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Editorial: Common threads in a rich tapestry

Heather Joshi

This is the first issue of Longitudinal and Life Course Studies under its new editorial crew. The transition continues to be gradual. Most of the items we are publishing this time were initiated while John Bynner was still at the helm and many of them were seen through by the outgoing section editors. We continue to benefit from the expertise of Cara Randall as journal manager. The outcome of these joint efforts does not therefore represent any dramatic departure from the journal's course. We maintain the breadth of content and direction of travel in providing a multi-disciplinary, international forum for research on longitudinal data and studies of the life course. These are times when the scientific uses of longitudinal data are proliferating. The technology for creating longitudinal data sets and the methodology for handling and analysing them continue to develop. These are also times when two ambitious large scale cohort studies, in US and UK (the National Children' Study and Life Study), have been abandoned, and when, under fiscal austerity, the costs of data collection are more than ever under scrutiny. The UK's portfolio of investment in longitudinal resources is under an official review from international peers. The future of such investments in other countries is also far from assured. The contributions to this issue of the journal provide evidence of what can be done with some of the existing the data resources, and how longitudinal evidence might be developed in the future.

The first paper in the issue, 'Duration, timing and order: How housing histories relate to later life wellbeing' is by Bram Vanhoutte, Morten Wahrendorf and James Nazroo. They take their evidence, from the English Longitudinal Survey of Ageing, on people over 50 and use several approaches to summarising the history data, and to assessing wellbeing. The paper is novel in its focus on housing as a marker of material progress through life, in its handling of data on sequences, and that it draws on retrospective data. The retrospective approach permits some glimpses of life histories involving international immigration or spells not living in private households which tend to be missed in prospective surveys of private households. All three aspects of wellbeing – affective, cognitive and eudemonic – were lower for those spending adult life as a tenant, particularly if they were downwardly mobile from an owned home in childhood, compared to those whose pathways through housing histories had more sustained owner occupation. The highest wellbeing scores were associated with those who had been living abroad as children. The findings also illustrate the importance for life course studies of allowing for historical contexts. The association of owner occupation and social advantage may have been particularly strong in late Twentieth Century England.

The second paper, 'Moving up, feeling down: socioemotional health during the transition into college' by Julie Olson takes us to the US, and a life stage which normally represents positive progress, but has its own perils. The Add Health survey provides evidence on the mental health of young people over six years as they move into college from high school. It uses the same Depression Scale, (CES-D) as used by Vanhoutte and colleagues for the affective wellbeing of older English people. Here it is used to construct contrasting trajectories of depressive symptoms, across three waves of data. These are related to information about the competitiveness in their educational environments and the curriculum studied. The hypothesis that those with a strong deterioration in their mental health would be those encountering more competitive regimes in college than school was not borne out. However those majoring in maths and science subjects seemed more successful in sustaining good mental health.

The third paper 'Linkable administrative data: Increasing the value of existing information', by Leslie Roos, describes the potential of linked administrative datasets to provide a rich information resource for research. This is illustrated in the de-identified population data repository held by the government of Manitoba in Canada. She emphasises the institutional environment which ensures co-operation between data providers, and the 'smiling persistence' needed to bring additional sources in. This is not always replicated in other settings, even most other Canadian provinces. There are some kinds of data which one cannot

expect record linkage to provide, which suggests that the way forward may be to supplement survey data with administrative records, rather than to supplant them. This entails surveys collecting permission to link administrative data, often hitherto under-used.

Our fourth contribution is one of the first journal publications to appear that draws lessons from the experience of the Life Study, which would have been the fifth British birth cohort study, until it was closed down in 2015. 'Innovations in the design and analysis of cohort studies: integrating area-based and national samples' is research note from

Harvey Goldstein, Francesco Sera, Peter Elias and Carol Dezateux, about one particular aspect of Life Study design: the combination of local hospital-based studies with a national probability survey. The authors describe how weighting was proposed, and could be used in studies elsewhere with a similar dual design. It is expected this journal will be publishing more about the Life Study in due course.

The next contribution, 'Is there a wage penalty associated with degree of indecision in career aspirations?' is a research note by Ricardo Sabates, Leslie Gutman and Ingrid Schoon. They use data linking 16 year olds in the British Cohort of 1970 with their attainment in the labour market in mid-life. The interest is in relating the precision of occupational aspirations of teenagers with hourly pay at age 34. A degree of imprecision at 16 seemed not to matter for pay at 34. Those with complete uncertainty had lower pay, but this largely reflected in failure to acquire educational qualifications. Though neither this nor Olson' s paper explores this question, taken together these contributions suggest, as a topic for further research, the role mental ill-health in less successful transitions to adulthood. Furthermore, they both illustrate uses of prospective data, on aspirations, expectations or depressive symptoms – the sort of information that cannot be assembled from administrative sources.

The final paper,– 'Journeys Home: tracking the most vulnerable' by Rosanna Scutella, Yi-Ping Tseng and Mark Wooden – is a study profile from Australia. It provides a novel example of a combination of administrative and survey data collection to reach a little-studied group – the homeless and those at risk of homelessness. Such people tend to be missed by conventional household surveys, but are clearly of interest to policy makers as well as social scientists. The exercise was made possible by the collaboration between the researchers and the income support authorities. It proved possible to select and follow a sample of vulnerable individuals for 6 waves over 3 years from 2011. The study profile gives references to published research results and details of the possibilities for secondary analysis. Typical of such data collaborations elsewhere, there are some restrictions on the secondary use of some administrative variables.

The new editorial team hope that readers will enjoy this selection, not only finding connections across the pieces but inspiration to keep submitting more material.

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Duration, timing and order: How housing histories relate to later life wellbeing

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Abstract

Accumulation, critical period and social mobility are three powerful, interrelated life course mechanisms often tested using relatively crude empirical measures. This contribution wants to highlight the possibilities of life history data in grasping the importance of duration, timing and order of housing over the life course, by examining its association with wellbeing in later life. Housing is a key dimension of life course socioeconomic position, as the most common form of wealth accumulation in the UK. Our study makes use of the residential life history data, from birth up until the age of 50, collected in wave 3 of the English Longitudinal Study of Ageing (ELSA), in a combination of sequence analysis, cluster analysis and regression techniques. A longer duration of renting and owning accommodation is related to respectively worse and better later life affective and eudemonic wellbeing. Moving more in childhood is not associated with later life wellbeing, while frequent moving in young adulthood has a positive association with affective and eudemonic wellbeing. Moving more in midlife is associated with lower life satisfaction. Ten distinct housing careers emerge, illustrating the importance of accommodating heterogeneity in the population. Downward housing trajectories are associated with significantly lower later life wellbeing, while growing up abroad as a child is associated with higher later life wellbeing.

Keywords

Life course, housing, life history data, sequence analysis, United Kingdom

Introduction

The life course perspective acknowledges the linkage between personal and historical chronologies, so that contextualised insights into how events and outcomes are related can emerge (Abbott, 2001; Elder, Johnson, & Crosnoe, 2003). In particular, the conceptual frameworks used to examine how personal history affects health and wellbeing, critical periods, accumulation and social mobility, have been shown to be powerful explanations for the relationship between location in the social hierarchy and various health outcomes (Ben-shlomo & Kuh, 2002; Kendig & Nazroo, 2016). The maturation of analytical techniques and data to examine life histories in more detail urges a refining of these conceptual mechanisms, each emphasising a different way in which time influences our lives. This paper illustrates how duration, timing and ordering can be used as empirical translations of the concepts of respective accumulation, critical periods and mobility (Vanhoutte & Nazroo, 2016b; Wahrendorf & Chandola, 2016) in the context of accommodation histories in the UK.

Accommodation histories, or the sequence of dwellings occupied throughout a lifetime are a

relevant starting point to examine life course influences (Stovel & Bolan, 2004). Where and how people live reflects their current social position (Savage et al., 2013), as well as social origins and life trajectories (Feijten & Mulder, 2002). Furthermore, studying housing has some additional benefits, over other indicators of socioeconomic position such as occupation or education. While not everyone has an occupation, and education is accomplished for most people by early adulthood, everyone has a place of residence throughout her or his life. In addition, owning a property is the most common, and typically largest, form of financial investment, especially in the UK context (Banks, Blundell, & Smith, 2012).

Housing careers: Housing and life course

The housing career, or the succession of dwellings occupied by individuals over their lives (Kendig, 1990), has been examined in the context of life course studies in two main ways: either by examining the link between housing careers and other life domains (Clark, Deurloo, & Dieleman, 1994, 2003a; Feijten & Mulder, 2002) or the influence of societal context on housing trajectories (Clark et al., 1994; Kendig, 1990). Rather than deepening existing knowledge of housing careers themselves, this paper proposes a wider view of the long term associations of housing by addressing two issues: the implicit assumption of eventual home-ownership, and the restriction on housing careers in private dwellings in one country.

Tenure change, and especially the move from renting to owning, is seen as the key event of the housing career in most housing research (Kendig, 1990; Mulder & Wagner, 1998). Although we do not dispute this, the primary focus on this specific transition blurs the fact that a substantial, and increasing, part of the population never acquires their own home (Lupton et al., 2009). The experiences of current younger generations in the UK illustrate this clearly: more and more people are unable to afford to buy a home, and either move back into their parental homes or rent for extended periods of time from private landowners (Dorling, 2015; Lupton, 2016). This change in housing careers for younger compared with older generations underwrites the need for a broader view on housing careers, examining the long term correlates of more varied and flexible trajectories, without home ownership as a normative endpoint.

A second limitation we want to address is to include more diversity in the type of housing considered. Alongside renting or owning, a number of non-private forms of residence exist. These other forms of accommodation, such as orphanages, boarding schools, and army accommodation, are often tied to a specific life phase, and can tell us more about a person's life course. A second form of dwelling diversity is tied in with international migration, and the aftermath of UK's colonial history. In the bulk of housing studies, only accommodation inside one country is examined, although a significant part of the population lived abroad for at least a part of their life. While these limitations often arise from pragmatic and data-related considerations, they influence results and policy conclusions, and as such narrow the view on housing and how it reflects other life domains at particular life stages.

This paper examines the correlates of housing through the prism of the life course mechanisms of accumulation, critical period and social mobility. Rather than seeing the sequences and events that make up housing careers as outcomes, we examine to what extent housing careers can be used to trace social differences over the life course and the associations of these differences with wellbeing in later life. Reflecting the different conceptions of time in life course studies, we give an overview of previous research on housing careers through the lens of duration, timing and ordering (Vanhoutte & Nazroo, 2016b; Wahrendorf & Chandola, 2016). Widening rather than deepening the understanding of housing careers from a life course perspective, we want to incorporate forms of housing that do not fit the renting/owning dichotomy, such as non-private dwellings and living abroad.

Duration, or accumulation of risk exposure

A commonly studied life course mechanism relevant to the possible influence of housing careers is accumulation. In the logic of cumulative (dis)advantage, inequalities are expressed over time, not instantaneously (Dannefer, 2003). Small differences at one point can grow over time and develop into large disparities in health, wealth and wellbeing (Vanhoutte & Nazroo, 2016a). Therefore accurately capturing the duration of exposure to potentially damaging (or protective) environments is an essential step. It allows investigation of the extent to which a response-type relationship exists

between the stressor over the life course and the outcome under study.

In the context of accumulative exposure, we believe type of tenure is a primary indicator. Housing quality is a reliable proxy for exposure to health risks and socioeconomic position. Housing conditions mark risk exposure to environmental stressors, such as toxins, pollutants, noise and crowding, while at the neighbourhood level there are further differences in ambient conditions in the form of traffic, availability of green or blue space, presence of municipal services and the type of food provisions. These are all part of the causal chain that links socioeconomic circumstances with health outcomes (Ellaway & Macintyre, 1998; Evans & Kantrowitz, 2002; Windle, Burholt, & Edwards, 2006). As renters and owners occupy different kinds of dwellings (Rossi & Weber, 1996), ownership has effects on health and wellbeing over and above the material wealth it represents, through this exposure to health hazards in the dwelling or its immediate environment (Ellaway & Macintyre, 1998; Macintyre et al., 2003). Lower housing quality of rented accommodation as such contributes to worse mental health (Hopton & Hunt, 1996) A final point is that owning a house can contribute to a higher feeling of ontological security, and deliver less tangible psycho-social benefits (Hiscock, Kearns, MacIntyre, & Ellaway, 2001).

Timing, or critical period

Closely interlinked with the idea of duration is the idea of timing. The point at which an event happens can be crucial for the impact it has, an idea that lies at the base of the concept of critical period, and most research on scarring early life effects (Ben-shlomo & Kuh, 2002). Next to the event itself, unfavourable timing can set in motion a whole cascade of knock-on effects that negatively influence the outcome.

