Life course partnership status and biomarkers in mid-life: Evidence from the 1958 British birth cohort.

Abstract

Numerous studies have found that married people have better health than the unmarried. The vast majority of these studies relied on self reported health outcomes and considered only current marital status or transitions over relatively short periods, therefore ignoring the accumulated benefits and risks of marital status trajectories over the lifecourse. We employed data from a population based birth cohort to summarise longitudinal patterns of partnership status spanning 21 years that distinguished marital status and non-marital cohabitation. After controlling for selection due to early life and early adulthood characteristics, we found that lifecourse trajectories of partnership status were associated with haemostatic and inflammatory markers, the prevalence of metabolic syndrome and respiratory function in mid-life. Never marrying and neither cohabiting was detrimental to health in mid-life for both genders but the effect was more pronounced in men. Women married during their late 20's or early 30's that remained married had the most optimal health in mid-life. Not married cohabiters of both genders had similar mid-life health outcomes with those that were married. We found that the accumulated effect of partnership status over 21 years affects a wide range of biomarkers in mid-life. Further research is needed to identify the pathways that link lifecourse trajectories of partnership status and mid-life health

Introduction

Numerous studies have found that married people have better health and lower mortality than the unmarried, with many showing the worst health and mortality among the formerly married, with these findings replicated in different countries and time periods [1-18]. Reducing health inequalities related to marital status has the potential to shift the distribution of risk and therefore improve population health [19]. However, to do so further understanding of the association between marital status and health is needed. With a few exceptions [20] studies of marital status and health have considered only current marital status or transitions over relatively short periods, therefore ignoring the accumulated benefits and risks of marital status trajectories over the lifecourse. Individuals with the same current marital status may have experienced very different trajectories in reaching that particular state, with some having the same status over the lifecourse and others having experienced one or more transitions [15].

There is also lack of evidence on the association between non-marital cohabitation and health, a topic of increasing public health importance considering that cohabitation is becoming more common [21]. Furthermore, most studies have employed self reported measures of health and in the few studies where objective health indicators were used the sample sizes were relatively small [22, 23]. In this study we use data from a population based birth cohort to summarise longitudinal patterns of partnership status that distinguish marital status and non-marital cohabitation. We employed a model based approach that allowed us to capture stability as well as transitions in partnership status over a 21 year period (ages 23 to 44) and used this to investigate the effects that 21 year trajectories of partnership status have on a wide range of biomarkers in mid-life.

Methods

Sample

We employed the British 1958 birth cohort which includes all persons born in England, Scotland and Wales during one week in March 1958. Cohort members have been followed-up periodically from birth into adulthood [24]. To derive the partnership status trajectories we used data from four sweeps of the NCDS, 1981 (N = 12537), 1991 (N= 11469), 2000 (N = 11419) and 2002-4 (N = 8018), when study members were aged 23, 33, 42 and 44-46 years respectively). Our outcomes are derived from the 2002-4 clinical examination that was carried out at participants' households by 122 specially trained nurses from the National Centre for Social Research. In order to control for selection effects we used information from earlier sweeps carried out between 1958 and 1974 (when study members were aged 0-16 years, N= 18858). Our analytic sample included participants with at least three valid responses in the marital status and cohabitation indicators (N= 5160 for women and N = 4877 for men, total N = 10037).

Measures

Indicators of partnership status

We used binary indicators representing whether a participant was married or was cohabiting with someone that they were not married with. Each of the four measurement waves is thus represented by two indicators (one for marital status and one for cohabitation). We also included in the model information on whether participants have been remarried (see Table 1).

