

Socio-economic inequalities in profiles of social integration across adulthood: evidence from a British birth cohort study

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Abstract

Social integration in older age is a key quality of life component and is associated with reduced mortality and morbidity risk. There are socio-economic differences in social integration, but the influence of different indicators of socio-economic position on long-term change in social integration at older ages is not known. This study aimed to identify profiles of social integration across adulthood and explore the impact of various socio-economic indicators at different ages. Data were drawn from the MRC National Survey of Health and Development. A latent class analysis used measures of contact with friends and family, participation in group activities and marital status at ages 36, 43 and 60-64 to identify profiles of change in social integration for men and women. One-step analyses related profiles to father's occupation-based socio-economic position, own educational attainment and head of household occupation-based socio-economic position. Four profiles of social integration were identified for men: high and maintained, married; medium and maintained, married; declining, married; and declining, unmarried. Higher head of household occupation and educational attainment were associated with greater likelihood of maintained integration. Four profiles of social integration were also identified for women: high and maintained, married; high and maintained, unmarried; declining group participation, unmarried; and declining group participation, married. Higher socio-economic position on all indicators was associated with greater likelihood of maintained integration. Lower socio-economic groups are more likely to experience declining social integration by early old age. Support to promote social integration may be particularly important for those with lower occupational grade or education.

Keywords: United Kingdom; social integration; social engagement; socio-economic position; gender; cohort; longitudinal; National Survey of Health and Development

Background

Social integration

Social integration has been defined as attachment to society through ties to family and friends and formal links to community institutions (Berkman, Glass, Brissette, & Seeman, 2000; Fothergill et al., 2011). As such, it is a structural

measure of the quantity of social networks as opposed to a functional measure of the subjective experience of social support or loneliness, and is commonly assessed through the construction of indices comprising contact with friends and family, participation in clubs or associations and marital

status (Berkman, & Syme, 1979; Berkman et al., 2004; Stringhini et al., 2012; Vonneilich et al., 2011).

Studies suggest that social integration changes across the life course, with a small decrease in network size at older ages and an increasing emphasis on contact with family members as opposed to non-family members (Kalmijn, 2012). One explanation for this pattern of change is 'socio-emotional selectivity theory' (Carstensen, Isaacowitz, & Charles, 1999) whereby older individuals prioritise social relationships that provide immediate emotional payoff over those that confer future advantage. Studies have suggested, however, that there is heterogeneity in change over time, with both increasing and decreasing profiles of social integration (Bassuk, Glass, & Berkman, 1999; van Tilburg, 1998) and some variation by gender (Gallant & Dorn, 2001).

Most longitudinal analyses are short, focus on later life (Cerhan & Wallace, 1997) and, where they explore change in social integration, focus on specific life events such as marriage, parenthood, divorce or widowhood (Kalmijn, 2012). An exception is the Americans' Changing Lives survey, that has been used to explore comprehensively assessed within-person longitudinal profiles of social integration in over 60 year olds across longer time periods. Women were found to have consistently higher levels of social integration than men over an eight year period (Thomas, 2011a). Two further studies using prospective data over 17 years in this population describe five different profiles of change in social integration and clearly demonstrate the heterogeneity of change in social integration in older age (Thomas, 2011b; 2012).

Patterns of social integration may vary by socio-economic position

In middle and older age, lower levels of social contact (Krause & Borawski-Clark, 1995; Van Groenou & Van Tilburg, 2003; Weyers et al., 2008) and leisure time activity (Scherger, Nazroo, & Higgs, 2010; Shaw, Krause, Gallant, & McGeever, 2010) have been found in individuals with lower income or educational attainment. There are mixed findings, however, with other studies finding higher levels of social contact in the lower socio-economic groups (Kubzansky, Berkman, Glass, & Seeman, 1998) and no work examining change across long periods of time.

Inconsistencies in the relationship between socio-economic position and social integration may arise from differences in the type of group or network measured. Those with lower educational attainment, income or occupational social class are suggested to have more frequent contact with family, but smaller friendship networks and less frequent participation in groups (Granovetter, 1973; Park & Roberts, 2003; Thomas, 2012). Findings from the British Household Panel Study (in men only) suggest that the types of organisational affiliations also vary with socio-economic position in older age, with higher socio-economic groups being affiliated with civic and religious groups, and lower socio-economic groups being affiliated with social clubs (Perren, Arber & Davidson, 2003). Socio-economic inequalities in social integration may depend on age and gender, with smaller inequalities for women (Marmot, Bosma, Hemingway, Brunner, & Stansfeld, 1997; Van Groenou & Van Tilburg, 2003) and at younger ages (Stringhini et al., 2012).

The English Longitudinal Study of Ageing has contributed to descriptions of change in social network ties amongst the over 50 years old population, with observations of large variations in individual level change in social integration over eight years (Jivraj, Nazroo, & Barnes, 2012). When examining the socio-economic factors associated with a move into social detachment, authors found poorer, lower-educated, unhealthy and married individuals to be more likely to become socially detached (with detachment defined as not being a member of a group, not going to cultural event and not having at least weekly contact with a friend or family member).

