories and later life health has been studied in depth and usually nulliparous, high parity or women who started childbearing early have a higher risk of mortality (Grundy and Read 2015, Read and Grundy 2016). However, this research is mainly limited to high income settings and it is rather limited in terms of understanding of the mechanisms that drive this relationship (Gustafsson, Janlert et al. 2011, Premji 2014).

Previous analysis conducted on Indonesian data of other outcomes which include allostatic load (a measure of wear and tear of the body) as the outcome showed the negative impact of terminations on women's health later in life but didn't detect any effect of parity (Leone et al, 2017). The study was limited in sample and only included women aged 40+. Also, evidence in Brazil shows that early childbearing can accelerate the process of ageing measured through grip strength and gait speed (Câmara, Pirkle et al. 2015).

Women usually exhibit a higher cumulative burden of physiological dysregulation across multiple systems indicated by the allostatic load than men. Although such difference is small before menopause, it grows larger afterwards. Two studies have shown that grip strength declines from the same age for both men and women at around age 40 but men lose strength at a faster pace relative to their peak (Metter, Conwit et al. 1997, Nahhas, Choh et al. 2010). It is unclear though whether women's higher burden of disease compared to men could be linked to their reproductive lives.

Detecting early signs of ageing whether physical or cognitive can be cost saving as it would lead to early intervention and a more effective active ageing later on. As life expectancy increases, we need to check how contextual settings can make the difference in the ageing process from mid-life. This is particularly true in low income countries where our knowledge on the ageing process is rather scarce and where more than everywhere else the costs of ageing will hit economies the worse as the social care systems are often inexistent.

Using the first five waves of the Indonesian Family Longitudinal Survey (IFLS), the aim of this study is to understand the cumulative effect of the fertility history on women's grip strength later in life.

### **Conceptual framework: the cumulative approach**

The *weathering hypothesis* (Geronimus, Hicken et al. 2006) and the *cumulative inequality theory* are used to add a further dimensions, contending that cumulative inequality interacts with one's ability to mobilise social, economic and psychological resources, shaping the individual's health and wellbeing in old age (Ferraro and Shippee, 2009). Individuals with early life traumas are thus more likely to encounter and generate further stressful events (e.g.: the loss of a child or major health issues in childhood) throughout the later lifestages, but with fewer personal and psycho-social resources to cope with them. Moreover, such individuals are more likely to amplify their biological and emotional response to any later-emerged stressor and are predisposed to self-medicating behaviours like smoking, drug use and consumption of high-fat diets (Nusslock and Miller, 2016).

The weathering hypothesis, which states that the health of individuals who have been exposed to socio-economic disadvantage throughout their life, deteriorates more quickly than those in more advantageous positions (Geronimus, Hicken et al. 2006). Several studies provide support for the accumulation of risk hypothesis in that cumulative measures of SES adversity across childhood and adulthood are stronger predictors of physiological risk, such as high inflammatory burden (e.g., Loucks et al., 2010 ; Pollitt et al., 2008) and weight gain (e.g., Baltrus et al., 2005 ; Senese et al., 2009), than measures from single points in the life course (Gruenewald, Karlamangla et al. 2012). It is feasible to hypothesise that women in low income settings, in particular from low income groups might have experienced a greater burden and higher level of stressors than women from high income settings. In this study we want to apply those theories to the impact of reproductive lives on women's health through grip strength.

Falkingham et al (2020) highlighted the need to look at the cumulative effect through the synthesis of overall previous experiences (Falkingham, Evandrou et al. 2020). In this study we start from a single-issue approach through multivariate fixed effects models moving to a cumulative one through latent class analysis where we account for childhood as well as reproductive histories events. We consider pregnancy complications and possible traumas (e.g.: stillbirth, c-section, hypertension) as well as pregnancy outcomes and their timings and possible stressors which could have had an impact on women's health later in life. These experiences throughout the lifecourse are synthesised as a cumulative variable.