Biomarkers in mid-life

We used five haemostatic and inflammatory markers: C-reactive protein (CRP), fibrinogen [25], fibrin D-dimer (Ddimer) [26], von Willebrand factor (VWF) and tissue plasminogen activator antigen (TPA) [27]. Metabolic syndrome was characterised by the standard International Diabetes Federation definition. Finally we used forced vital capacity (FVC), a marker of respiratory functioning. Further details of laboratory procedures are available elsewhere [28, 29] and in Appendix I

Confounders

To control for possible selection into partnership status we included various early life and early adulthood (age 23) characteristics in our models. Serious financial hardship during the last year at age 11, paternal social class at age 7, housing tenure at age 7 and paternal weekly net pay at age 16 were used as indicators of early life socio–economic position. Health centre attendance during the last year at age 16, disability at age 16 and height at age 7 were used as indicators of early life health status. General ability measured at age 11 was used as an indicator of early life cognitive ability. We also controlled for variables measured at age 23: educational attainment, self rated health, depression, employment status, body mass index and presence of long standing disability. Finally, current use of medication and lab processing-related variables were are also included in the analysis. Descriptive statistics for all confounders and further details are presented in Appendix II.

INSERT TABLE 1 ABOUT HERE

Statistical modelling

In the first stage of the analysis we employed Latent Class Analysis (LCA) to derive a longitudinal typology of partnership status. The longitudinal trajectories are unknown but can be inferred from observed indicators of marital status and cohabitation measured over time. Since we employed nine binary indicators (Table 1) the number of possible response patterns in theory is $9^2 = 512$. However since married participants cannot be cohabiting at the same time makes the possible response patterns equal to $2 * (3^4) = 162$. In this instance LCA is used to summarise these patterns creating longitudinal profiles – trajectories - in a parsimonious way that can be used in further analysis. This approach can be viewed as an evidence-based approximation that improves a researcher's ability to identify, summarize, and communicate complex patterns in longitudinal data [30] that has been used in a wide range of applications [31], [32] [33].

In the second stage of the analysis we used the derived longitudinal typology from stage 1 to investigate the association between trajectories of partnership status with a wide range of biomarkers in mid life. CRP, fibrinogen, D-dimer, t-PA and VWF were log transformed to normalize their distributions prior to performing analyses. Metabolic syndrome was modelled as a binary outcome, while FVC raw scores were used as they were normally distributed. All outcomes were analysed jointly within a single model; continuous outcomes were modelled with linear regression and metabolic syndrome with binary logistic regression. Missing data were handled with the Full Information Maximum Likelihood (FIML) method which is naturally incorporated into the generalised latent variable modelling framework. In this full likelihood context model parameters and standard errors are estimated directly from the available data and the selection mechanism is ignorable under the Missing at Random (MAR) assumption [34, 35]. In this case MAR implies that the if all the variables that are responsible for the missing data generating mechanism are included in the model, this can be ignored and

parameter estimates can be robustly computed for participants with missing data. Practically, in our analysis MAR translates to the following assumption: all systematic missingness is due to variables included in our models, (serious financial hardship during the last year at age 11, paternal social class at age 7, housing tenure at age 7, paternal weekly net pay at age 16, health centre attendance during the last year at age 16, disability at age 16, height at age 7, cognitive ability at 11, educational attainment at 23, smoking status at 23, self rated health at 23, depression at 23, employment status at 23, body mass index at 23, presence of long standing disability at 23, current use of medication at 42). Any other missingness that is not accounted by these variables is assumed to be random (thus missing at random, since we assume that all systematic causes of attrition have been included in the model). We believe that this is a reasonable assumption since it has been shown that socio – economic position and age and are the main drivers of attrition in population surveys in the UK [36, 37]. All models were estimated with the Mplus 7 [38] software, using the robust maximum likelihood estimator (MLR) and Monte Carlo integration.

INSERT TABLE 2 ABOUT HERE

Results

In Table 2 we present information criteria, likelihood based tests and the entropy coefficient, a measure of classification quality (values close to 1 indicate good allocation quality – low classification error). As expected for both men and women model fit improved with each additional class. The classification quality as indicated by the entropy was highly satisfactory for all models. Since all BLRT tests returned significant p values, model selection was based on relative fit and substantive criteria. As can be observed from Table 2 and Graph 1 in Appendix II, the difference between models in all information criteria becomes smaller from the 6 class model onwards for both men and women, indicating that 6 - 8 classes would adequately describe the data. Closer inspection of the derived classes revealed that the additional 7^{th} and 8^{th} classes were largely replicating the patterns of already existing classes, but with a very small prevalence (<1%) for men and (<2 %) for women. We therefore selected 6 class models for both men and women as the most parsimonious description of the longitudinal patterns in the data.