Most studies have focused on socio-economic indicators in adulthood. but a small number have considered parental education or occupational socio-economic position as a possible determinant of their offspring's social networks in adulthood, although the association with other measures of socio-economic position is found to be stronger (Van Groenou & Van Tilburg, 2003; Hatch & Wadsworth, 2008). Several plausible conceptual pathways have been suggested to explain these relationships, with suggestions that socio-economic position at a number of different points in life may independently affect patterns of adult social integration.

Childhood socio-economic position is related to a number of characteristics of early life living situation, including housing and neighbourhood characteristics (Van de Mheen, Stronks, Van den Bos & Mackenbach, 1997) family attitudes, beliefs and behaviours (Van Groenou & Van Tilburg, 2003; Singh-Manoux & Marmot, 2005) and risk of exposure to early life and family stresses (Lehman, Taylor, Kiefe, & Seeman, 2005). These may affect an individual's physical and psychosocial development, socialisation and network formation later in life (Repetti, Taylor, & Seeman, 2002) and may result in decreased interpersonal capacity and networks (Gallo, Espinosa de los Monteros, & Shivpuri, 2009; Matthews, Gallo, & Taylor, 2010). Education may directly relate to adult social networks by means of the availability of cognitive resources or skills to develop personal relationships (Van Groenou & Van Tilburg, 2003). Education may also act as a mediator, explaining the effect of a range of lifetime exposures including anxious or sad adolescent affect on adult social integration (Hatch & Wadsworth, 2008). Occupational measures of socio-economic position may relate to social networks via available material resources, prestige or social norms that facilitate social integration. It has been suggested that lower socio-economic position may lead to a restricted breadth of relationships (lower relational radius) in order to prevent recognition of social disadvantage or feelings of shame (Weyers et al., 2008), with withdrawal from extended social networks but a stronger reliance on family, kinship and neighbourhood. There may also be a direct effect of poverty on social integration due to lack of financial resources to enable participation.

Whilst there is considerable interest within the epidemiological literature on the possible impact of lack of social integration on morbidity and mortality risk (Fratiglioni, Paillard-borg, & Winblad, 2004; Gorman & Sivaganesan, 2007; Holt-Lunstad, Smith, & Layton, 2010; Seeman et al., 2011; Zunzunegui et al., 2004), it is also likely that the onset of poor health or functional limitation results in declining social integration, and this pathway might also explain why those in lower socio-economic positions are less socially integrated. Participation in the labour market involves a degree of social contact but a clear distinction is drawn in the literature between social engagement or integration, and social interactions that are paid for

or enforced (Prohaska, Anderson, & Binstock, 2012). In line with this body of literature, we elected to focus on social ties and interpersonal aspects of social integration outside of the workplace in the current study, and paid employment was not included as an indicator of social integration. Participation in the labour market has strong and well-established associations with childhood circumstances and education and we were concerned that socio-economic pathways alone should not drive our analyses.

In summary, several studies have considered socio-economic inequalities in social integration cross-sectionally or with short-term follow-up. One recent study examined socio-economic differences in social detachment (Jivraj et al., 2012). Studies have not, however, investigated the relative contribution of indicators of socio-economic position, at different points in the life course, on patterns of change in social integration over mid to late adulthood.

This study examined longitudinal patterns of social integration between the ages of 36 and 60-64, i.e. over a 24 to 28 year period. It aimed to identify profiles of changing social integration and to explore their association with indicators of socio-economic position at different ages, in a nationally representative cohort of men and women.

Data

Participants: the 1946 British birth cohort

The MRC National Survey of Health and Development (NSHD), also known as the 1946 British birth cohort, is a population based birth cohort, originally consisting of a socially stratified sample of 5362 singleton births in one week in March 1946. Data have been collected at 23 points since birth. The main data collections in adulthood were undertaken when study members were 26, 36, 43, 53 and 60-64 years of age (Wadsworth, Kuh, Richards, & Hardy, 2006). The cohort generally has high rates of marriage and high marital stability over time.

Measures

Social integration

Consistent with commonly-used definitions of social integration, this study included indicators of marital status, group participation and contact with friends and family. Questions assessing frequency of participation in different clubs or associations

(group participation), frequency of informal social contact (contact with friends and family), and marital status were included in NSHD at ages 36, 43 and 60-64 years (see Appendix 1) though with slightly different question wording. Frequency of group participation was summarised from items about doing, helping to run or being involved in a number of social, secular and religious group activities. A binary variable (participating in at least one activity weekly or more often, participating less frequently or not at all) was derived for each sweep to allow comparison across the different time points. Frequency of contact with friends or family was summarised from items asking about how often participants met, visited or were visited by friends, parents, partner's parents or other relatives. A binary variable (seeing friends or family three times a month or more, less often or never) was derived at each sweep to maintain consistency across the different time points. It was not possible to quantify how many social contacts were seen at the reported frequencies. Marital status at each sweep was summarised as a binary variable (married, not married). Rates of cohabitation outside of marriage are low in this cohort (about 3.5% of respondents at age 36).