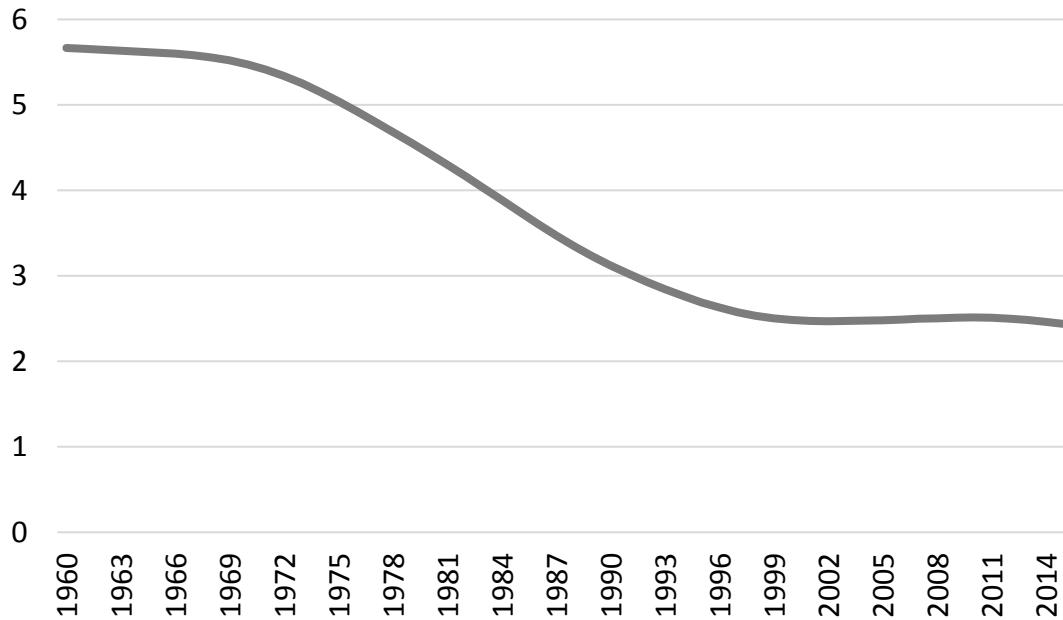
### **The context**

Indonesia is a lower middle-income country which has experienced a considerable economic growth as well as a considerable fertility decline over the last three decades (Fig 1.) Life expectancy was 48 years in 1960 while it has risen to 69 years in 2014. Births attended by

skilled staff ≈40% in early 1990s with an increase to 87% in 2013. Finally, contraceptive prevalence was <30% in the mid-1970s, 63% in 2013 (UNPD 2017).

We are therefore looking at a country which only recently had a very high level of fertility and more in general a need of safe maternal health care which often would go unmet.

**Figure 1. Indonesia fertility 1960-2017.**



Source: World Bank, 2017

### Methods and data

This study uses the first five waves (1996-2014) of the Indonesian Family Longitudinal Survey (IFLS). A total sample of 8203 women was selected which included those with grip strength information as well as reproductive histories. The models were run in Stata 15.

Grip strength is the mean of the best result obtained in each hand squeezing a Smedley's hand dynamometer where the dominant hand is reported by the interviewer. It is widely regarded as an excellent predictor of disability and worse health at older ages (Sayer, Syddall et al. 2006). When standardised it produces a reliable objective measure of health status ([Rantanen et al., 1999](#), [Sayer et al., 2006](#), [Taekema et al., 2009](#)). We first apply a linear regression fixed effects model to identify the relationship between key lifecourse events in reproductive life and grip strength. We will then apply latent class analysis (LCA) to add up the cumulative effects of key lifecourse events related childhood and reproductive lives which include: parity, terminations (whether induced or natural), childhood illnesses, hospitalisations, child deaths, pregnancy complications, c-sections, age at first birth. This will be done iteratively.

**Table 1 Fixed level effects multivariate grip strength model Indonesia IFLS**

Grip strength	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
<b>Terminations (ref 0)</b>						
1	-0.399	0.297	-1.340	0.180	-0.982	0.184
2+	0.769	0.522	1.470	0.090	-0.253	1.792
<b>Parity (ref 0)</b>						
1	0.186	0.841	0.220	0.825	-1.462	1.834
2	0.283	0.831	0.340	0.733	-1.346	1.913
3	-0.234	0.908	-0.260	0.797	-2.015	1.547
4	-1.149	1.149	-1.000	0.318	-3.402	1.104
5+	-4.889	3.906	-1.250	0.211	-12.547	2.770
<b>Age</b>	-0.133	0.018	-7.450	0.000	-0.168	-0.098
<b>Marital status (ref in union)</b>						
Not in a union	-0.110	0.449	-0.250	0.806	-0.990	0.769
<b>Ethnicity (Ref Javanese)</b>						
Sundanese	-0.709	0.311	-2.280	0.023	-1.319	-0.098
Batak	1.879	0.443	4.240	0.000	1.011	2.748
Minangkabau	-1.173	0.401	-2.920	0.003	-1.960	-0.387
Balinese	1.120	0.410	2.730	0.006	0.316	1.924
other	-0.817	0.225	-3.630	0.000	-1.259	-0.376
<b>Education</b>	0.112	0.112	1.000	0.317	-0.107	0.332
<b>Wealth quantile (ref poorest)</b>						
Poor	0.326	0.343	0.950	0.342	-0.346	0.998
Average	-0.075	0.361	-0.210	0.835	-0.783	0.632
Rich	-0.185	0.339	-0.550	0.585	-0.849	0.479
Richest	0.486	0.358	1.360	0.175	-0.216	1.188
<b>Experienced child illness (Ref no)</b>						
Yes	0.284	0.259	1.100	0.273	-0.224	0.791
<b>Experienced child death (ref no)</b>						
yes	-0.258	0.398	-0.650	0.516	-1.038	0.521
<b>Residence (ref urban)</b>						
Rural	0.655	0.205	3.200	0.001	0.254	1.056
<b>Age at first birth (ref &lt;18)</b>						
18+	0.035	0.019	1.830	0.067	-0.002	0.072
<b>Constant</b>	22.904	1.320	17.350	0.000	20.317	25.492