In a housing career, moving house and the circumstances this reflects is the most typical event that would come to mind. The timing of the transition from renter to owner is often seen as the key moment of the housing career, and as such has been researched intensively (Clark et al., 1994; Clark, Deurloo, & Dieleman, 2003b; Mulder & Wagner, 1998). Here we emphasise the more general influence of the timing of moving house in the life course.

Moving as a single event can have positive, neutral and negative effects, mainly because of the transitions that provoke or accompany it (Gambaro & Joshi, 2016). It is a stressful event in itself, and in addition potentially disrupts place attachment and social embeddedness, two factors related to higher wellbeing especially for low-income families (Manzo, Kleit, & Couch, 2008). Moving house is often motivated by positive life events and is related to an improvement in housing quality, and has been shown to have a small positive effect on housing satisfaction, but no tangible effect on life satisfaction (Nakazato, Schimmack, & Oishi, 2011).

However, moving house frequently reflects instability or even housing insecurity, which inhibits building up meaningful close friendships and can potentially be damaging for children (Evans, Wells, & Moch, 2003; Oishi & Schimmack, 2010). At the same time, some important life course events, such as attending tertiary education, forming or ending a partnership, and having children, relate to moving house (Clark et al., 1994), so that in some phases of the life cycle moving will occur more frequently than in others (Clark & Onaka, 1983). The absence of moves in these busy life phases, such as early adulthood, can have negative implications later in life.

Ordering, or social mobility

A contextualised and holistic approach to the life course places events and spells in a sequential order, instead of considering them as isolated (Abbott, 1995; Aisenbrey & Fasang, 2010). Knowing what happened before and after an event can guide our understanding of the variation in life courses, and in this way allows a consideration of dynamic and diverse life course trajectories.

As housing can be considered a marker of socioeconomic position, housing careers become a means to study social mobility. Earlier studies on social mobility in England have illustrated that although stability is by far the most common life course trajectory, upward and downward mobility do occur, and have consequences for later life health and wellbeing (Blane, Harding, & Rosato, 1999; Niedzwiedz, Katikireddi, Pell, & Mitchell, 2012; Vanhoutte & Nazroo, 2016a). The influence of housing careers on later life wellbeing should be considered in the context of the typical upward trajectory to home ownership, with an upward trend in terms of quality, price and tenure (Clark et al., 2003a) which represents social norms about housing careers. A frustration of this norm may reflect a lack of either financial resources, or

missing out on life course events such as forming a partnership, or having children, both of which can have a negative impact on later life wellbeing.

Later life wellbeing

We investigate the relevance of these aspects of housing careers for later life wellbeing, a common outcome in the broader framework of successful ageing (Hildon, Smith, Netuveli, & Blane, 2008; Stone, Evandrou, & Falkingham, 2013). Wellbeing is multidimensional in nature and comprises three different, empirically identifiable, conceptions: affective, cognitive and eudemonic, respectively reflecting happiness, satisfaction and self-actualisation (Vanhoutte, 2014). Distinguishing multiple forms of wellbeing is useful as each type of wellbeing has its own dynamic, is produced by different sets of resources (Jivraj, Nazroo, Vanhoutte, & Chandola, 2014), and relates in an idiosyncratic way to different life course mechanisms (Vanhoutte & Nazroo, 2016a). The affective aspect of wellbeing consists of moods and emotions, (Diener, Suh, & Lucas, 1999), of which depressive symptoms (CES-D, (Radloff, 1977)) capture the negative side of the spectrum (Wood, Taylor, & Joseph, 2010). Childhood adversities have shown to matter more for later life affective wellbeing (Kessler, 1997), as the way we respond to stress is thought to be embedded in our formative years. Cognitive wellbeing, or life satisfaction, is a judgemental process in which individuals asses the quality of their life based on their own criteria (Pavot & Diener, 1993). Life satisfaction in old age is more closely related to later stages of the life course, as our judgement tends to be driven by what we experienced recently (Kahneman & Krueger, 2006).. Eudemonic wellbeing, or the degree of control, autonomy and self-realisation (Ryff & Keyes, 1995) is related more strongly to accumulative (dis)advantages across the life course (Blane, Higgs, Hyde, & Wiggins, 2004; Vanhoutte & Nazroo, 2016a).

Hypotheses

Spending a longer part of the housing career in rented accommodation is associated with in lower wellbeing, and inversely longer durations of home-ownership are associated with higher wellbeing in later life.

Moving house in childhood and midlife are negatively associated with wellbeing, but moving in young adulthood is positively associated.

Movements from owning to renting will have a negative association with later life wellbeing.

Data and methods

Data

We use the retrospective life history data of the English Longitudinal Study of Ageing (ELSA) (Marmot et al., 2017), collected in wave 3 (2007) (Ward, Medina, Mo, & Cox, 2009). ELSA is a panel study of people aged 50 or older living in private households in England, with a sample that was drawn from households previously responding to the Health Survey for England between 1997 and 2004. The sample was refreshed in wave 3 to maintain representation of people aged 50-53, yielding a total of 9,771 participants of which 7,855 provided life history information (Steptoe, Breeze, Banks, & Nazroo, 2013). Of these respondents, 56% are aged between 50 and 65, reaching the age of 15 between 1957 and 1972.

The event history calendar (Axinn, Pearce, & Ghimire, 1999; Freedman, Thronton, Camburn, Alwin, & Young-DeMarco, 1988), which uses visual aids, enquires about streams of events, records event sequences, and contextualises questions about various life events was used to collect retrospective information on several domains (e.g. work, relationships and housing). This data collection tool is more reliable than standard survey approaches for complex autobiographical data (Belli, 1998), yields higher response rates (Belli, 1998), and is adaptable to other modes of information gathering (Kendig et al., 2014). Following its use in ELSA, the event history calendar has been used in several other studies, such as the Survey of Health, Ageing and Retirement in Europe (SHARE) (Schröder, 2011), the Australian Life Histories and Health (LHH) study (Kendig et al., 2014) and the US Health and Retirement Study (HRS).

The life history data used in this paper are accommodation histories. They allow for a description of the accommodation situation for each year of age from birth up until the age of 50. We distinguish between four different states: respondents can describe themselves as living in rented, owned, or non-private accommodation, or abroad. Figure 1 is a chronogram of the accommodation histories, which shows the proportion in each state for each year of age. Owning and renting are the most common

categories of accommodation, while residing in other, non-private forms of accommodation (armed forces, accommodation tied to employment, boarding school, or children's home, hospital, etc.) and living abroad are relevant markers for specific life phases or life courses, each occurring for at least one year in about 20% of our sample. Over the life course, there is an expansion of occupying owned housing, and a decrease in rented housing. In the period between the age of 15 and 20 there is a marked, but temporary, increase of non-private dwelling (5%) and living abroad (about 2 percent).

We limit our analysis of accommodation histories from birth to the age of 50, not to lose respondents by age censoring. Due to inaccuracies in reporting, some gaps between housing spells occurred, which we imputed using multiple imputation for categorical time series (MICT) in Stata (Halpin, 2015), a technique specifically developed for this type of data. This form of imputation informed by the state prior and/or after the gap, increased the sample from 6,848 to 7,505 cases. To account for selectivity of respondents to the life history data, we used the weighting provided (Ward et al., 2009).

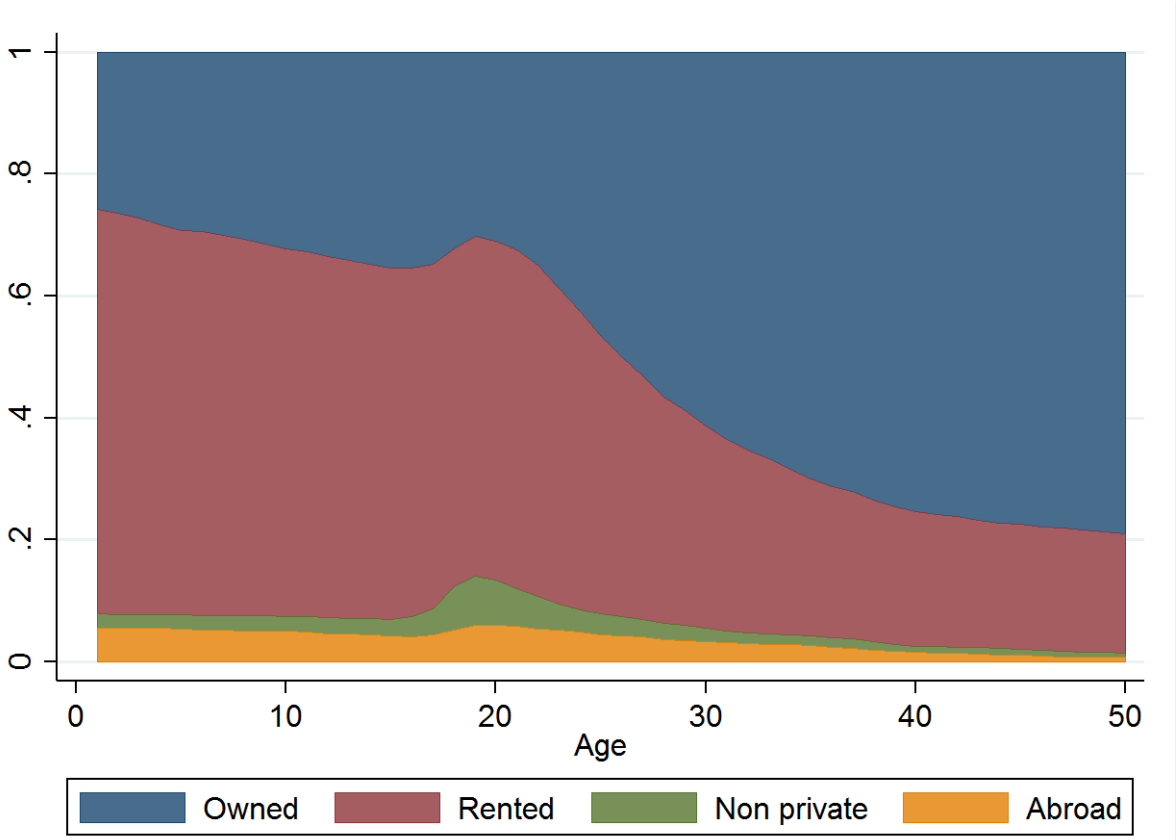

Figure 1: Chronogram of accommodation states over age (n=7505)

Table 1. Descriptive statistics of dependant variables

	N	Mean	Std. Dev.	Min	Max
CESD	7,432	1.46	1.93	0	8
SWLS	6,475	24.96	6.50	5	35
CASP	6,347	34.07	6.95	4	45

Dependant variables

The eight item CES-D scale, with binary yes or no answering categories is used as a measure of low affective wellbeing. The satisfaction with life scale (SWLS) (Diener, Emmons, Larsen, & Griffin, 1985), used as a measure of cognitive wellbeing, consist of five items and is answered using a five point likert scale ranging from totally agree to totally disagree. To gauge eudemonic wellbeing the adapted 15 item Control, Autonomy, Self-Actualisation and Pleasure (CASP) scale (Hyde, Wiggins, Higgs, & Blane, 2003; Vanhoutte, 2014) is used, which has better measurement properties and theoretical justification than the original 19 item version, with four answering categories varying in frequency. Except for affective wellbeing (CES-D), our wellbeing measures where part of the self-completion questionnaire.

Control variables

We adjust for a number of current sociodemographic characteristics (Table 2) (age, gender and ethnicity), health status (limitations in instrumental activities of daily living), and marital status, each of which has an established influence on subjective wellbeing in later life (Jivraj et al., 2014).

Table 2. Descriptive statistics of control variables

	N	Mean/ Proportion	Std. Dev.	Min	Max
Age	7486	65.04	10.27	49	91
Gender (ref.: Female)					
Male	7486	44%			
Ethnicity (ref.: White)					
Non-White	7486	2%			
Limitations in instrumental activities daily living (ref.: At least one)					
None	7486	25%			
Marital status (ref.: Never married)					
Widowed, divorced or separated	7486	25%			
Married or cohabiting	7486	70%			

Methods

Our analysis consists of examining the individual housing careers using sequence analysis (Abbott, 1995; Aisenbrey & Fasang, 2010). Sequence analysis is a group of research methods taking a holistic approach by focusing on trajectories more than transitions, recently gaining impetus by range of new methodological developments in response to life course applications.