Socio-economic position

Childhood socio-economic conditions were captured by father's occupation at age 4 (or ages 11 or 15 if this was missing, $n=54$). Occupations were coded according to the UK Registrar General's Social Class scheme: professional; managerial and technical; skilled (non-manual); skilled (manual); partly skilled; and unskilled (Galobardes, Shaw, Lawlor, Lynch, & Davey Smith, 2006). Educational attainment was measured as highest recorded qualification at age 26, categorised as none, below secondary, O-level or equivalent (usually attained at age 16), and A-level (High School) or above (usually attained at age 18 or older). Early-adult socio-economic position was captured as head of household occupation at age 36 (defined at this time as male occupation or own if there was no male in the household). Again, this was coded according to the UK Registrar General's Social Class scheme.

Statistical methods

Bivariate associations between each measure of socio-economic position and frequent group

participation, frequent contact with friends and family and marital status were examined separately for men and women. The latent class analysis used data on three observed categorical indicators of social integration (group participation, contact with friends or family and marital status) at three time points, to identify unobserved profiles of social integration from ages 36 to 60-64. Individuals were grouped according to the similarity of their responses to identify 'classes' of people within the study population. A priori, the number of classes (or profiles of social integration) was unknown so models with an increasing number of classes were fitted to the data, and model selection was conducted via comparison of Bayesian Information Criterion (BIC) values as recommended by Nylund, Asparouhov, and Muthén (2007). To assess the quality of the classification we considered the model's entropy. The entropy is a function that takes values between 0 and 1, with high values indicating high certainty of classification. Latent class analysis and mixture modelling was performed in MPlus (version 5). All other analyses were performed in STATA version 12.

The association of childhood, educational and early adult measures of socio-economic position with classification of the different adult profiles of social integration was explored in the latent class model. This one step approach was chosen in preference to a two stage approach (using likely class membership as an outcome in multinomial regression) as it has been shown to be more sensitive to detection of effect size and is preferable where the number of covariates is small enough to make computation feasible (Clark & Muthén, 2009; Feingold, Tiberio & Capaldi, 2014). Models use full information maximum likelihood (FIML) for missing data when deriving social integration profiles, including all individuals who have data on one or more observed variables at one or more time point, and we restricted the analytical sample to those with complete data for covariates (socio-economic position variables). Missing data are assumed to be missing at random (Little & Rubin, 2002).

Analytic sample

Of the 2,815 men in the original cohort, 958 (34%) provided no social integration data because of death or other loss to follow-up, and a further 370 men had incomplete socio-economic data. Thus 1,487 men were included in these analyses (998

provided social integration data on three occasions, 382 on two occasions and 107 on one occasion). Of the 2,547 cohort women, 719 did not provide social integration data, 386 did not provide socio-economic data, and 1,442 were included in these analyses. Of these, 1,063 (277, 102) provided social integration data on three (two, one) occasions.

Men included in the model were more likely to have O level or above education (57% compared to 47%, $p < 0.001$) and more likely to be married (82% were married compared to 71%, $p < 0.001$) than those not included in analyses. Women included in the model were more likely to be educated to O level or above (53% compared to 46%, $p = 0.02$) and have frequent friend or family contact (80% compared to 72%, $p = 0.01$), but had slightly lower head of household occupation (only 9% were in

households headed by a professional compared to 15% of those not included, $p = 0.05$). Married people, women with frequent group participation at age 36 and women with frequent contact with friends and family at age 60-64 were over-represented among those with complete socio-economic data ($p < 0.05$). Taken together, this indicates that our analytical sample tended to have more advantaged socio-economic circumstances and greater social integration than those not included.

Results

Frequent group participation, frequent contact with friends and family and marital status show variations by age and by gender, as shown in table 1.

Table 1. Social integration by age and gender

	Males			Females		
	Age 36	Age 43	Age 60-64	Age 36	Age 43	Age 60-64
	% (n)					
Group participation						
at least weekly	74 (1098)	37 (493)	52 (497)	59 (846)	37 (478)	49 (502)
less than weekly or not at all	26 (389)	63 (844)	48 (596)	41 (596)	63 (825)	51 (522)
Contact with friends and family						
at least weekly	69 (1031)	80 (1062)	67 (583)	71 (1022)	77 (1003)	80 (742)
less than weekly or not at all	31 (455)	20 (273)	33 (282)	29 (416)	23 (295)	20 (188)
Married	84 (1252)	82 (1101)	82 (776)	86 (1245)	81 (1062)	75 (752)
Not married	16 (235)	18 (238)	18 (166)	14 (197)	19 (242)	25 (248)

Frequent group participation was most prevalent at age 36 for both men and women, with 74% and 59% participating in activities once a week or more respectively. Frequent participation fell at age 43 (only 37% of both genders reported participating once a week or more) but increased again at age 60-64 (52% of men and 49% of women participated at least once a week). A different pattern was seen for frequent contact with friends and family, with the highest rates of weekly contact being at age 43 for men and 60-64 for women. There were gender differences in social integration although these varied at different ages. Men had more frequent group participation than women at age 36, but no difference in group participation was found at other ages. At age 60-64, a higher

proportion of women had at least weekly contact with friends or family than men (80% compared to 67%, $p < 0.001$). Men were more likely than women to be married at age 60-64 (82% compared to 75%, $p < 0.001$).