INSERT TABLE 3 ABOUT HERE

Although the number of classes was identical for the two genders, the prevalence and interpretation of the latent longitudinal typologies differed. The probabilities of being married, cohabiting and/or remarried, conditional on group membership, are presented in Tables 3 (men) and 4 (women). In men the first and most prevalent class (N = 3010, 61.7%) comprises of men who were married in their 20's or early 30's and remain married, and this is their one and only marriage. The second class (N = 401, 8.2%) comprised of men that got married in their 20's or early 30's, but later got divorced and do not appear to be remarried or cohabiting. In the third class (N = 362, 7.4%) were allocated men that mostly never married and some that married in tier 20's, but cohabited after their early 30's. The fourth class (N = 462, 9.5%), included men that married in their mid or late 30's and remain married since. The fifth class (N = 100, 2.1%) comprised of men who divorced in their 30's but later remarried. Finally the sixth class (N = 542, 11.1%), comprised of men that never married and never cohabited.

INSERT TABLE 4 ABOUT HERE

In women, the most prevalent class (N = 2168, 42%), comprised of women who got married in their early 20's, are still married and this was their only marriage until age 44. The second class, (N = 1199, 23.2%) comprised of women who got married in their 30's and this was their only marriage until age 44. In the third class (N = 415, 8.0%) were allocated women that never married or married in their 20's but were more likely to cohabit from their early 30's onwards. The fourth class, Class4 (N = 291, 5.6%) comprised women who got married and subsequently divorced in their 20's/ early 30's, later cohabited and remarried. Women allocated in the fifth class (N = 446, 8.6%), were divorced in their mid/late 30's, but later cohabited or remarried. The sixth class, (N = 641, 12.4%), comprised women that never married or cohabited.

In Table 5 we present the estimated parameters and 95% confidence intervals that capture the association between the longitudinal partnership status typology with biomarkers in mid-life. Linear regression coefficients are presented for all outcomes with the exception of metabolic syndrome where Odds Ratios are presented. Men that never married or cohabited (Class 6) had worse health outcomes compared to the reference group (men that were married in their 20's or early 30's and remained married ever since – Class 1). They scored higher on fibrinogen, b = 0.034 (0.012 to 0.056), CRP, b = 0.148 (0.025 to 0.270) and TPA, b = 0.061 (0.006 to 0.116), while they score lower onFVC, b = -0.130 (-0.225 to -0.035). Furthermore men who divorced in their late 30's, but did not remarry or cohabited (Class 2) were less likely to have metabolic syndrome compared to the reference group OR = 0.756 (0.575 to 0.993). Men that were not married [but?] cohabiters since their late 20's or early 30's (Class 3), had lower FVC compared to the reference group, b = -0.112 (-0.214 to -0.009). There was evidence of effect modification by early life health and early life SEP indicators with respect to fibrinogen, CRP and FVC. The observed effects of the longitudinal typology were more pronounced in men that were healthy and comfortable financially during their childhood.

A different pattern of associations emerged in women. Women that never married or cohabited (Class 6) scored higher on fibrinogen, b = 0.028 (0.006 to 0.050) compared to the reference group (Class 1 - married in their early 20', still married, only marriage). On the contrary, women that married during their late 20's or early 30's and remained married since (Class 2) had the most optimal health. Compared to the reference group (Class 1) they scored lower on fibrinogen, b = -0.018 (-0.035 to -0.002) and higher on FVC b = 0.054 (0.002 to 0.106). Women who divorced in mid/late 30's and later remarried or cohabited (Class 3) were less likely to have metabolic syndrome compared to the reference group, OR = 0.673 (0.481 to 0.943). There was evidence of effect modification by early life health and early life SEP indicators with respect to fibrinogen and FVC. The observed effects of the longitudinal typology were more pronounced in women that were healthy and comfortable financially during their childhood.