Although the main idea of sequence analysis is to study whole sequences, and as such investigate duration, timing and order together, this paper separates them out to highlight some simple but valuable metrics that can be derived from life history data. Using these different ways of looking at sequences can get us closer to the three conceptual aspects of the life courses we are studying. All calculations and figures were done with Stata using the 'sadi' package (Halpin, 2014) and the 'sq' package (Brzinsky-Fay, Kohler, & Luniak, 2006).

Duration

A straightforward way of examining accommodation histories is capturing the total time spent in a state. Cumulative duration in a state as such only reflects this passage of time, and does not take into account house moves or other aspects of a housing career. Table 3 illustrates on average our cohort spent their first 50 years by renting about 22 years, owning a house for 25 years, living abroad for almost two years and living in non-private dwellings for about one year. There is a large variation in how long people spent renting and owning, as well as substantial variation in the duration of living abroad.

Timing over the life course

We are equally interested in examining if similar events, i.e. moving frequently, have a differential influence on later life depending on which life phase they occurred. For this purpose, we delineate three life phases, based on figure 1: early life (1-18), young adulthood (19-29) and midlife (30-50), and calculate metrics specific for each life phase (Table 3).

A simple way of thinking about housing instability is the number of changes in accommodation, or the number of moves. Using the number of moves by life phase does not distinguish if a person is moving to the same type of accommodation or not. Table 3 shows that on average, people move more in the young adult phase than in early life or midlife.

Moving between different types of accommodation is captured by Shannon's entropy. Shannon's entropy is a measure for the complexity of a sequence, based on the cumulative duration in each state. It does not take into account the number of moves, but only time spent in different states.

By multiplying Shannon's entropy with the number of housing spells divided by the total length of time, we distinguish between different states, and incorporate the number of house moves, which gives us a value for the instability of the housing career, with a value between 0 (very stable) and 1 (very instable).

Table 3. Descriptives of metrics derived from sequences (N=7505) (weighted)

	Mean	SD	Min	Max
Cumulative Duration				
Ownership	24.64	15.59	0	50
Renting	22.13	15.78	0	50
Non-private	1.27	4.04	0	50
Abroad	1.96	6.07	0	50
Number of moves				
Childhood	1.53	0.89	1	8
Young adult	2.02	1.10	1	9
Midlife	1.46	0.86	1	8
Entropy				
Childhood	0.25	0.40	0	1.97
Young Adult	0.56	0.50	0	1.96
Midlife	0.22	0.38	0	1.94
Instability				
Childhood	0.04	0.07	0	0.79
Young adult	0.08	0.10	0	0.95
Midlife	0.02	0.04	0	0.52

Ordering

To group whole sequences, we use dynamic hamming (Lesnard, 2006), an extension to optimal matching (OM) analysis (Abbott, 1995; Aisenbrey & Fasang, 2010). Both techniques compare sequences and quantify their differences (or "distances"). In line with our theoretical focus on ordering, we use the dynamic hamming procedure (Lesnard, 2006). This method is a data informed way of calculating substitution costs, by taking into account how common a transition is at each time point. In a second step, the resulting distance matrix can be used in cluster analysis to identify empirically homogeneous groups, with similar sequences. At this point, we used Ward's linkage to determine the most appropriate number of clusters, based on commonly used measures of cluster quality (Halpin, 2016). Findings favour either three, eleven or twelve clusters (Table 4). We considered the three best solutions for each measure of cluster quality. We opted for the ten cluster solution as it was ranked second best for two separate measures, as well as making substantive sense.

Table 4. Cluster stopping rules for 2-15 cluster solutions

Number of clusters	Calinski Harabasz pseudo F	Duda-Hart Je(2)/Je(1)	Duda-Hart pseudo T squared
2	2523.81	0.6365	2642.09
3	**2774.28**	0.8226	620.00
4	2246.48	0.8480	582.75
5	1931.21	0.8338	521.05
6	1758.84	0.6760	658.42
7	1625.96	0.8626	294.31
8	1514.66	0.7185	523.33
9	1409.59	0.8394	178.54
10	1325.42	**0.8724**	**74.45**
11	1242.01	**0.8801**	228.67
12	1175.50	0.8656	**50.00**
13	1108.25	0.7596	343.68
14	1050.52	0.8555	236.73
15	1001.80	**0.8679**	**104.25**

One descriptive way to represent these clusters is through a modalplot, representing the "medoid sequence", or sequence closest to the cluster centre (see Figure 2) (Brzinsky-Fay et al., 2006). In this graphical representation the modal category for each age year is plotted, so that an impression of the modal sequence in each cluster emerges. A white gap, such as in the last cluster denotes equal probability of two states, in this case living in rented or owned accommodation. We present the clusters according to the age at which respondents first lived in an owned home. Two clusters have a homogenous pattern of occupying either rented (14.5 %) or owned homes (22.4%), and together capture more than a third of respondents. Four clusters illustrate a similar pattern of transition, from living in a rented home to an owned home, at respectively the age of 10 (9.2%), 22 (18.7%), 28 (10.6%) and 32 (7.2%). The remaining four clusters, comprising about a fifth of the cases, have widely different housing careers. A more mixed profile shows an alternation between rented and owned housing in adulthood (6.8%). One cluster illustrates a transition from growing up in an owned house to a life of renting starting at age 20 (3.8%). Two clusters illustrate the relatively fast transition to living in an owned home of those growing up abroad and coming back as a child (3.3%) or as an adult (3.5%).

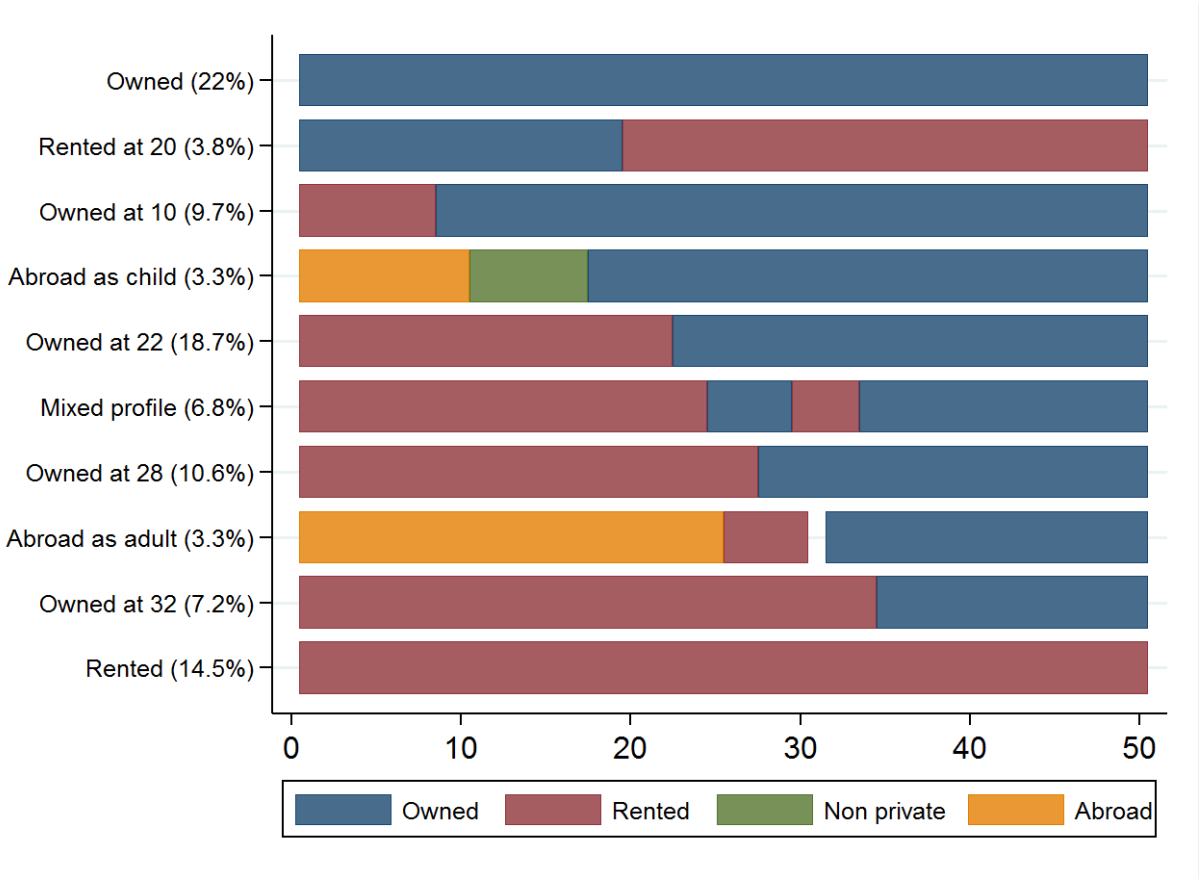

Figure 2. Modalplot of the 10 clusters (proportion of respondents) (N=7505)

Analysis

Using a series of multivariate regressions, the associations of duration and timing, as well as different types of sequences, with later life wellbeing are examined. We control for age, gender, ethnicity, marital status and health status, and use weights to account for selection of respondents who answered the life history questionnaire (Ward et al., 2009). We consciously do not control for other aspects of socioeconomic position (such as wealth, class or education) for theoretical reasons. Housing careers in our opinion constitute an alternative marker for life course socioeconomic position, in line with current ideas on the multidimensionality of social class (Savage et al., 2013). As housing careers can therefore be correlated, potentially causally related and a part of other measures of social position, we refrain from including them in our analysis, focusing instead on the direct relationship between housing careers and later life wellbeing. Note that the reported coefficients come from separate multivariate models, and as such we are only testing one measure at the time.

Duration

Table 5. Unstandardised coeffients in multivariate regression of duration measures on wellbeing, controlling for age, sex, ethnicity, marital status, health status (weighted)

	SWLS (n=6025)		CES-D (n=6926)		CASP (n=5902)	
	coef	Se	Coef	Se	Coef	se
Ownership	.005	.006	-.011***	.002	.034***	.006
Renting	-.010	.006	.012***	.002	-.039***	.006
Non private	.023	.020	-.001	.006	.030	.022
Abroad	.027	.018	.003	.005	.031	.017

*** p<0.01, ** p<0.05, * p<0.1

Table 5 shows the associations of duration in a type of housing on different dimensions of wellbeing in later life. It is clear that renting for longer has a negative association with CES-D (emotional wellbeing) and CASP (eudemonic wellbeing) in later life, with SWLS (life satisfaction) showing a weaker, non-significant association. Being an owner for a longer time is associated with fewer depressive symptoms as well as higher eudemonic wellbeing, but not with life satisfaction. Time lived in non-private accommodation or abroad is not significantly associated with later life wellbeing, but there is a suggestion of higher satisfaction and eudemonic wellbeing for those that lived abroad, or in non-private dwellings longer.

Timing

Table 6. Unstandardised coeffients in multivariate regression of timing measures on wellbeing, controlling for age, sex, ethnicity, marital status, iadl (weighted)

	SWLS (n=6025)		CESD (n=6926)		CASP (n=5902)	
	Coef	SE	Coef	SE	Coef	SE
Number of moves						
Childhood	.012	.087	-.012	.027	.148	.100
Young Adult	-.062	.073	-.056**	.019	.227**	.075
Midlife	-.326***	.094	-.014	.024	-.134	.104
Entropy						
Childhood	-.086	.204	-.002	.058	.235	.229
Young Adult	.080	.167	-.131**	.046	.495**	.178
Midlife	-.827***	.221	.051	.059	-.599*	.244
Instability						
Childhood	.640	1.057	-.010	.331	2.205	1.218
Young Adult	.891	.763	-.660**	.230	2.641**	.858
Midlife	-4.320*	2.023	.045	.543	-2.616	2.386

*** p<0.01, ** p<0.05, * p<0.1

The results of the importance of the timing of house moves over life stages (Table 6) are similar over different measures of house moves, but differ by form of later life wellbeing. While satisfaction in later life is negatively associated with more and more diverse house moves in midlife, depressive symptoms and eudemonic wellbeing are associated consistently, respectively negatively and positively,

with moving more in young adulthood. Moving more or to different types of housing as a young adult is associated with less depressive symptoms and higher eudemonic wellbeing in later life. More changes, or changing to a different type of dwelling in midlife is negatively associated with autonomy in later life. There is no significant association of moving more, or to different types of housing as a child. One caveat in this last finding is that different types of less common non-private types of housing are investigated as one category, so that changes between them are not detected in our instability or entropy measures.