Levels of educational attainment and age 36 socio-economic position were lower for women than for men (Table 2). At age 36, frequent group participation was not associated with socio-economic indicators. Frequent contact with friends and family at age 36 was more prevalent among men and women in lower socio-economic positions on all three indicators. Being married at age 36 was more prevalent among men with higher education and higher early adult socio-economic position (occupation at age 36).

Table 2: Socio-economic position and social integration at age 36 and 60-64

	Total frequency in analytical sample (%)	Frequent group participation at age 36 (%)	Frequent contact with friends and family at age 36 (%)	Married at age 36 (%)	Frequent group participation at age 60-64 (%)	Frequent contact with friends and family at age 60-64 (%)	Married at age 60-64 (%)
MALES							
Childhood socio-economic position (Father's occupation)							
I	5.6	73.5	60.2	77.1	56.1	66.7	74.2
II	17.3	67.7	64.1	86.8	55.8	73.2	88.8
IINM	18.2	76.3	66.8	86.0	62.5	70.3	83.5
IIIM	30.3	75.6	75.1	86.7	44.7	66.1	80.6
IV	21.9	72.6	68.6	80.6	44.9	60.2	80.3
V	6.8	79.2	74.3	79.2	57.6	73.5	84.5
		<i>p</i> =0.1	<i>p</i> =0.006	<i>p</i> =0.2	<i>p</i> =0.02	<i>p</i> =0.1	<i>p</i> =0.5
Education							
A-Level or above	41.6	74.6	61.7	86.3	62.2	66.3	84.4
O-level or equivalent	15.5	73.9	68.6	85.7	57.6	69.6	87.1
Below secondary	6.0	74.2	74.2	83.2	50.0	64.0	76.8
No qualifications	37.0	72.9	77.6	81.5	64.6	68.7	78.3
		<i>p</i> =0.5	<i>p</i> <0.001	<i>p</i> =0.02	<i>p</i> <0.001	<i>p</i> =0.06	<i>p</i> =0.02
Head of household socio-economic position (occupation) at age 36							
I	12.2	70.7	61.9	85.6	66.2	63.8	82.7
II	32.7	73.7	61.9	88.7	59.7	65.7	84.8
IINM	10.1	74.7	64.7	84.7	57.3	76.6	87.1
IIIM	32.2	75.0	76.4	82.3	37.5	68.8	82.8
IV	11.2	71.7	81.3	76.5	42.3	64.0	69.5
V	1.7	88.0	84.0	72.0	35.3	71.4	70.6
		<i>p</i> =0.3	<i>p</i> <0.001	<i>p</i> <0.001	<i>p</i> <0.001	<i>p</i> =0.5	<i>p</i> =0.01
FEMALES							
Childhood socio-economic position (Father's occupation)							
I	6.1	67.1	58.0	86.4	75.3	83.3	81.4
II	17.0	36.3	73.0	83.7	59.3	77.0	76.2
IINM	18.6	55.2	63.8	87.7	57.4	75.9	75.6
IIIM	30.5	59.8	73.1	88.0	40.6	82.8	75.6
IV	21.2	53.1	74.7	84.3	36.1	78.7	72.7
V	6.7	61.5	77.8	88.5	41.4	87.2	69.1
		<i>p</i> =0.06	<i>p</i> =0.002	<i>p</i> =0.7	<i>p</i> <0.001	<i>p</i> =0.4	<i>p</i> =0.1
Education							
A-Level or above	27.3	58.9	59.2	83.3	69.6	78.1	76.7
O-level or equivalent	25.7	60.0	72.4	88.4	51.4	79.4	76.5
Below secondary	9.2	67.4	81.8	82.6	40.0	86.4	71.8
No qualifications	37.9	55.5	76.1	88.1	28.8	79.9	73.5
		<i>p</i> =0.3	<i>p</i> <0.001	<i>p</i> =0.1	<i>p</i> <0.001	<i>p</i> =0.4	<i>p</i> =0.3
Head of household socio-economic position (occupation) at age 36							
I	9.2	58.3	57.6	94.7	64.7	73.5	58.0
II	29.9	60.6	68.2	84.0	41.5	81.4	73.1
IINM	15.9	57.6	68.2	75.6	44.0	76.5	74.4
IIIM	28.1	60.0	76.5	93.1	39.9	83.4	78.9
IV	14.2	56.5	75.7	85.5	36.7	76.5	68.2
V	2.6	42.1	84.2	81.6	18.2	86.4	66.8
		<i>p</i> =0.2	<i>p</i> <0.001	<i>p</i> =0.7	<i>p</i> <0.001	<i>p</i> =0.4	<i>p</i> =0.1

Notes. % shown for the total analytic sample are the proportion with different socio-economic position. %s shown for the other subgroups are the proportions of that social class reporting weekly or more social contact or group participation. P-values are from test for linear trend across socio-economic groups.