INSERT TABLE 5 ABOUT HERE

Discussion

A longitudinal typology of partnership status spanning 21 years was associated with a wide range of inflammatory and haemostatic markers as well as other objectively measured health outcomes in mid-life after controlling for well known selection mechanisms. The observed effects differed between men and women implying that the mechanisms that link marital status and health may be gender specific. In men, those that never married or cohabited had significantly higher levels on three haemostatic function biomarkers as well as

detrimental respiratory function compared to men that were married and remained married for the duration of the observation period. This finding is largely in agreement with studies using self reported health outcomes as well as studies on mortality [9, 12, 17, 18, 39]. A different pattern of associations emerged in women. Those that married in mid/late 20's or early 30's and remained married for the whole observation period had the most optimal health, having lower fibrinogen levels and better respiratory function compared to women who married in their early 20's. As expected from previous literature the women that never married or cohabited had worse health compared to married women. However, this effect was only manifested in fibrinogen levels, indicating that not marrying or cohabiting is less detrimental in women compared to men, or as it has been suggested, being married appears to be more beneficial to men [10, 20, 40-42].

We found that with the exception of worse respiratory functioning in men, non-marital cohabitation has similar effects to being married on mid-life health. Not married cohabiters of both genders did not differ from married participants in the health outcomes used in our study, a finding with implications for public health considering the increasing number of individuals that choose to cohabit and not marry. Our results are in agreement with recent findings on self rated health [43] but contradict earlier findings on depression and self reported physical health in the USA [44]. Further research is required to shed more light on whether non married cohabiters have worse health compared to married people, or as our results suggest the differences found in other studies are due to self reporting bias or simply because the effect of non-marital cohabitation on health differs between the UK and the USA. Similarly, it appears that for both genders transitions from and to marriage or non-marital cohabitation do not have a detrimental effect on mid-life health. We did not observe a difference in the biomarkers used in our study between participants that divorced and subsequently remarried or cohabited and those that were married for the duration of the observation period. We also found that men who divorced during their late 30's and did not subsequently remarried or cohabited were less likely to suffer from metabolic syndrome in mid-life. Both results are in accordance with previous findings where it has been shown that after an initial decline on health men tend to bounce back to pre-divorce health status [45].

We found that trajectories of partnership status over 21 years are associated with a wide range of biomarkers in mid-life. Not marrying or cohabiting was detrimental to health in mid-life for both genders but the effect was more pronounced in men. Women who married during their late 20's or early 30's and remained married during the 21 years of observation had the most optimal health in mid-life. Cohabiters of both genders had similar mid-life health outcomes to those that were married, as did those that divorced and remained single or subsequently remarried or cohabited. These effects were observed after controlling for factors that influence partnership status (direct selection) or both partnership status and health (indirect selection). In accordance with previous findings [10, 12, 40, 46, 47] as well as a recent study in the UK [48] we found evidence of selection mainly due to early life socio – economic position and early life health, but also due to educational attainment in early adulthood (results not presented here, available from corresponding author). However, assuming that all sources of direct and indirect selection were represented by variables included in our models, our finding that partnership status is associated with mid-life health implies that this effect is independent of selection. Several explanations of the mechanism that links partnership status and health have been proposed, they include fertility history, social support, health related behaviour and socio-economic position [49-52]. An added complexity to understanding the proposed mechanism is that these pathways may differ between longitudinal trajectories of partnership status and may also be gender specific. This analysis is beyond the scope of the present paper, but we will address these questions in a

future study where the mechanism that underlies the association between the longitudinal partnership status typology on mid-life biomarkers will be investigated.