Order

We examine the extent to which the ten housing career patterns resulting from our optimal matching analysis of the sequence data explain later life wellbeing, controlling for age, gender, ethnicity, marital status and functional health (Figure 3). The group that stands out negatively over each of the wellbeing outcomes are those that start to rent at 20, having grown up in owned accommodation. Buying a house before the age of thirty is associated with better outcomes for all three wellbeing indicators. Those with a mixed profile, who showed on average to return from owned housing to renting in their late twenties, have a similar, lower than average, wellbeing as late buyers. The relation of other housing patterns with wellbeing is more indicator-specific. Lifelong house-owners having an average score in life satisfaction, but markedly fewer depressive symptoms and a higher degree of autonomy in later life. Lifelong renters have an average score on life satisfaction, but stand out as having more depressive symptoms as well as having lower scores on autonomy in later life. Those who grew up abroad, but came to England as a child stand out positively in life satisfaction and autonomy, but not depressive symptoms. People who grew up abroad and came to England as an adult, report average scores of life satisfaction and eudemonic wellbeing, but more depressive symptoms.

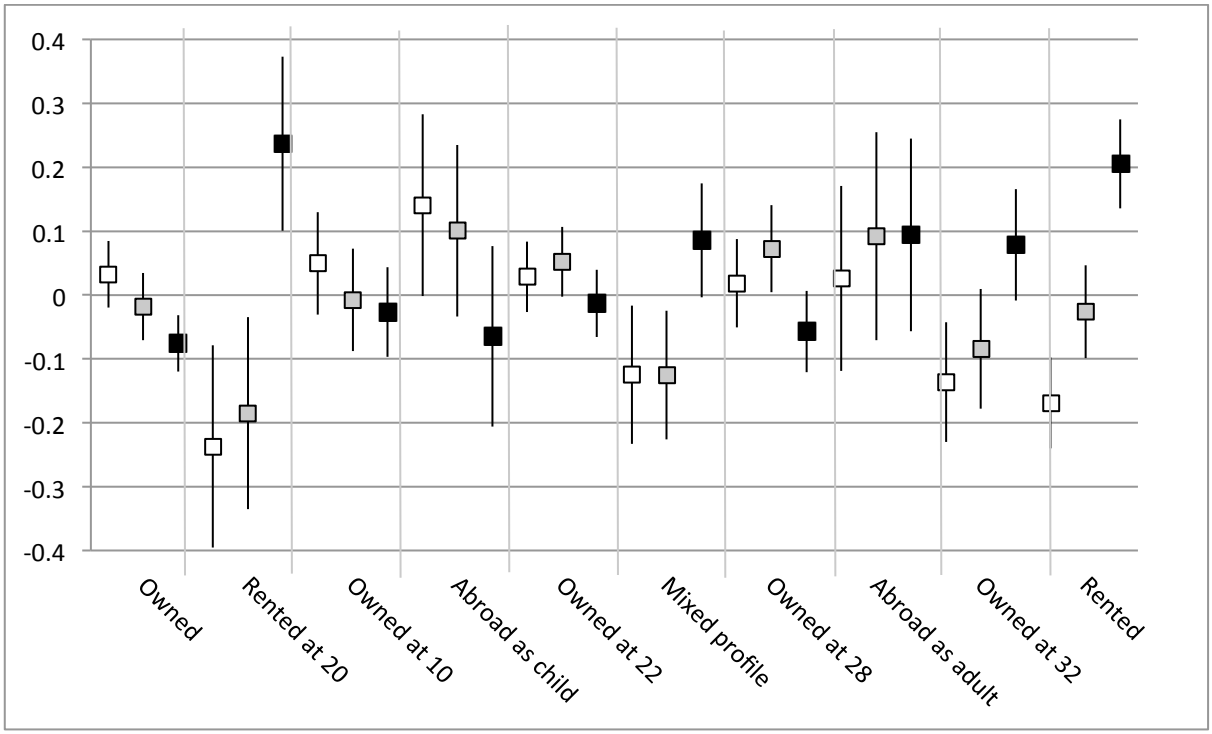

Fig 3: Predicted standardised wellbeing scores CASP (white, N=5904), SWLS (grey, N=6027) and CES-D (black, N=6928) for 10 housing career clusters, adjusted for age, sex, ethnicity, marital status, iadl (weighted)

Discussion and conclusions

This paper examines the potential association of housing careers from birth to the age of 50 with later life wellbeing in England. Housing is a marker of socioeconomic position, being one of the primary forms of wealth accumulation, as well as potentially having more psychosocial effects, as a safe space or source of instability. Informed by life course theory, we distinguish between aspects of duration, timing and order in housing sequences, as empirical measures of respectively accumulation, critical period and mobility. Using the information on housing in the life history data of the English Longitudinal Study of Ageing (ELSA), we use four possible housing states: renting, owning, non-private dwelling or living abroad. As later life wellbeing consists of different but related dimensions, we distinguish between affective (CES-D), cognitive (SWLS) and eudemonic (CASP) wellbeing.

Duration in a state is a way to translate accumulation of (dis)advantage over the life course. Certain types of housing, such as living in an owned house, exemplify advantage, while others, such as renting, represent disadvantage. By extracting the total cumulative duration in a state from the housing sequences, we illustrated that the more years a person spent in rented housing, the poorer her/his later life affective and eudemonic wellbeing was. Inversely, the longer one lived in owned housing the better later life affective and eudemonic wellbeing was. These findings support our hypothesis, flowing from cumulative (dis)advantage theory, that differences in housing tenure represent differences in housing quality and exposure to risk, which over the long term produce marked differences in quality of life. The quantity of time spent in non-private housing or abroad is not related with later life wellbeing.

The timing of moves is the second aspect of the housing career that we examined. Rather than examining a single move, or moving over the whole housing career, we analysed the associations with later life wellbeing of moving in different life phases. This relates to life course ideas of critical or sensitive periods (although typically only focused on early life) that can scar a person for the rest of her/his life. Our analysis, using three distinct measures of the frequency of moving, found no negative associations with wellbeing of moving more frequently in childhood, in line with other research. This surprising finding supports the idea that moving house is often motivated by a perceived improvement in neighbourhood or housing conditions. The absence of the hypothesised negative side to moving house more often, such as the loss of social resources, which are thought to affect the disadvantaged more than others, can be understood when thinking about the temporal context of the cohorts we are studying. For the bulk of respondents in our study childhood was situated in the period when social housing expanded substantially, in the period around 1960 for the median birth cohort in our study. Social housing in this period was often an improvement from what was available on the private market, detached or semi-detached houses with gardens instead of shared ageing Victorian accommodation. As such it is likely that moving in childhood, even for the more disadvantaged, more often represented an improvement rather than deterioration in living circumstances.

Moving more as a young adult actually was associated negatively with symptoms of depression in later life and positively with eudemonic wellbeing. The positive associations of instability in our opinion mark important life course transitions occurring in this period, such as attending higher education, cohabiting with a partner or having a child, all of which function as important social and economic resources later on in life. Missing out on these transitions can be linked indirectly, through building up less human, social and economic capital as a young adult, to lower later life wellbeing. Satisfaction with life is not related to residential instability as a young adult, but is negatively associated with moving more often in midlife. Major adverse events, such as divorce, loss of spouse, unemployment and disability have shown to have lasting negative effects on subjective wellbeing (Lucas, 2007), and are often associated with moving (Clark, 2016). As negative shocks such as divorce, separation and onset of disability occur more in midlife, we believe this explains the negative association between moving more often in this life stage and lower satisfaction in later life.

The third aspect of the timing of events that this paper examines is order. Does the order of transitions between one housing state and the next matter for later life wellbeing? Conceptually the importance of order is related to social mobility.

Earlier research has confirmed that upward mobility is positively related with later life health and wellbeing, while downward mobility is negatively associated (Otero-Rodríguez et al., 2011; Vanhoutte & Nazroo, 2016a). Nevertheless, social mobility might to some extent reflect larger societal changes like the expansion of education or the shift to a service economy, depending on which indicators are used to measure mobility, so that it is useful to examine housing as an alternative indicator of position on the social ladder. Using optimal matching analysis with dynamic hamming to determine distances between sequences, the housing careers were divided into ten identifiable groups. It is clear from our analysis that renting after growing up in an owned house, which is an unambiguously downward form of social mobility, is associated with the lowest levels of later life wellbeing in comparison to other housing careers. This makes clear how essential housing is to wellbeing: no matter what your social origins are, not managing to secure an own home is associated with lower later life wellbeing. The results for upward mobility, or moving from rented to owned housing, are less clear, and strongly depend on the age of transition, with earlier ownership generally related to better later life outcomes.

Investigating order in housing careers through whole sequences allows us to uncover the heterogeneity present in housing careers, and their possible associations with later life wellbeing. To what extent do atypical housing careers, which deviate from the normative transition from renting to home-ownership, relate to either higher or lower wellbeing in later life? How do periods of residence abroad or in non-private dwellings fit in a housing career, and are they related to better or worse later life outcomes? Important to keep in mind in looking at the order of these sequences is that the home is not necessarily owned by the respondent, parents can be owners as well. About a third of the sample did not report change in housing state, continuously being in either rented or owned accommodation. As this study has shown, longer duration of living in either rented or owned accommodation has important implications for later life wellbeing, so it is no surprise that these trajectories are associated with respectively relatively poor and good later life wellbeing, with the exception of life satisfaction, on which duration had no association. Just under half of the sample transitioned from living in rented to owned accommodation, at different ages, as discussed earlier. The remaining share of respondents, about 17%, has atypical life courses. The mixed profile, where living in an owned home is followed by a period of renting, and then again ownership, is associated with lower wellbeing scores in terms of life satisfaction and autonomy. The two remaining atypical trajectories both start off living abroad. One group moves into non-private dwellings (which could be boarding schools) in England around the age of ten, and starts living in an owned home before the age of 20. The other group lives in rented housing in England in their twenties, and after a relatively short time moves to an owned house. Taking into account the cohorts included in the study, both groups must be seen in the context of the end of empire, coming from privileged backgrounds, which is evident by possible attendance of boarding schools and living in an owned home early. A secondary interpretation is that the latter group, arriving in England as young adults exhibits the typical characteristics of positive selection common among migrants (Borjas, 1989), such as a high motivation as well as better education and health, resulting in a steep and "successful" career. While both groups have a high satisfaction later in life, those who returned as child score high for the other forms of wellbeing, while those who returned as adults have a near average level of autonomy, but strangely have higher than average levels of depressive symptoms.

The methods used in this paper do not allow statistical causal inference, as there is a possibility of reverse causality, common cause or spuriousness due to a confounding variable, next to the possibility that our findings are coincidental or resulting from type I error. Our results nevertheless provide a suggestion of logical causality, because of the low probability of reverse causality on the one hand and the theoretical approach to housing careers as a dimension of social position in its own right. Reverse causality is unlikely due to the earlier temporal occurrence of the housing histories in relation to the measurement of wellbeing. There is a theoretical possibility that people with higher wellbeing retrospectively report more favourable housing histories, but the literature considers retrospective reports using event history questionnaires to be reliable (Belli, 1998), so that this is unlikely. The investigated aspects of housing histories could, partly or entirely, be attributed to a

latent common cause, i.e. social position, or mediate other measures of social position such as occupational class position, education or wealth. Adopting a conception of class which is multidimensional, and comprises housing as a distinct form of economical capital (Savage et al., 2013), we chose to firmly establish the primary relationship between housing careers and wellbeing, not investigating the interplay between housing careers and other dimensions of class in this study, as multicollinearity between these measures could underestimate the importance of housing careers.

This paper illustrates that different types of wellbeing do not always behave in a similar way. While satisfaction with life tends to reflect what has happened in more recent life stages, depressive symptoms and eudemonic measures of wellbeing reflect experiences across the whole life course. This finding confirms the notion that life satisfaction, due to its cognitive nature, functions as an adaptive, homeostatic system, while affective and eudemonic aspects of wellbeing are more responsive to respectively mental and physical health issues.

Our study suffers some important limitations. Firstly, some respondents did not respond to the life history questionnaire, and although we correct for this using the design weights, the reported proportions of certain less desirable housing careers in the population could be underestimated, or some heterogeneity might not be captured. Secondly, our analysis is based on relatively coarse, and subjective, reports of housing. More detailed information on the value or size of dwellings, as well as social or private renting, was not collected, and several categories were collapsed to non private dwellings. Using more detailed categories made it difficult to impute the gaps, and a more complete sample was chosen over more detailed information. The highlighted associations with tenure could equally be a function of the neighbourhood in which houses are located. Furthermore, as we use retrospective data, we rely on the subjective recollection individuals have of their housing situation. Hybrid housing situations as well as part-time non-private housing therefore are forced into one category, which can lead to underreporting. Thirdly, this study is based on historical data, so that the validity of our findings cannot be straightforwardly extrapolated to younger cohorts and the current period. Furthermore we did not investigate specific cohort or period effects, as this requires a different approach. The possible interplay of housing with other indicators of social position with housing was deliberately left outside the scope of this study, whose contribution lies not only in its focus on housing but in its exploration of the multi-dimensionality of wellbeing. We hope that future research can address these limitations.