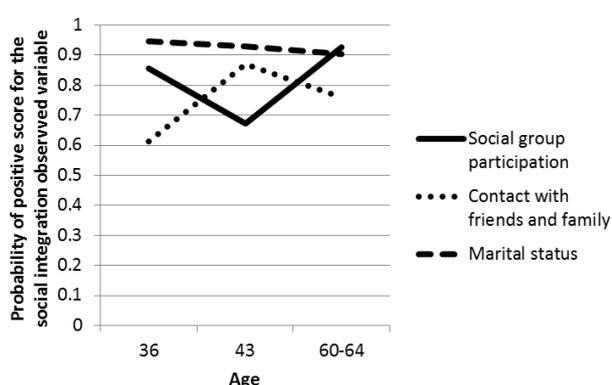
By age 60-64, test for linear trend indicated a general pattern of lower group participation in the more socio-economically disadvantaged groups. However, there was indication of non-linearity by father's occupation and educational attainment among men, with those in the middle socio-economic positions having the lowest frequent group participation. Frequent contact with friends and family at age 60-64 was not socio-economically patterned. Marriage at age 60-64 was less prevalent among more socio-economically disadvantaged men.

Longitudinal profiles of social integration - men

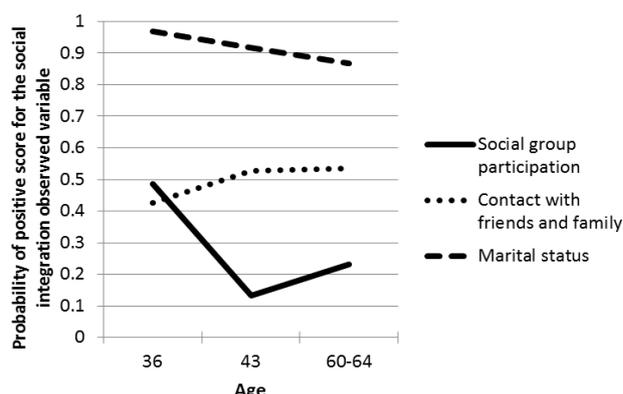
A model with four latent class profiles of social integration between ages 36 and 60-64 provided the best fit to the data in men (see Appendix 2 for fit statistics). The profiles of observed variables within each class are shown in figure 1. For men, the entropy was 0.569 which, whilst acceptable, demonstrates some uncertainty in class classification (0.6 is considered good, 0.5 poor)(Asparouhov & Muth, 2014).

Figure 1. Male profiles of social integration

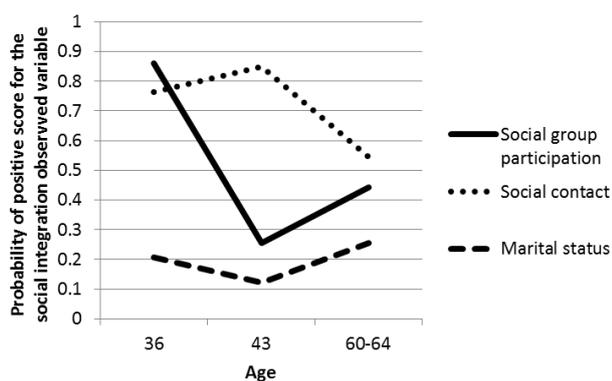
“High and maintained, married men” (36%)



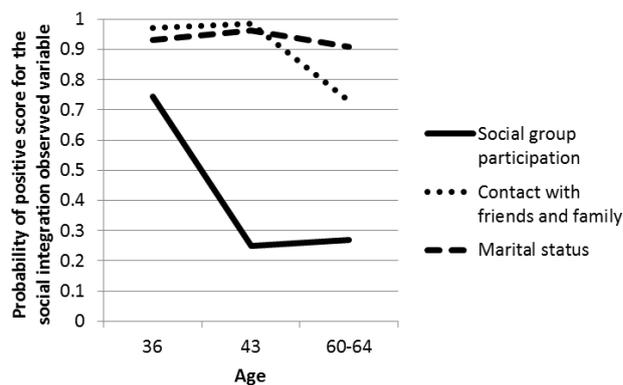
“Medium and maintained, married men” (20%)



“Declining, unmarried men” (14%)



“Declining, married men” (30%) *



Notes. *denotes reference class in latent class model.

The profile of declining married social integration was taken as the reference in the latent class regression analyses, as it was large in size and had a comparable group among women (see next section). Each step increase in educational attainment was associated with an odds ratio of 1.64 (that is, a 64% higher likelihood) of following the profile, with high and maintained married social

integration compared to the profile of decline. Higher head of household occupation at age 36 was also associated with higher odds of being “high and maintained, married” and “medium and maintained, married”, though only the latter attained statistical significance at the 5% level. No relationship was found between childhood socio-economic position and men’s social integration.