Strengths of this study are the inclusion of a wide range of biomarkers as health outcomes in mid-life, the availability of data to control for well known selection mechanisms and the derivation of a longitudinal typology which allowed us to capture trajectories of partnership status over 21 years. However, there are several limitations that should be considered while interpreting our results. We employed observational data and despite the wealth of the 1958 cohort, bias due to unknown unmeasured confounders cannot be ruled out. Furthermore, our longitudinal typology captured the cumulative effect of different trajectories of partnership status in biomarkers in mid-life. Thus, the investigation of the short term effects of stressful events such as marital dissolution on health suggested by the literature [11, 53] was not possible. Another important limitation is that our data on partnership status were based on self reports. Although the latent variable specification of our longitudinal typology controls for measurement error, extreme bias (a participant misreporting in all nine indicators of our typology) due to social desirability may have influenced our results. Finally, we note that our results can be generalised to those born in 1958 and perhaps to other cohorts born close to this year. The partnership status trajectories as well as the association between these and health outcomes may be different in other – especially younger – cohorts and future research is needed to investigate these possibilities

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Table 1. Marital status and non marital cohabitation indicators.

		Men		Women				Men		Women	
		f	%	f	%			f	%	f	%
Married at at 23	No	4084	42.6	2861	31.9	**Cohabiting at 23**	No	5833	60.8	5779	64.5
	Yes	2179	22.7	3409	38.1		Yes	296	3.1	358	4
	Missing	3333	34.7	2689	30		Missing	3467	36.1	2822	31.5
Married at 33	No	1660	17.3	1569	17.5	**Cohabiting at 33**	No	4679	48.8	4982	55.6
	Yes	3701	38.6	4063	45.4		Yes	570	5.9	535	6
	Missing	4235	44.1	3327	37.1		Missing	4347	45.3	3442	38.4
Married at 40	No	1644	17.1	1667	18.6	**Cohabiting at 40**	No	4952	51.6	5136	57.3
	Yes	3948	41.1	4098	45.7		Yes	520	5.4	503	5.6
	Missing	4004	41.7	3194	35.7		Missing	4124	43	3320	37.1
Married at 42	No	1220	12.7	1325	14.8	**Cohabiting at 42**	No	3845	40.1	3892	43.4
	Yes	3303	34.4	3262	36.4		Yes	529	5.5	533	5.9
	Missing	5073	52.9	4372	48.8		Missing	4374	45.6	4534	50.6
Remarried	No	5299	55.2	5240	58.5						
	Yes	847	8.8	993	11.1						
	Missing	3450	36	2726	30.4						

Table 2. Log-Likelihood and information criteria for competing latent class analysis models

Men	Parameters	Log-Likelihood	AIC	BIC	ssa BIC	Entropy	BLRT	p
1 Class	9	-18113.063	36244.126	36302.557	36273.958	1.000		
2 Classes	19	-15085.063	30208.127	30331.480	30271.105	0.927	6056.001	0.001
3 Classes	29	-14513.203	29084.406	29272.682	29180.530	0.946	1143.721	0.001
4 Classes	39	-14248.346	28574.693	28827.892	28703.964	0.931	529.713	0.001
5 Classes	49	-14004.856	28107.713	28425.835	28270.130	0.909	486.981	0.001
6 Classes	59	-13881.343	27880.687	28263.731	28076.250	0.922	247.026	0.001
7 Classes	69	-13779.315	27696.629	28144.612	27925.339	0.925	204.058	0.001
8 Classes	79	-13704.204	27566.407	28079.298	27828.264	0.912	150.222	0.001
9 Classes	89	-13657.883	27493.767	28071.580	27788.770	0.921	92.641	0.001
10 Classes	99	-13624.711	27447.421	28090.156	27775.570	0.924	66.347	0.001
Women	Parameters	Log-Likelihood	AIC	BIC	ssa BIC	Entropy	BLRT	p
1 Class	9	-19548.128	39114.255	39173.193	39144.594	1.000		
2 Classes	19	-15989.385	32016.771	32141.196	32080.820	0.945	7117.485	0.001
3 Classes	29	-15383.938	30825.875	31015.787	30923.635	0.962	1210.895	0.001
4 Classes	39	-15100.217	30278.435	30533.834	30409.905	0.940	567.440	0.001
5 Classes	49	-14884.450	29866.899	30187.785	30032.079	0.918	431.536	0.001
6 Classes	59	-14710.590	29539.180	29925.553	29738.071	0.905	347.719	0.001
7 Classes	69	-14612.640	29363.279	29815.139	29595.880	0.916	195.901	0.001
8 Classes	79	-14524.971	29207.942	29725.289	29474.253	0.935	175.337	0.001
9 Classes	89	-14476.328	29130.656	29713.489	29430.677	0.933	97.286	0.001
10 Classes	99	-14436.959	29071.918	29720.239	29405.650	0.938	78.737	0.001