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References

Abbott, A. (1995). Sequence Analysis: New Methods for Old Ideas. *Annual Review of Sociology*. https://doi.org/10.1146/annurev.so.21.080195.000521

Abbott, A. (2001). *Time matters. On Theory and Method.* Chicago: Univeristy of Chicago Press.

Aisenbrey, S., & Fasang, a. E. (2010). New Life for Old Ideas: The "Second Wave" of Sequence Analysis Bringing the "Course" Back Into the Life Course. *Sociological Methods & Research*, *38*(3), 420–462.

https://doi.org/10.1177/0049124109357532
Axinn, W. G., Pearce, L. D., & Ghimire, D. (1999). Innovations in Life History Calendar Applications. *Social Science Research*, *28*, 243–264. https://doi.org/10.1006/ssre.1998.0641
Banks, J., Blundell, R., & Smith, J. P. (2012). Understanding Differences in Household Financial Wealth between the United States and Understanding Differences in Household Financial Wealth between the United States and Great Britain.
Belli, R. F. (1998). The structure of autobiographical memory and the event history calendar: Potential improvements in the quality of retrospective reports in surveys. *Memory*, *6*(4), 383–406. https://doi.org/10.1080/741942610
Ben-shlomo, Y., & Kuh, D. (2002). A life course approach to chronic disease epidemiology: conceptual models , empirical challenges and interdisciplinary perspectives. *International Journal of Epidemiology*, *31*(6), 285–293. https://doi.org/10.1093/intjepid/31.2.285
Blane, D. B., Harding, S., & Rosato, M. (1999). Does social mobility affect the size of the socioeconomic mortality differential?: evidence from the Office for National Statistics Longitudinal Study. *Journal of the Royal Statistical Society. Series A, (Statistics in Society)*, *162*(Pt. 1), 59–70. https://doi.org/10.1111/1467-985X.00121
Blane, D. B., Higgs, P., Hyde, M., & Wiggins, R. D. (2004). Life course influences on quality of life in early old age. *Social Science & Medicine (1982)*, *58*(11), 2171–9. https://doi.org/10.1016/j.socscimed.2003.08.028
Borjas, G. J. (1989). Economic Theory and International Migration. *International Migration Review*, *23*(3), 457–485. https://doi.org/10.2307/2546424
Brzinsky-Fay, C., Kohler, U., & Luniak, M. (2006). Sequence analysis with Stata. *Stata Journal*, *6*(4), 435–460.
Clark, W. A. V. (2016). Life events and moves under duress: disruption in the life course and mobility outcomes. *Longitudinal and Life Course Studies*, *7*(3), 218–239. https://doi.org/10.14301/llcs.v7i3.376
Clark, W. A. V, Deurloo, M. C., & Dieleman, F. M. (1994). Tenure Changes in the Context of Micro-level Family and Macro-level Economic Shifts. *Urban Studies*, *31*(1), 137–154. https://doi.org/10.1080/00420989420080081
Clark, W. A. V, Deurloo, M. C., & Dieleman, F. M. (2003a). Housing Careers in the United States , 1968 – 93 : Modelling the Sequencing of Housing States. *Urban Studies*, *40*(1), 143–160. https://doi.org/10.1080/00420980220080211
Clark, W. A. V, Deurloo, M., & Dieleman, F. (2003b). Housing Careers in the United States, 1968–93: Modelling the Sequencing of Housing States. *Urban Studies*, *40*(1), 143–160. https://doi.org/10.1080/00420980220080211
Clark, W. A. V, & Onaka, J. (1983). Life Cycle and Housing Adjustment as Explanations of Residential Mobility. *Urban Studies*, *20*(1), 47–57. https://doi.org/10.1080/713703176
Dannefer, D. (2003). Cumulative advantage/disadvantage and the life course: Cross-fertilizing age and social science theory. *The Journals of Gerontology Series B: Social Sciences*, *58*(6), 327–337. https://doi.org/10.1093/geronb/58.6.S327
Diener, E., Emmons, R., Larsen, R. J., & Griffin, S. (1985). Satisfaction with life scale. *Journal of Personality Assessment*, *49*(1), 71–75. https://doi.org/10.1207/s15327752jpa4901_13
Diener, E., Suh, E., & Lucas, R. E. (1999). Subjective well-being: Three decades of progress. *Psychological Bulletin*, *125*(2), 276–302. https://doi.org/10.1037/0033-2909.125.2.276
Dorling, D. (2015). *All that is solid. How the great housing disaster defines our times, and what we can do about it*. London: Penguin.
Elder, G., Johnson, M., & Crosnoe, R. (2003). The emergence and development of life course theory. In J. Mortimer & M. Shanahan (Eds.), *Handbook of the life course.* (pp. 3–19). New York, NY: Kluwer Academic. https://doi.org/10.1007/978-0-306-48247-2_1
Ellaway, A., & Macintyre, S. (1998). Does housing tenure predict health in the UK because it exposes people to di erent levels of housing related hazards in the home or its surroundings ? *Health & Place*, *4*(2), 141–150. https://doi.org/10.1016/S1353-8292(98)00006-9

Evans, G. W., & Kantrowitz, E. (2002). Socioeconomic status and health: the potential role of environmental risk exposure. *Annual Review of Public Health*, *23*(Figure 1), 303–31. https://doi.org/10.1146/annurev.publhealth.23.112001.112349

Evans, G. W., Wells, N. M., & Moch, A. (2003). Housing and mental health: a review of the evidence and a methodological and conceptual critique. *Journal of Social Issues*, *59*(3), 475–500. https://doi.org/10.1111/1540-4560.00074

Feijten, P., & Mulder, C. H. (2002). The Timing of Household Events and Housing Events in the Netherlands: A Longitudinal Perspective. *Housing Studies*, *17*(5), 773–792. https://doi.org/10.1080/0267303022000009808

Freedman, D., Thronton, A., Camburn, D., Alwin, D., & Young-DeMarco, L. (1988). The Life History Calendar: A Technique for Collecting Retrospective Data. *Sociological Methology*, *18*, 37–68. https://doi.org/10.2307/271044

Gambaro, L., & Joshi, H. (2016). Moving home in the early years: what happens to children in the UK? *Longitudinal and Life Course Studies*, *7*(3), 265–287.

Halpin, B. (2014). *SADI: Sequence Analysis Tools for Stata* (No. WP2014-03). Limerick.

Halpin, B. (2015). *Multiple Imputation for Categorical Time-series* (No. WP2015-02). Limerick.

Halpin, B. (2016). *Cluster analysis stopping rules in Stata* (No. WP2016-01).

Hildon, Z., Smith, G., Netuveli, G., & Blane, D. B. (2008). Understanding adversity and resilience at older ages. *Sociology of Health & Illness*, *30*(5), 726–40. https://doi.org/10.1111/j.1467-9566.2008.01087.x

Hiscock, R., Kearns, A., MacIntyre, S., & Ellaway, A. (2001). Ontological security and psycho-social benefits from the home: Qualitative evidence on issues of tenure. *Housing, Theory and Society*, *18*(1990), 50–66.

Hopton, J. L., & Hunt, S. M. (1996). Housing conditions and mental health in a disadvantaged area in Scotland. *Journal of Epidemiology and Community Health*, *50*(1), 56–61. https://doi.org/10.1136/jech.50.1.56

Hyde, M., Wiggins, R. D., Higgs, P., & Blane, D. B. (2003). A measure of quality of life in early old age: the theory, development and properties of a needs satisfaction model (CASP-19). *Aging & Mental Health*, *7*(3), 186–94. https://doi.org/10.1080/1360786031000101157

Jivraj, S., Nazroo, J., Vanhoutte, B., & Chandola, T. (2014). Aging and Subjective Well-Being in Later Life. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, 1–12. https://doi.org/10.1093/geronb/gbu006

Kahneman, D., & Krueger, A. (2006). Developments in the measurement of subjective well-being. *The Journal of Economic …*, *20*(1), 3–24. https://doi.org/10.1257/089533006776526030

Kendig, H. L. (1990). A life course perspective on housing attainment. In D. Myers (Ed.), *Housing demography: linking demographic structures and housing choices* (pp. 133–156). Madison: Univeristy of Wisconsin Press. https://doi.org/10.1136/bmjopen-2013-004476

Kendig, H. L., Byles, J. E., Loughlin, K. O., Nazroo, J. Y., Mishra, G., Noone, J., … Forder, P. M. (2014). Adapting data collection methods in the Australian Life Histories and Health Survey : a retrospective life course study. *BMJ Open*, *4*, e004476. https://doi.org/10.1007/s12062-015-9138-7

Kendig, H. L., & Nazroo, J. (2016). Life Course Influences on Inequalities in Later Life : Comparative Perspectives. *Journal of Population Ageing*, *9*(1-2), 1–7.

Kessler, R. C. (1997). THE EFFECTS OF STRESSFUL LIFE EVENTS ON DEPRESSION. *Annual Review of Psychology*, *48*(1), 191–214. https://doi.org/10.1146/annurev.psych.48.1.191

Lesnard, L. (2006). *Optimal Matching and Social Sciences: Describing Social Rhythms with Optimal Matching*. Paris.

Lucas, R. E. (2007). Adaptation and the Set-Point Model of Subjective Well-Being. *Current Directions in Psychological Science*, *16*, 75–79. https://doi.org/10.1111/j.1467-8721.2007.00479.x

Lupton, R. (2016). The Influence (s) of housing policies on the residential moves of families with young children. *Longitudinal and Life Course Studies*, *7*(3), 288–301. https://doi.org/10.14301/llcs.v7i3.377

Lupton, R., Tunstall, R., Sigle-Rushton, W., Obolenskaya, P., Sabates, R., Meschi, E., … Salter, E. (2009). *Growing up in social housing in Britain: A profile of four generations, 1946 to the present day*.

London.

Macintyre, S., Ellaway, A., Hiscock, R., Kearns, A., Der, G., & McKay, L. (2003). What features of the home and the area might help to explain observed relationships between housing tenure and health? Evidence from the west of Scotland. *Health and Place*, *9*(3), 207–218. https://doi.org/10.1016/S1353-8292(02)00040-0

Manzo, L. C., Kleit, R. G., & Couch, D. (2008). "Moving Three Times Is Like Having Your House on Fire Once": The Experience of Place and Impending Displacement among Public Housing Residents. *Urban Studies*, *45*(9), 1855–1878. https://doi.org/10.1177/0042098008093381

Marmot, M., Oldfield, Z., Clemens, S., Blake, M., Phelps, A., Nazroo, J., … Oskala, A. (2017). *English Longitudinal Study of Ageing: Waves 0-7, 1998-2015.*

Mulder, C. H., & Wagner, M. (1998). First-time Home-ownership in the Family Life Course : A West German - Dutch Comparison. *Urban Studies*, *35*(4), 687–713. https://doi.org/10.1080/0042098984709

Nakazato, N., Schimmack, U., & Oishi, S. (2011). Effect of Changes in Living Conditions on Well-Being: A Prospective Top-Down Bottom-Up Model. *Social Indicators Research*, *100*(1), 115–135. https://doi.org/10.1007/s11205-010-9607-6

Niedzwiedz, C. L., Katikireddi, S. V, Pell, J. P., & Mitchell, R. (2012). Life course socio-economic position and quality of life in adulthood: a systematic review of life course models. *BMC Public Health*, *12*(1), 628. https://doi.org/10.1186/1471-2458-12-628

Oishi, S., & Schimmack, U. (2010). Residential mobility, well-being, and mortality. *Journal of Personality and Social Psychology*, *98*(6), 980–994. https://doi.org/10.1037/a0019389

Otero-Rodríguez, A., León-Muñoz, L. M., Banegas, J. R., Guallar-Castillón, P., Rodríguez-Artalejo, F., & Regidor, E. (2011). Life-course socioeconomic position and change in quality of life among older adults: evidence for the role of a critical period, accumulation of exposure and social mobility. *Journal of Epidemiology and Community Health*, *65*(11), 964–71. https://doi.org/10.1136/jech.2010.113555

Pavot, W., & Diener, E. (1993). Review of the satisfaction with life scale. *Psychological Assessment*, *5*(2), 164. https://doi.org/10.1037/1040-3590.5.2.164

Radloff, L. S. (1977). The CES-D Scale: A Self-Report Depression Scale for Research in the General Population. *Applied Psychological Measurement*, *1*(3), 285–401. https://doi.org/10.1177/014662167700100306

Rossi, P., & Weber, E. (1996). The social benefits of homeownership: Empirical evidence from national surveys. *Housing Policy Debate*, *7*(1), 1–36. https://doi.org/10.1080/10511482.1996.9521212

Ryff, C. D., & Keyes, C. L. M. (1995). The structure of psychological well-being revisited. *Journal of Personality and Social Psychology*, *69*(4), 719. https://doi.org/10.1037/0022-3514.69.4.719

Savage, M., Devine, F., Cunningham, N., Taylor, M., Li, Y., Hjellbrekke, J., … Miles, A. (2013). A New Model of Social Class? Findings from the BBC's Great British Class Survey Experiment. *Sociology*, *47*(2), 219–250. https://doi.org/10.1177/0038038513481128

Schröder, M. (2011). *Retrospective Data Collection in the Survey of Health, Ageing and Retirement in Europe. SHARELIFE Methodology*. Mannheim: Mannheim Research Institute for the Economics of Ageing (MEA).