Table 3. Socio-economic position and profile of social integration for men

	Father’s occupation odds ratio (95% CI)	Education at age 26 odds ratio (95% CI)	Head of household occupation at age 36 odds ratio (95% CI)
High and maintained, married men (36%)	0.92 (0.75 to 1.13)	1.64 (1.33 to 2.03)*	1.62 (0.89 to 2.96)
Medium and maintained, married men (20%)	1.01 (0.76 to 1.34)	1.07 (0.67 to 1.71)	1.71 (1.28 to 2.26)*
Declining, unmarried (14%)	0.97 (0.79 to 1.2)	1.19 (0.95 to 1.50)	1.09 (0.71 to 1.66)
Declining, married (30%)	1	1	1

Note. * represents $p \leq 0.05$

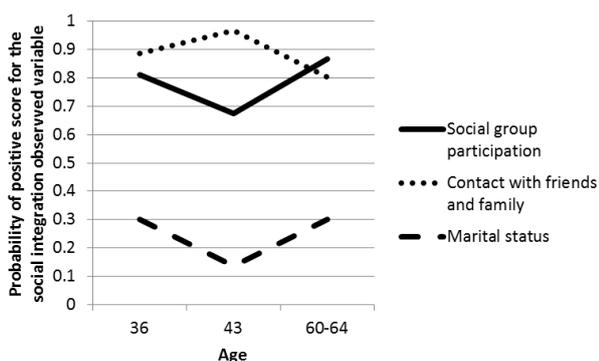
Longitudinal profiles of social integration - women

The model fit criteria in the latent class analysis for women identified that the model that best fitted the data had five classes (see Appendix 2) but the difference between the values of BIC was small and,

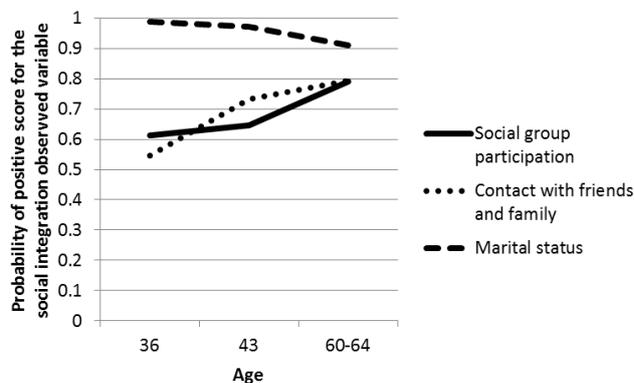
as recommended (Muthen & Muthen, 2007), did not justify the reduction in parsimony and entropy, so a four class model was chosen; i.e. four profiles of social integration were identified between ages 36 and 60-64 (Figure 2). Class classification was good with entropy of 0.720.

Figure 2. Female profiles of social integration:

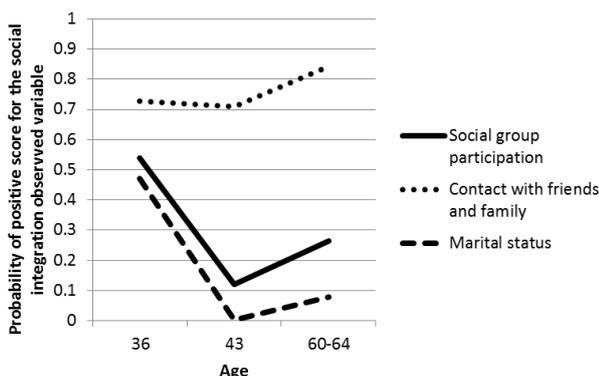
“High and maintained, unmarried women” (8%)



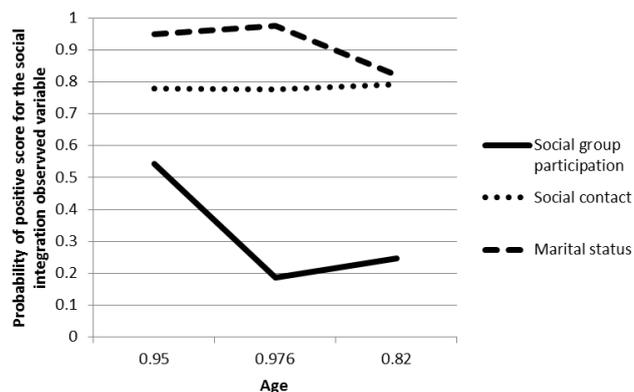
“High and maintained, married women” (29%)



“Declining group participation, unmarried” (10%)



“Declining group participation, married” (53%)*



Note. *denotes reference class in latent class model

The “declining group participation, married” was used as the reference category. Women with higher education were more likely to experience high and maintained social integration between ages 36 and 60-64 (Table 4). Each step increase in educational attainment was associated with an odds ratio of 2.89 (that is 189% higher likelihood) of being in the “high and maintained, unmarried” profile and 2.60 (95% confidence interval 1.53 to 4.40) of being in the “high and maintained, married” profile

compared to being in the “declining group participation, married” profile, independently of other socio-economic indicators. Socio-economic position at age 36 was also related to the likelihood of following these two profiles. Higher childhood socio-economic position was associated with greater likelihood of being in the “high and maintained, unmarried” profile of social integration compared to the “declining group participation, married” profile.