AIC – Akaike Information Criterion
BIC – Bayesian Information Criterion
ssa BIC – sample size adjusted Bayesian Information Criterion
BLRT – Bootstraped likelihood ratio test comparison for n vs n – 1 class models

Table 3. Conditional probabilities of partnership status indicators after class allocation - Men

Men	**Class1 (N = 3010, 61.7%)**	**Class2 (N = 401 , 8.2%)**	**Class3 (N = 362, 7.4%)**	**Class4 (N = 462, 9.5%)**	**Class5 (N = 100, 2.1%)**	**Class6 (N = 542, 11.1%)**
	Married in 20's/early 30's, only marriage	Divorced at late 30's not remarried or cohabited	Not married, cohabiting	Married at mid/late 30's, remain married	Divorced at 30's, later remarried	Never married or cohabited
Married at 23	0.432	0.498	0.137	0.219	0.510	0.058
Cohabiting at 23	0.041	0.060	0.087	0.065	0.007	0.024
Married at 33	1.000	0.919	0.000	0.000	0.666	0.073
Cohabiting at 33	0.000	0.000	0.604	0.492	0.101	0.070
Married at 40	0.997	0.198	0.024	0.975	0.000	0.000
Cohabiting at 40	0.000	0.210	0.744	0.000	0.650	0.000
Married at 42	0.971	0.000	0.184	0.949	1.000	0.054
Cohabiting at 42	0.008	0.543	0.786	0.008	0.063	0.057
Remarried	0.125	0.177	0.036	0.379	0.783	0.022

Table 4. Conditional probabilities of partnership status indicators after class allocation - Women

Women	**Class1 (N = 2168, 42%)**	**Class2 (N = 1199, 23.2%)**	**Class13(N = 415, 8.0%)**	**Class4 (N = 291, 5.6%)**	**Class5(N = 446, 8.6%)**	**Class6 (N = 641, 12.4%)**
	Married in early 20's - only marriage remain married	Married in late 20's early 30's, only marriage remain married	Cohabiting after 30	Divorced in 20's early 30's, cohabited, then remarried	Divorced at mid/late 30's, later remarried or cohabited	Never married or cohabited
Married at 23	1.000	0.000	0.328	0.482	0.739	0.193
Cohabiting at 23	0.000	0.129	0.119	0.063	0.043	0.063
Married at 33	1.000	0.939	0.000	0.000	0.905	0.140
Cohabiting at 33	0.000	0.000	0.570	0.579	0.000	0.086
Married at 40	1.000	1.000	0.018	0.975	0.108	0.015
Cohabiting at 40	0.000	0.000	0.736	0.000	0.273	0.000
Married at 42	0.967	0.959	0.101	0.954	0.228	0.025
Cohabiting at 42	0.004	0.000	0.736	0.003	0.455	0.078
Remarried	0.139	0.121	0.080	0.659	0.316	0.024