Steptoe, A., Breeze, E., Banks, J., & Nazroo, J. (2013). Cohort profile: the English Longitudinal Study of Ageing. *International Journal of Epidemiology*, *42*(6), 1640–8. https://doi.org/10.1093/ije/dys168

Stone, J., Evandrou, M., & Falkingham, J. (2013). The transition to living alone and psychological distress in later life. *Age and Ageing*, *42*(March), 366–372. https://doi.org/10.1093/ageing/aft006

Stovel, K., & Bolan, M. (2004). Residential Trajectories. Using optimal alignment to reveal the structure of residential mobility. *Sociological Methods & Research*, *32*(4), 559–598. https://doi.org/10.1177/0049124103262683

Vanhoutte, B. (2014). The Multidimensional Structure of Subjective Well-Being In Later Life. *Journal of Population Ageing*, *7*, 1–20. https://doi.org/10.1007/s12062-014-9092-9

Vanhoutte, B., & Nazroo, J. (2016a). Life Course Pathways to Later Life Wellbeing: A Comparative Study of the Role of Socio-Economic Position in England and the U.S. *Journal of Population Ageing*, *9*(1), 157–177. https://doi.org/10.1007/s12062-015-9127-x

Vanhoutte, B., & Nazroo, J. (2016b). Perspective: Life-history data. *Public Health Research & Practice*, *26*(3), 4–7. https://doi.org/10.17061/phrp2631630

Wahrendorf, M., & Chandola, T. (2016). A Life Course Perspective on Work Stress and Health. In J. Siegrist & M. Wahrendorf (Eds.), *Work Stress and Health in a Globalized Economy, The model of Effort Reward Imbalance* (pp. 43–66). Springer International. https://doi.org/10.1007/978-3-319-32937-6_3

Ward, K., Medina, J., Mo, M., & Cox, K. (2009). *ELSA Wave Three : Life History Interview. A user guide to the data*. London.

Windle, G. S., Burholt, V., & Edwards, R. T. (2006). Housing related difficulties, housing tenure and variations in health status: Evidence from older people in Wales. *Health and Place*, *12*(3), 267–278. https://doi.org/10.1016/j.healthplace.2004.08.010

Wood, A. M., Taylor, P. J., & Joseph, S. (2010). Does the CES-D measure a continuum from depression to happiness? Comparing substantive and artifactual models. *Psychiatry Research*, *177*(1-2), 120–123. https://doi.org/10.1016/j.psychres.2010.02.003

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Moving up, feeling down: socioemotional health during the transition into college

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Abstract

Moving from high school to college is a critical juncture in socioemotional health, and how young people fare likely depends on their academic settings and experiences. To examine variation in trajectories of depressive symptomatology among a sample of US youth who transition from high school into college, this study applied growth mixture modeling to data from the National Longitudinal Study of Adolescent to Adult Health, which revealed multiple patterns of symptomatology over time that ranged from healthy to unhealthy. Adolescents appeared to have the healthiest trajectories when they experienced consistently competitive academic settings in high school and college. Overall, transitioning into college was a period of socioemotional vulnerability for some and wellbeing for others, but challenging curricula and contexts across this transition could differentiate between the two.

Keywords

Socioemotional well-being; depressive trajectories; college-going; academic context; curricular position

In the US, rates of college-going have reached unprecedented levels with increasing numbers of young people pursuing the economic, social, and health benefits of higher education (Goldin & Katz, 2008; Mirowsky & Ross, 2003). As youth flood into college and reach for the long-term returns to a degree, they move between distinct high school and college settings during a period of developmental sensitivity. Consistencies and disjuncture between these two sets of settings therefore have implications for their wellbeing beyond their academic prospects (Benner, 2011; Eccles et al., 1993). Indeed, college-going is likely to be a critical juncture in trajectories of socioemotional health during the early life course.

This study, therefore, uses a life-course framework to shed light on the role of the transition into college in shaping young people's socioemotional health. The first aim is to identify variation in wellbeing among college-going youth, which I do by classifying trajectories of depressive symptoms among college-goers in the National Longitudinal Study of Adolescent to Adult Health (Add Health). The second aim is to examine how the settings and experiences of high school and college are related to this socioemotional variation, which I do by predicting socioemotional trajectories by the match or mismatch of academic settings and curricular experiences at each educational stage (defined by school competitiveness and pathways of science and math course-taking). In doing so, this study identifies the contexts in which socioemotional difficulties among college-goers may be most and least pronounced. The results inform efforts to encourage positive wellbeing among the increasingly diverse

group of young people who access higher education in the US.

Socioemotional variability and the transition to college

Adolescence is a time of rapid change and growth, when individuals struggle to establish their identities (i.e., developing a sense of who they are and where they fit in the world) and, in the process, individuate from parents and set themselves up for adulthood (Kroger, 2007). This process has socioemotional implications, as individuals develop physically, socially, and psychologically at different rates and struggle with competing demands and expectations from peers and adults (Cavanagh, Riegle-Crumb & Crosnoe , 2007). As young people seek to leave adolescence behind and enter adulthood—a developmental stage often referred to as emerging adulthood—they become financially independent, involved in intimate romantic relationships, and prepare for stable adult employment (e.g., Arnett, 2015). While navigating these transitions, a hallmark of this life course stage is that many youth will also complete high school and enter college (Johnson, Crosnoe, & Elder, 2011). Their developmental trajectories and institutional pathways are therefore closely connected to each other in a two-way exchange (South, Haynie & Bose, 2007; Staff & Kreager, 2008).

This two-way exchange is closely aligned with the basic focus of life course theory, which is a valuable frame for understanding the transition into college. This perspective views transitions as specific points of change in status and/or setting that act as mechanisms of deflection and intensification in general trajectories of adjustment and functioning, the concrete periods in which life course trajectories are likely to change directions (Elder, 1998; George, 1993). The transition from high school into college is indeed a concrete change in status and setting, and, as such, is likely to be a critical period in which long-term educational trajectories take new shape. It is a short-term experience embedded in a long-term trajectory, and how young people fare during this short-term experience can create stability — or disjuncture — between past histories and future prospects. In socioemotional terms, how might the transition into college look? On average, individuals who go to college thrive. Other adolescents, conversely, may experience difficulties with the transition from high school to college. The pressure of the transition along with the demands of navigating a new social environment may lead to stress. Going to college often means leaving home, making new friends, and worrying about the future. Despite the promise of personal growth and the excitement of new opportunities, college-goers may fear failure. Even when these stressful and difficult experiences are comparatively short-term 'growing pains', they may have long term effects by influencing grade point average or coursework, for example. Overall, distress associated with college-going may shape the cumulative trajectories of adolescents over broader periods of time.

My first aim, therefore, is to highlight variation in how adolescents experience the transition into college. I use depressive symptomatology to capture socioemotional adjustment because such symptoms indicate difficulty during the transition. I hypothesise that adolescents will differ in their socioemotional health across this transition, such that some adolescents will suffer (defined by rising depressive symptomatology) while others will have stable trajectories.

Academic setting and curricular position

A major tenet of life course theory is that developmental trajectories (e.g., socioemotional adjustment) unfold within social contexts. Contexts — such as institutional contexts like educational systems — provide opportunities for different experiences, place constraints on individual behaviour and relationships, introduce stressors and supports, and serve as sites for cultural socialisation into prevailing norms and values (Bronfenbrenner & Morris, 1998). Thus, the transition into college can be better understood by anchoring it within such institutional contexts. The transition into college is one piece of a sequence of institutional experiences within the educational system. Consequently, it needs to be studied in relation to how the pieces of this sequence fit together, past and present. This sequence has multiple dimensions, including the school settings and the curricular experiences of young people over time.

First, one aspect of the school setting concerns academic competitiveness — how achievement-oriented and successful are the students in a given school? School-level influences not only during the transition to college but also pre-transition may encourage or prevent individuals from realising their educational capabilities. The courses adolescents take in high school are highly influenced by the school itself (Frank et al., 2008). Individuals in more competitive high schools, therefore, are more likely to develop skills that facilitate ability to thrive in any academic setting. Indeed, the effects of high school settings persist, and academic context and high school curriculum are predictive of bachelor degree completion (Adelman, 1999). Likewise, more selective colleges may generate more competitive environments that encourage focus in the classroom and motivation despite difficulties that the transition to college may present. No exposure to competitive and selective academic settings, on the other hand, may leave individuals unprepared to realise their academic capabilities or persisting through difficulties. Adolescents in these less competitive and selective environments during high school may take their education less seriously and may therefore experience distress upon transitioning to higher education. The potential importance of educational settings for socioemotional trajectories may, therefore, vary not only by high school or college context but also by how these contexts align.

Second, one aspect of curricular position concerns exposure to Science, Technology, Engineering and Mathematics (STEM) curricula that are often touted as positioning youth for socioeconomic mobility and security in the modern economy. The foundation for STEM is set with high school maths and science coursework, as courses in high school have implications for later educational experiences. High-level STEM coursework in high school is associated with college attendance and graduation in the US (Adelman, 1999; Schneider, Swanson, & Riegle-Crumb, 1997). These advanced courses are referred to as the STEM 'pipeline' (Burkham & Lee, 2003), and US policy frequently directs efforts towards maintaining the progression of students through the pipeline. Beyond high school, research has shown STEM majors are a foundation for economic security after college and, notably, for academic anxiety in college (Schneider & Keesler, 2007). Together, advanced math and science coursework in high school and STEM majors in college may prepare adolescents for the curricular demands of higher education and, ultimately, for highly favored employment in U.S. society, thereby having implications for wellbeing. If so, how high school and college curricular pathways intersect might also matter to socioemotional health. Having high-level curricular position in high school (as indicated by advanced math and science coursework) and a valued curricular focus in college (as indicated by declaration of a STEM major) may prevent individuals from experiencing distress during the transition from high school to college.

Whether considering academic settings or curricular pathways, the experiences of young people in high school or college likely matter, independently, to their adjustment during the transition into college. Yet, life course theory suggests that continuity and change in experiences between high school and college matters—in other words, do settings and experiences across high school and college match up or not? Certainly, there is likely to be consistency across levels, with students from more competitive high schools often going into more selective colleges and the math/science pipeline flowing into STEM sectors of higher education (Berryman, 1983). To the extent that consistency protects youth from having to adapt to a major disjuncture, youth whose high school and college settings and positions match up will be better able to adjust to college than those whose settings and positions do not. Match/mismatch matters above and beyond the pressures put forward by any one setting or position at any one time. For example, navigating a STEM major in a selective college may come with a great deal of expectation and stress for any student, but less so for students who came into this situation with advanced math/science credentials from a competitive high school. Thus, the match/mismatch between high school and college is a qualifier to the experience of college.

My second aim is, therefore, to identify who is at risk of distress during this transition based on their high school and college experiences and how the match (or mismatch) of academic setting and curricular position across high school and college may

prevent (or facilitate) depressive symptoms. The hypothesis is that adolescents who have experienced a disjuncture (or mismatch) between the settings and/or curricula of their high schools and colleges will face more socioemotional difficulty than others.