Table 4. Socio-economic position and profile of social integration for women

	Father’s occupation odds ratio (95% CI)	Education at age 26 odds ratio (95% CI)	Head of household occupation at age 36 odds ratio (95% CI)
High and maintained, unmarried (8%)	1.32 (1.02 to 1.71)*	2.89 (1.62 to 5.18)**	1.31 (1.03 to 1.67)*
High and maintained, married (29%)	1.13 (0.91 to 1.40)	2.60 (1.53 to 4.40)**	1.62 (1.21 to 2.16)*
Declining group participation, unmarried (10%)	0.90 (0.71 to 1.13)	1.01 (0.78 to 1.31)	1.06 (0.81 to 1.38)
Declining group participation, married (53%)	1	1	1

Notes. * demotes $p \leq 0.05$, ** denotes $p \leq 0.001$

Discussion

Within this cohort, multiple profiles of change in social integration between ages 36 and 60-64 were identified, indicating that people do not all experience the same changes in social integration as they age. This confirms recent work undertaken in a US sample of over 60s (Thomas, 2012). For both men and women, group participation changed more with age than either marital status or contact with friends of family. This is consistent with previous research that has identified informal social networks to be more stable over time than civic or leisure activities (Jivraj et al., 2012).

When comparing the four profiles identified for men, higher educational attainment was associated with a higher odds of having high and maintained social integration, compared to experiencing a profile of decline. Higher head of household occupation was also associated with a higher odds of following a profile of “medium and maintained, married men”). No relationship was identified between men’s early childhood socio-economic position and the profiles of social integration that followed, suggesting that the socio-economic

variables that may affect men’s patterns of change in social integration over these ages involve exposures during adolescence or adulthood.

For women, indicators of higher socio-economic position from childhood and adulthood were associated with greater likelihood of maintaining social integration between ages 36 and 60-64. Multiple pathways may be in operation to link socio-economic position and social integration in later life, with early life experiences having a lasting impact on women’s social integration in later life. Our analyses suggest that childhood socio-economic position was somewhat less strongly associated with social integration profiles than was age 36 socio-economic position, though note that at least some of any causal effect of childhood socio-economic position would be expected to operate through education and adult occupational status which were controlled for here. This is consistent with Van Groenou & Van Tilburg (2003) who found that network size in older age was associated with the adult household’s, but not father’s, socio-economic position. The strength of association between socio-economic position, especially

education, and patterns of social integration for women is novel, as previous research suggests that relationships between socio-economic position and social integration may be weak for women (Marmot, Bosma, Hemingway, Brunner, & Stansfeld, 1997; Van Groenou & Van Tilburg, 2003).

Higher wealth and education at baseline has previously been suggested to be protective against declining social integration or social detachment (Jivraj et al., 2012) but this is the first study to find multiple measures of socio-economic position across childhood and early adulthood to be independently associated with changes in social integration across adulthood. Considering the findings within a social capital framework (Putnam, 2000), group participation may be viewed as a type of bridging social capital, related to access to resources, whereas social contact with friends and family can be viewed as bonding social capital, providing contact between similar individuals but accessing more restricted forms of support. The emergence of socio-economic differences in social integration by early old age may represent differences in the availability of resources, and potentially be important for health and wellbeing within this age group.

Strengths and limitations

This is the first study to identify an independent relationship between multiple measures of socio-economic position and the change in social integration experienced during mid to late adulthood. The use of a data-driven approach such as latent class analysis allows consideration of patterns of change in the components of social integration, patterns that would be masked by the use of a summary index. This is also the first study to take a longitudinal approach to the measurement of both socio-economic position and social integration, considering socio-economic characteristics at multiple points through to early adulthood and social integration for almost thirty years of follow up.

The study does, however, have a number of limitations. There were differences in item wording and response categories (see Appendix 1) which may have affected responses, in particular regarding the lower group participation at age 43, where items were more specific than in other sweeps. Dichotomising the observed variables was

necessary for data harmonization but this lost some detail and it was not possible to explore patterns of change in different types of relationship (e.g. kin and non-kin) or different groups or activities (e.g. leisure and civic). The analysis treated change in each social integration indicator independently and did not explore the impact of life events such as widowhood or divorce on social contact and group participation. The 'not married' group includes never married, widowed and divorced, and these potentially have different profiles of other social integration indicators including informal contact with friends and family, and social group participation. The full information maximum likelihood method used here, in common with multiple imputation approaches, assumed the data to be missing at random. Our analytical sample appeared to over-represent more socio-economically advantaged and socially integrated study members, but we are not able to know whether associations between socio-economic exposures and integration are similar amongst excluded individuals. This is a data-driven approach to summarising multiple variables, and emerging latent classes will depend on the analytic sample. Additionally, the models for men did not have high entropy, which means that there may be uncertainty associated with class allocation. It should be acknowledged that, although data covers a 30-year time period, there are only 3 observations of each indicator of social integration.