Table 5. Model parameters and 95% confidence intervals

Men	**Fibrinogen**		**CRP**		**VWF**		**TPA**		**Ddimer**		**Metabolic Syndrome**		**FVC**	
Class1	0		0		0		0		0		1		0	
Class2	0.019	-0.006 to 0.045	0.131	-0.006 to 0.268	0.029	-0.010 to 0.069	0.036	-0.029 to 0.100	0.035	-0.036 to 0.105	**0.756**	**0.575 to 0.993**	0.071	-0.026 to 0.168
Class3	0.010	-0.014 to 0.033	-0.013	-0.161 to 0.135	-0.001	-0.046 to 0.044	0.026	-0.041 to 0.093	0.043	-0.029 to 0.114	1.067	0.808 to 1.410	**-0.112**	**-0.214 to -0.009**
Class4	0.008	-0.015 to 0.031	0.008	-0.113 to 0.128	0.003	-0.036 to 0.041	0.003	-0.053 to 0.059	0.054	-0.014 to 0.123	1.077	0.843 to 1.376	-0.076	-0.168 to 0.015
Class5	0.028	-0.021 to 0.076	0.064	-0.215 to 0.342	-0.006	-0.081 to 0.070	0.045	-0.078 to 0.169	0.016	-0.116 to 0.148	0.759	0.457 to 1.261	0.050	-0.129 to 0.229
Class6	**0.034**	**0.012 to 0.056**	**0.148**	**0.025 to 0.270**	0.020	-0.016 to 0.057	**0.061**	**0.006 to 0.116**	0.038	-0.029 to 0.105	0.867	0.677 to 1.111	**-0.130**	**-0.225 to -0.035**
Women	**Fibrinogen**		**CRP**		**VWF**		**TPA**		**Ddimer**		**Metabolic Syndrome**		**FVC**	
Class1	0		0		0		0		0		1		0	
Class2	**-0.018**	**-0.035 to -0.002**	-0.087	-0.186 to 0.011	-0.011	-0.038 to 0.017	-0.036	-0.081 to 0.010	-0.002	-0.048 to 0.043	1.009	0.810 to 1.257	**0.054**	**0.002 to 0.106**
Class3	0.001	-0.023 to 0.023	-0.032	-0.173 to 0.110	-0.014	-0.055 to 0.027	-0.011	-0.075 to 0.053	0.016	-0.046 to 0.079	**0.673**	**0.481 to 0.943**	0.026	-0.046 to 0.098
Class4	0.010	-0.018 to 0.038	**0.195**	**0.028 to 0.361**	0.038	-0.008 to 0.085	-0.026	-0.111 to 0.058	-0.037	-0.105 to 0.031	1.043	0.712 to 1.528	0.004	-0.094 to 0.101
Class5	-0.012	-0.037 to 0.014	-0.013	-0.161 to 0.134	0.003	-0.040 to 0.045	0.012	-0.058 to 0.082	-0.064	-0.131 to 0.002	0.778	0.560 to 1.081	0.033	-0.043 to 0.109
Class6	**0.028**	**0.006 to 0.050**	0.029	-0.104 to 0.162	0.022	-0.015 to 0.058	-0.030	-0.088 to 0.028	-0.012	-0.070 to 0.047	0.776	0.581 to1.038	-0.051	-0.116 to 0.014

*Adjusted for Serious financial hardship during the last year at age 11, paternal social class at age 7, housing tenure at age 7, paternal weekly net pay at age 16, health centre attendance during the last year at age 16, disability at age 16, height at age 7, cognitive ability at 11, educational attainment at 23, smoking status at 23, self rated health at 23, depression at 23, employment status at 23, body mass index at 23, presence of long standing disability at 23, current use of medication at 42 and lab processing related variables.

** All outcomes modelled with linear regression link functions, except from metabolic syndrome where a logistic link function was used

Appendix – I Added information on biomarkers

According to the IDA definition participants are diagnosed with metabolic syndrome if According to the new IDF definition, for a person to be defined as having the metabolic syndrome they must have: Central obesity (defined as waist circumference ≥ 94cm for men and ≥ 80cm for women, plus any two of the following four factors:raised TG level ≥ 150 mg/dL (1.7 mmol/L),reduced HDL cholesterol < 40 mg/dL (1.03 mmol/L*) in males and < 50 mg/dL (1.29 mmol/L*) in females, raised blood pressure: systolic BP ≥ 130 or diastolic BP ≥ 85 mm Hg, raised fasting plasma glucose ≥ 100 mg/dL (5.6 mmol/L). Fasting glucose measures were not made; therefore we were unable to include this component of the definition

Appendix – II Added information on confounders

Appendix – III Added information on LCA model selection