Methods

Data and sample

Add Health is a nationally representative survey of US adolescents in secondary school that launched in 1994 with an in-school survey and followed adolescents into young adulthood (Harris et al., 2009). Schools included in the study were selected by region, urbanicity, school size, school type, and racial composition based on a stratified sampling design. In-school data collection of 90,118 students in 132 schools had a census-like structure for each school, allowing for the aggregation of data across all respondents in a school. The in-school survey was also used to generate a nationally representative subsample of 20,745 students. This group was selected for Wave I in-home interviews in 1995 and was followed over the course of four waves. Wave II in-home interviews were conducted in 1996 and excluded participants who were Wave I in their last year of secondary school. In-home interviews were also conducted in 2001-2002 and 2007-2008 for Wave III and Wave IV, respectively. As part of the companion Adolescent Health and Academic Achievement (AHAA) study, 90% of the Wave III participants signed a transcript release form to grant access to their high school transcripts (Muller et al., 2007).

Prior to higher education (e.g., college), students in the US complete 12 years of schooling. Students begin primary school around age six and complete five to six years before starting secondary school. Secondary schools in the US have two programs: middle school (or junior high school) and high school, the latter of which is generally years nine to 12. Add Health surveyed students in both middle and high school, but the analytical sample for this study included only adolescents who were in high school at Wave I such that this paper captures only the educational transition from high school to college (rather than from middle to high school). The analytical sample was further restricted to students who had enrolled in either a two-year or four-year college after graduating from high school, persisted through Wave III, and had valid sampling weights. Youth who missed Wave II but came back into the study for Wave III were excluded given that they would be systematically missing on measures of depressive symptomatology necessary for estimation of socioemotional trajectories. Approximately 6,000 adolescents in the Add Health sample were not in high school at Wave I; of these, about 8,000 did not enroll in college after high school graduation. An additional 2,000 respondents did not have valid Wave III sampling weights, which included respondents who were excluded from Wave II data collection. Together, therefore, these filters resulted in a sample of 4,468 adolescents. Respondents in the final analytic sample were in year 10 of schooling (*M* Wave I grade = 10.2, *SD* = 0.9) such that, on average, the sample went to college two years after Wave I interview.

Measures

Depressive symptomatology. Add Health included a modified Center for Epidemiologic Studies-Depression scale in all waves (Pereira, Deeb-Sossa, Harris & Bollen, 2005). Youth reported the frequency of nine feelings in the past week (e.g., "You felt that you could not shake off the blues, even with help from your family and your friends," "You felt sad"). Responses, which ranged from 0 (never or rarely) to 3 (most of the time or all of the time), were summed into a 27-point scale.

Academic setting. For high school, academic setting was operationalised with a standardised composite variable ('academic pressure') based on the school means (aggregated from all individual responses in the school on the in-school survey) of GPA (standard four-point scale), maths/science enrollment, and educational expectations (likelihood the student will graduate from college) as well as the administrator report of the percentage of seniors who go to college (Crosnoe, Riegle-Crumb & Muller, 2007). This school-level measure is akin to measures in the educational literature gauging the emphasis on and pressure for achievement in schools (Shouse, 1996). Each item in the composite variable was standardised, and the final scale was the mean of the four z-scores (range of -1.37 to 1.48). For post-

secondary institutions, academic setting was operationalised with a selectivity variable provided by the AHAA team. Based on the SAT scores of incoming students in each institution, it ranged from 1 to 20, with a score of 1 indicating the most academically selective institutions that ranked in the top 5%, and a score of 20 representing the least academically selective institutions that ranked in the bottom 5% in terms of median SAT scores (Riegle-Crumb, Muller, Grodsky, Langenkam & Pearson, 2008). To gauge transitional matches and mismatches, the two academic setting variables were dichotomised and cross-classified. The high school variable — based on z-scores — was dichotomised at one-half standard deviation above the mean score to indicate low versus high competitiveness. The college variable was also dichotomised at the one-half standard deviation above the mean score to indicate low versus high selectivity. Values on the two variables were combined to create four categories: high competitiveness to high selectivity, high to low, low to high, and low to low. Low to low was the reference used in analyses.

Curricular position. Curricular position was operationalised by maths and science coursework across the transition from high school to college. Mathematics and science enrollment in American secondary education is largely standardised into a hierarchy of less to more demanding classes. The ordinal maths and science variables available from the AHAA transcript data captured this hierarchical pattern of course-taking (Riegle-Crumb et al, 2008). Measured as the highest point reached in high school, the math and science coursework variables ranged from 0 (no maths) to 9 (calculus) in maths and 0 (no science) to 6 (physics), respectively. For college curricular position, a binary STEM major variable (1 = science, technology, engineering, or math major, 0 = all other majors) was created based on self-reports of major. Majors were categorised as STEM or not-STEM using the degree program list maintained by the Department of Homeland Security. Again, these variables were dichotomised and cross-classified. Maths/science coursework measures were dichotomised at completion of both Algebra II and chemistry or higher to designate advanced coursework that has been shown to be most predictive of college preparedness (Adelman, 2006). This measure was combined with the college STEM variable to create four categories: went from advanced high school maths/science coursework into a STEM college major, advanced to non-STEM, non-advanced to STEM, and non-advanced to non-STEM). Non-advanced to non-STEM was the reference used in analyses.

Covariates. Several controls accounted for sociodemographic position: gender (1 = male), Wave I age, race/ethnicity (non-Hispanic white, non-Hispanic black, non-Hispanic Asian, Hispanic, and other/multi-racial), family structure (1 = lived with both biological parents at Wave I, 0 = other family form), and parent education (an ordinal variable ranging from 1, less than high school, to 5, post-college degree). Control variables were also measured to account for the broader institutional contexts in which students' academic settings and curricular positions were measured. To gauge general (non-maths/science-specific) status in high school, an honours English variable was constructed based on the number of honors English courses a respondent took in high school (range: 0 to 6), and cumulative high school GPA (on a 4.0 scale) at the end of school was measured, both based on transcript data. Additional school level controls were drawn from the in-school survey and included school sector (private versus public), the school size (in hundreds), the proportion of students with at least one college-going parent, the proportion of high school seniors enrolled in college preparatory classes, and the proportion of the high school students that identified as white. A dichotomous variable indicated whether the college that the respondent attended was a private institution (versus public).

Analytical strategy

The first step was to identify variation in trajectories of depressive symptomatology among college-goers as they transition from high school to college. Growth mixture modeling (GMM) is a type of structural equation model estimated in Mplus (Muthén & Muthén, 1998-2008) that identifies major heterogeneities in growth curves in a sample. This statistical technique is based on the theory that several categories of trajectories may occur within a population. Here, it produced a categorical variable grouping cases according to the various types of

trajectories of depressive symptomatology followed across Waves I, II, and III. The appropriate number of categories (or classes) was determined through several criteria including a log-likelihood test, Bayesian information criteria (BIC), and sample size adjusted BIC (ABIC).

Once GMM identified classes, the second step was to estimate the association of the match/mismatch of academic setting and curricular position with categories of socioemotional trajectories. Because four trajectories were identified, multinomial logistic regression in Stata (StataCorp, 2011) was used to predict trajectory by academic setting variables, curricular position variables, and their match/mismatch dummy variables, controlling for all measured covariates. Missing data were estimated with multiple imputation and longitudinal sampling weights were applied to all models. Additionally, all analyses adjust standard errors to account for the clustering of adolescents in schools, per the Add Health sampling design.

Results

Trajectories of depressive symptoms among college-goers

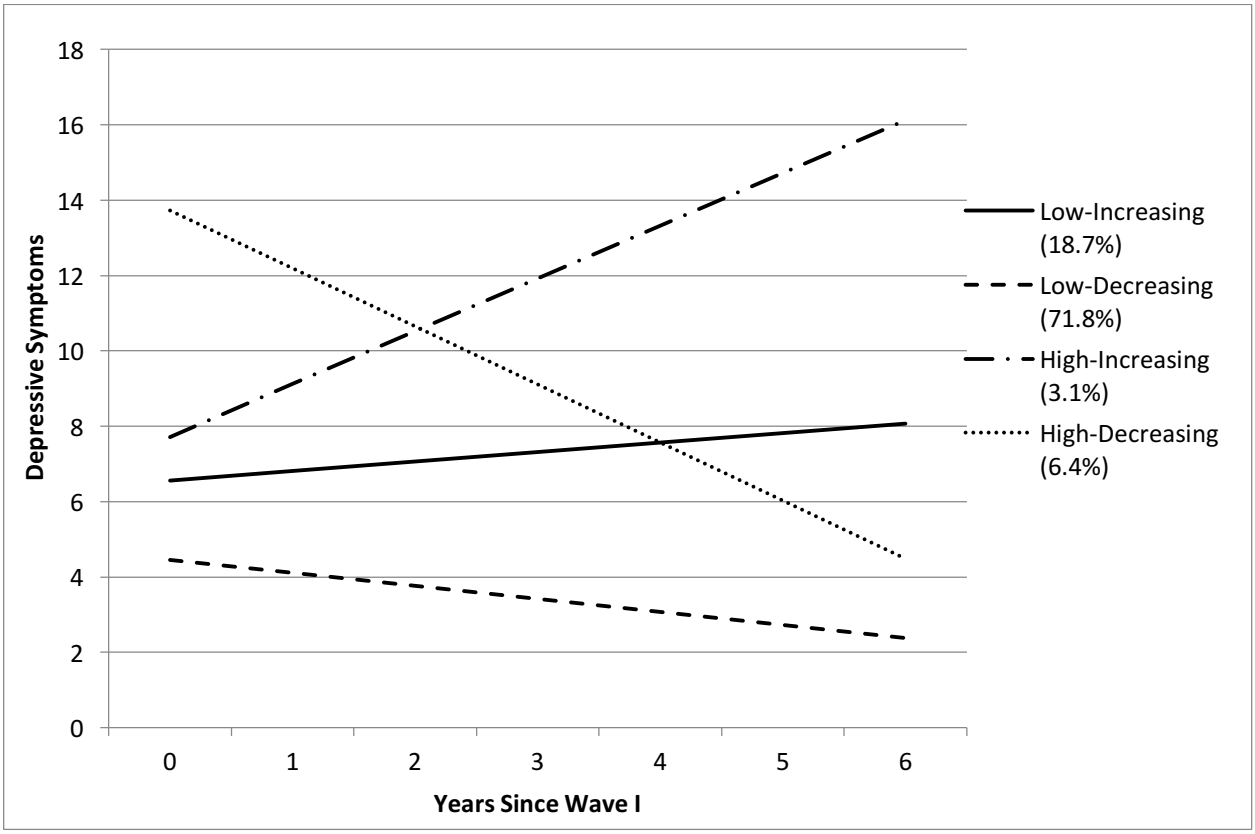
To test my first hypothesis and explore variation in the socioemotional health of adolescents transitioning from high school to college, GMM identified four main classes of depressive symptomatology across Waves I through III. Table 1 provides the criteria used to make this determination, and Figure 1 shows the trend lines of the classes. For log-likelihood, BIC, and ABIC measures of fit, smaller absolute values indicate better model fit; thus, the relative change from the *k*-class to *k-1*-class is important in assessing fit. For the Lo-Mendell Rubin (LMR) adjusted likelihood ratio test, a significant *p*-value suggests that the *k*-class model is better fitting than the *k-1*-class model. In this case, the four class model was the best fit of the data according to the relative changes in log-likelihood, BIC, and ABIC values and LMR *p*-value. The four identified trajectories also presented substantively meaningful and useful classes.

[**Table 1. GMM criteria for class determination**

	1 Class	2 Classes	3 Classes	4 Classes	5 Classes
Log-likelihood	-36024.102	-35520.757	-35271.334	-35088.191	-35019.651
# parameters	8	11	14	17	20
BIC	72115.443	71133.965	70660.335	70319.261	70207.396
ABIC (AIC)	72064.205	71063.514	70570.669	70210.381	70079.302
LMR *p*-value		0.0002	0.0087	0.0072	0.6188
Entropy		0.919	0.859	0.844	0.826
Distribution		7.09%, 92.91%	84.00%, 7.01%, 9.00%	2.89%, 16.81%, 74.51%, 5.80%	18.30%, 68.44%, 3.81%, 2.78%, 6.68%

Note: *n* = 4,468

Figure 1. Socioemotional trajectories across the transition to college determined by GMM



Note: *n* = 4,468; transition to college occurred 1-4 years after Wave I interview

The four classes included adolescents with moderate levels of depressive symptoms that increased slightly during the transition period (labeled Slight-Increasing), those with consistently low levels of symptoms that saw some decline during this transition period (labeled Low-Decreasing), those with moderate levels of depressive symptoms in high school that increased sharply over the transition period (labeled Sharp-Increasing), and those with high levels of symptoms that decreased during this transition period (labeled High-Decreasing). The majority group was the Low-Decreasing class, suggesting that approximately 70% of adolescents who move from high school to college fared quite well across this transition period. Another 20% of adolescents belonged to the Slight-Increasing trajectory, experiencing some heightened distress. The third trajectory, the Sharp-Increasing class, represented only approximately 3% of the adolescents in the sample, but it was particularly concerning given the troubling rise in distress experienced across the transition into college. The High-Decreasing trajectory, on the other hand, comprised 6% of the adolescents in the sample who had poor socioemotional health in high school that improved as they moved into college. In sum, I found support for my first hypothesis that adolescents will differ in several ways in their socioemotional health across the transition to college, such that some adolescents will suffer (defined by rising depressive symptomatology) as they make this transition while others will have stable trajectories across this period.