This study aimed to consider the structural dimensions of social relationships as the data on functional measures were not available over such a long time period. Considering patterns of change in functional social support would provide a more detailed picture of the changes in social relationships over time and it would be useful to see this developed further in future research. As already discussed, and in line with much of the past literature on this topic, we have not included work contacts within our definition of social integration. Different changes in work role and work-related social contacts across the socio-economic gradient may be related to the changes in non-work-related social integration observed here. Declining health or the onset of limitations may be another key pathway that we have not explored.

Conclusions

The study highlights the higher risk of declining social integration amongst those with lower socio-economic position. Having positive social relationships is a key component of quality of life as defined by older people (Bowling & Gabriel, 2007) and lack of social integration is associated with an increased likelihood of loneliness (Wenger, Davies, Shahtahmasebi, & Scott, 1996), morbidity, mortality and institutionalisation (Nicholson, 2012; Steptoe,

Shankar, Demakakos, & Wardle, 2013). With social integration increasingly viewed as a resource for healthy ageing, this study supports a growing body of literature highlighting the importance of fostering social integration in later life (Bowling, Holt-lunstad, Scharf, & Walker, 2012; Gorman & Sivaganesan, 2007; Social Care Institute for Excellence, 2011) and provides evidence of the potential socio-economic inequalities in social integration in later life.

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Appendix 1

Social integration variables

	1982 (age 36)	1989 (age 43)	2006-2011 (age 60-64)
Frequency of social group participation:	<p><u>Nurse led interviews:</u></p> <p><i>Do you do any of the following in your spare time and on average in the last year have you done this at least daily, weekly, less frequently? (chess bridge or similar, church or religious activities, going to the theatre concerts, going to pub/club, helping to run a club or playgroups or school, local government or trade union or political work, playing a musical instrument with others, voluntary social welfare work).</i></p> <p><i>Are there any other things you do with other people in your spare time that I haven't yet asked about? What are they and how often?</i></p>	<p><u>Nurse led interviews:</u></p> <p><i>In your spare time, do you help to run or are you currently involved in any of the following activities and do you take part weekly, monthly or less often? (Church activities, playgroup nurseries or school, local government, trade unions, voluntary services, sports clubs, evening classes/adult education, other organisations).</i></p>	<p><u>Postal questionnaire:</u></p> <p><i>In your spare time are you involved in any of the following activities, if yes have you taken part in the last 12 months weekly, monthly, less often or never? (Church-related group or religious activities, job related association, recreational groups, civic political group, other voluntary work, other groups or clubs, other social activities).</i></p>
Frequency of contact with friends or family:	<p><u>Nurse led interviews:</u></p> <p><i>How often do you have friends to spend the evening with you at home, or to spend some time at home with you on the weekend? (Once a week or more often, not more than once a fortnight, not more than once a month, rarely or never, unknown).</i></p> <p><i>How often do you see your parents and/or your wife's/husband's/partner's parents? (Once a week or more often, not more than once a fortnight, not more than once a month, rarely or never, not relevant no parents, unknown).</i></p>	<p><u>Nurse led interviews:</u></p> <p><i>On average, how often would you say you met friends or relatives socially? (Never, 1-2 times a month, 3-5 times a month, 6-10 times a month, 11-15 times a month, more than 15 times a month).</i></p>	<p><u>Nurse led interview:</u></p> <p><i>Thinking of all your relatives or friends, how often do you regularly visit or are you visited by these people? (Never/almost never, once every few months, about once a month, about once a week, almost daily).</i></p>
Marital status	<p><u>Nurse led interviews:</u></p> <p><i>And so may I just check at the moment you are single and not living with a partner, single i.e. never married and living with a partner, married, widowed and not living with a partner, separated and not living with a partner, divorced and not living with a partner, widowed and living with a partner, separated or divorced and living with a partner?</i></p>	<p><u>Nurse led interviews:</u></p> <p><i>So can I just check, are you currently single never married, married, widowed, separated, divorced?</i></p>	<p><u>Postal questionnaire:</u></p> <p><i>So, are you currently single that is never married, married & living with husband/wife, married & separated from husband/wife, divorced, widowed?</i></p>

Appendix 2a

Table 2a. Latent class analysis fit statistics for social integration for men in the MRC NSHD (age 43 to 60-64)

	2 classes	3 classes	4 classes	5 classes
<u>Information criteria^a</u>				
Schwarz's BIC	12169.5	12031.9	<i>12023.5</i>	12064.9
Smallest class percentage	16	14	14	7
Entropy ^b	0.823	0.613	0.569	0.587

Abbreviations: BIC, Bayesian Information Criterion

^a minimum information criterion is shown in italic type

^b based on estimated posterior class membership probabilities

Appendix 2b

Table 2b. Latent class analysis fit statistics for social integration for women in the MRC NSHD (age 43 to 60-64)

	2 classes	3 classes	4 classes	5 classes	6 classes
<u>Information criteria^a</u>					
Schwarz's BIC	12248.0	12077.6	12060.8	<i>12056.7</i>	12112.8
Smallest class percentage	18	16	8	7	7
Entropy ^b	0.863	0.657	0.720	0.664	0.633

Abbreviations: BIC, Bayesian Information Criterion

^a minimum information criterion is shown in italic type

^b based on estimated posterior class membership probabilities