## Discussion

Preliminary results (Table 1) show no effect on grip strength from parity. Living in rural areas and having a child after the age of 18 does have a positive impact on grip strength. Among the socio-economic variables only ethnicity shows variation. While the first stage of modelling is inconclusive, exploratory analysis (not shown here) or more in-depth variables shows correlations which need to be analysed cumulatively. Disentangling different events throughout the lifecourse will be key in understanding the of the ageing process. This study is very timely within the quest for a wider focus on ageing in LMICs and the shifting of priorities from communicable to non-communicable diseases where countries are the least prepared.

## References

- Câmara, S. M. A., C. Pirkle, M. A. Moreira, M. C. A. Vieira, A. Vafaei and Á. C. C. Maciel (2015). "Early maternal age and multiparity are associated to poor physical performance in middle-aged women from Northeast Brazil: a cross-sectional community based study." BMC Women's Health **15**(1): 1-10.
- Falkingham, J., M. Evandrou, M. Qin and A. Vlachantoni (2020). "Accumulated lifecourse adversities and depressive symptoms in later life among older men and women in England: a longitudinal study." Ageing and Society **40**(10): 2079-2105.
- Geronimus, A. T., M. Hicken, D. Keene and J. Bound (2006). "'Weathering" and age patterns of allostatic load scores among blacks and whites in the United States." Am J Public Health **96**.
- Geronimus, A. T., M. Hicken, D. Keene and J. Bound (2006). "'Weathering" and Age Patterns of Allostatic Load Scores Among Blacks and Whites in the United States." American Journal of Public Health **96**(5): 826-833.
- Gruenewald, T. L., A. S. Karlamangla, P. Hu, S. Stein-Merkin, C. Crandall, B. Koretz and T. E. Seeman (2012). "History of socioeconomic disadvantage and allostatic load in later life." Social Science & Medicine **74**(1): 75-83.
- Grundy, E. and S. Read (2015). "Pathways from fertility history to later life health: Results from analyses of the English Longitudinal Study of Ageing." Demographic Research **32**(4): 107-146.
- Gustafsson, P. E., U. Janlert, T. Theorell, H. Westerlund and A. Hammarstrom (2011). "Socioeconomic status over the life course and allostatic load in adulthood: results from the Northern Swedish Cohort." J Epidemiol Community Health **65**.
- Metter, J., R. Conwit, J. Tobin and J. L. Fozard (1997). "Age-Associated Loss of Power and Strength in the Upper Extremities in Women and Men." Journal of Gerontology: Biological Science **52A**(5): 267-276.
- Nahhas, R. W., A. C. Choh, M. Lee, W. M. Cameron Chumlea, D. L. Duren, R. M. Siervogel, R. J. Sherwood, B. Towne and S. A. Czerwinski (2010). "Bayesian Longitudinal Plateau Model of Adult Grip Strength." American Journal of Human Biology **22**(5): 648-656.
- Premji, S. (2014). "Perinatal Distress in Women in Low- and Middle-Income Countries: Allostatic Load as a Framework to Examine the Effect of Perinatal Distress on Preterm Birth and Infant Health." Maternal and Child Health Journal **18**(10): 2393-2407.
- Read, S. L. and E. M. D. Grundy (2016). "Fertility History and Cognition in Later Life." The Journals of Gerontology Series B: Psychological Sciences and Social Sciences.
- Sayer, A. A., H. E. Syddall, H. J. Martin, E. M. Dennison, H. C. Roberts and C. Cooper (2006). "Is grip strength associated with health-related quality of life? Findings from the Hertfordshire Cohort Study." Age and Ageing **35**(4): 409-415.