To understand the composition of these categories of socioemotional trajectories, Table 2 presents descriptive statistics. Variation in academic context and curricular position can be seen across classes. In terms of academic context, 24% of the Low-Decreasing class, for example, moved from highly competitive high schools to highly selective colleges as compared to only 14% of the High-Decreasing class. The Slight-Increasing, Sharp-Increasing and High-Decreasing classes had higher proportions of youth in uncompetitive to non-selective schools (37-44%), whereas the Low-Decreasing class had the lowest proportion of students in this school-to-college pattern (31%). In terms of curricular position, nearly 6% of the Low-Decreasing class moved from advanced maths/science in high school to STEM major in college compared to less than 1% of the Sharp-Increasing class. The High-Decreasing class had the highest proportion of youth who were not in advanced maths/science in high school and not in STEM in college (63%) compared to the Low-Decreasing class, which contained the lowest proportion of young people following this pattern (49%).

Table 2. Descriptive statistics by depressive trajectory

	Slight-Increasing *n* = 861 Mean (SD)/ %		Low-Decreasing *n* = 3,199 Mean (SD)/ %		Sharp-Increasing *n* = 145 Mean (SD)/ %		High-Decreasing *n* = 263 Mean (SD)/ %	
Depressive symptoms								
Wave I	6.91	(3.80)	4.52	(3.11)	7.94	(5.17)	14.38	(3.42)
Wave II	7.05	(3.96)	4.38	(3.17)	8.43	(4.56)	12.99	(3.93)
Wave II	8.54	(1.80)	2.38	(1.79)	16.28	(2.58)	4.59	(2.50)
Academic context								
High school competitiveness	-0.04	(0.54)	0.09	(0.57)	0.02	(0.50)	-0.01	(0.49)
College selectivity	11.41	(4.11)	10.55	(4.09)	11.18	(3.73)	12.09	(4.10)
Match/mismatch of academic context								
High competitive to high selective	18.12		24.20		19.31		13.69	
High competitive to low selective	5.23		4.94		5.52		6.08	
Low competitive to high selective	37.75		39.79		38.62		36.50	
Low competitive to low selective	38.91		31.07		36.55		43.73	
Curricular position								
Cumulative math coursework	6.56	(1.63)	6.96	(1.53)	6.57	(1.50)	6.50	(1.60)
Cumulative science coursework	4.65	(1.09)	4.86	(1.06)	4.59	(1.09)	4.48	(1.15)
STEM major	6.39		7.60		2.76		3.80	
Match/mismatch of curricular position								
Advanced math/science to STEM	4.30		5.53		0.69		2.28	
Advanced math/science to not STEM	35.54		43.61		35.86		33.08	
Not advanced math/science to STEM	2.09		2.06		2.07		1.52	
Not advanced math/science to not STEM	58.07		48.80		61.38		63.12	

Table 2, continued.

	Slight-Increasing *n* = 861 Mean (SD)/ %		Low-Decreasing *n* = 3,199 Mean (SD)/ %		Sharp-Increasing *n* = 145 Mean (SD)/ %		High-Decreasing *n* = 263 Mean (SD)/ %	
Sociodemographic covariates								
Age	15.98	(1.06)	15.96	(1.10)	15.89	(1.07)	16.13	(1.00)
Parent education	3.08	(1.25)	3.38	(1.22)	3.16	(1.23)	3.24	(1.28)
Two-bio parent household	58.42		64.83		55.17		55.51	
Male	44.60		47.11		28.28		31.56	
Race/ethnicity								
Non-Hispanic white	44.13		54.92		40.69		47.91	
Non-Hispanic black	19.16		17.85		27.59		17.87	
Hispanic	17.65		14.57		16.55		16.35	
Non-Hispanic Asian	13.47		8.03		7.59		13.31	
Other/ multi-racial	5.57		4.63		7.59		4.56	
School covariates								
HS honors English	0.80	(1.29)	0.95	(1.41)	0.85	(1.34)	0.81	(1.32)
HS cumulative GPA	2.75	(0.70)	2.93	(0.68)	2.80	(0.69)	2.69	(0.74)
HS private	6.97		9.85		7.59		4.56	
HS size (hundreds)	14.18	(8.39)	13.33	(8.24)	15.67	(7.92)	13.83	(7.30)
HS proportion college-going parents	0.41	(0.15)	0.43	(0.16)	0.42	(0.14)	0.40	(0.13)
HS percentage college-prep seniors	58.12	(26.76)	60.38	(26.69)	58.99	(26.25)	57.87	(23.15)
HS racial composition (proportion white)	0.46	(0.34)	0.52	(0.33)	0.44	(0.34)	0.47	(0.34)
College private	9.64		12.57		10.34		9.51	

Note: *n* = 4,468

Academic setting, curricular position, and socioemotional trajectory

To accomplish my second aim and to identify who is at risk for distress during this transition based on their high school and college experiences, the first step was to determine how academic setting and curricular position in high school and college were associated with socioemotional trajectory. The initial multinomial logistic regression to predict membership in these four classes therefore included academic setting and curricular position variables from high school and college, along with the full set of sociodemographic and school covariates (see Table 3, with the Low-Decreasing class as the reference). Competitive high school settings ($p < .05$) predicted lower risk of membership in the Slight-Increasing class (vs. Low-Decreasing), advanced maths coursework during the high school years ($p < .05$) predicted lower risk of membership in the Sharp-Increasing class (vs. Low-Decreasing), and advanced science coursework ($p < .05$) predicted lower risk of membership in the High-Decreasing (vs. Low-Decreasing). High school settings and curricular pathways were, therefore, associated with socioemotional trajectories across the transition to college independent of college settings and curricular pathways. College setting and curricular variables were not significantly associated with class membership.

Table 3. Multinomial logistic regression predicting class membership by academic setting and curricular position

	Slight-Increasing *RRR (SE)*	Sharp-Increasing *RRR (SE)*	High-Decreasing *RRR (SE)*
Academic setting			
High school competitiveness	0.625 *	1.053	0.921
	(0.114)	(0.465)	(0.272)
College selectivity	0.989	0.987	1.059
	(0.018)	(0.044)	(0.043)
Curricular position			
Maths coursework	0.954	0.786 *	1.060
	(0.048)	(0.093)	(0.067)
Science coursework	0.985	0.973	0.806 *
	(0.059)	(0.153)	(0.078)
STEM major	0.945	0.767	0.555
	(0.210)	(0.599)	(0.292)

Note: n = 4,468; relative risk ratios presented (*RRR*) with standard errors (*SE*); reference group for socioemotional trajectory is Low-Decreasing; models control for sociodemographic covariates including age, parent education, family structure, gender, race/ethnicity; models also control for school covariates including high school English course-taking, GPA, sector, size, college-going parents, college-prep courses for seniors, and racial composition, along with college sector; * $p < .05$, ** $p < .01$, *** $p < .001$.

Having examined the independent role of high school and college settings and curricular positions in trajectories of depressive symptomatology, the next step was to consider their dual or synergistic roles; in other words, exploring matches and mismatches across high school and college (see Table 4, with the Low-Competition/Less-Selective group as the reference for setting and Not Advanced/Not STEM group as reference for curriculum but all pairwise comparisons estimated in ancillary models). In terms of academic setting, the consistency or disjuncture between high and low demands across high school to college was not significantly associated with socioemotional trajectory. Turning to curricular position, consistency across the two sides of the transition seemed to matter. Specifically, as compared to adolescents who moved from low-level math and science in high school to non-STEM majors in college, adolescents who transitioned from advanced maths and science curriculum in high school to STEM majors in college were significantly less likely to be in the Sharp-Increasing ($p < .001$) or High-Decreasing ($p < .05$) classes of depressive symptomatology (relative to the Low-Decreasing class). Adolescents in more challenging curricula appeared to be somewhat protected against trajectories of socioemotional health characterised by troubling rises in depressive symptoms and against those characterised by heightened distress that improves across the transition to college.

Table 4. Multinomial logistic regression predicting class membership by match/mismatch of academic setting and curricular position

	Slight-Increasing *RRR (SE)*	Sharp-Increasing *RRR (SE)*	High-Decreasing *RRR (SE)*	Slight-Increasing *RRR (SE)*	Sharp-Increasing *RRR (SE)*	High-Decreasing *RRR (SE)*
Academic setting						
High competitive to high selective	1.021	0.806	0.786			
	(0.233)	(0.425)	(0.305)			
High competitive to low selective	1.011	0.887	1.221			
	(0.237)	(0.490)	(0.505)			
Low competitive to high selective	0.899	0.718	0.817			
	(0.141)	(0.251)	(0.253)			
Curricular position						
Advanced maths/science to STEM				0.832	0.006 ***	0.294 *
				(0.203)	(0.006)	(0.181)
Advanced maths/science to not STEM				0.990	0.739	0.700
				(0.126)	(0.222)	(0.175)
Not advanced maths/science to STEM				1.176	2.587	0.734
				(0.403)	(2.247)	(0.631)

Note: n = 4,468; relative risk ratios presented (*RRR*) with standard errors (*SE*); reference group for socioemotional trajectory is Low-Decreasing; reference group for academic setting is Low Competitive to Low Selective; reference group for curricular pathways is Not Advanced Maths/Science to Not STEM; models control for sociodemographic covariates including age, parent education, family structure, gender, race/ethnicity; models also control for school covariates including high school English course-taking, GPA, sector, size, college-going parents, college-prep courses for seniors, and racial composition, along with college sector; *p < .05, **p < .01, ***p < .001.

In sum, I did not find support for my second hypothesis that a disjuncture (or mismatch) between the settings and/or curricula of their high schools and colleges will be associated with more distress. Instead, results suggest that more academic challenges in science and maths course-taking across high school — and consistency in these challenges over the transition to college — was associated with being in latent classes of depressively symptomatology that suggested better socioemotional health across the transition into college. I ran sensitivity analyses testing the consistency of my results with other methods by regressing the probabilities of membership in each latent class on educational attainment and all covariates (Bray, Lanza, & Tan, 2015). Results (not shown) are consistent with the findings presented. One slight exception is that cumulative maths sequence was only marginally significantly associated with reduced probability of membership in the Sharp-Increasing (compared to a significant association at p <.05 in Table 3).

Discussion

The pool of American youth transitioning from high school to college has expanded, and more adolescents than ever are attempting to earn a college degree (Jacob & Wilder, 2010; Reynolds, Stewart, MacDonald & Sischo , 2006). In turn, the pool of college-goers is increasingly diverse. Thus, advantages associated with college-going are likely to mirror the heterogeneity of incoming students. Indeed, when college-goers interact with new academic institutions and face new challenges in the classroom, some may thrive and others may falter. Socioemotional distress during the transition may, in turn, launch adolescents on trajectories of diminished wellbeing. The goals of this study, therefore, were to identify variation in trajectories of socioemotional health across the transition from high school to college and to determine how consistency or disjuncture across academic settings and curricular position helped to explain this variation.

Although many adolescents did quite well when transitioning from high school into college with greater than 70% showing a healthy socioemotional trajectory, others seemed to be vulnerable during this transitional period. In fact, greater than 20% of student experienced increases in depressive symptoms across the transition. Further analyses suggested that, independent of college setting or curriculum, the academic competitiveness of an adolescent's high school and their math and science course-taking in high school were associated with trajectories of socioemotional health as he or she transitioned into college. Consistency in maths and science curriculum across high school to college, furthermore, appeared to protect adolescents from trajectories of socioemotional distress during this transition. The match or mismatch of the academic setting, on the other hand, was not associated with socioemotional trajectories. These results are intriguing and raise two important questions.

First, why were curricular matches more important than *mis*matches in predicting trajectories of depressive symptomatology during the transition to college? Perhaps students enrolled in more science and maths courses may be more capable of handling the transition to higher education due to educational skills stressed in these secondary school classrooms. This explanation is consistent with previous work showing that high school setting influences course-taking in college, which, in turn, predicts bachelor degree completion (Frank et al., 2008; Adelman, 1999) and with previous work showing that pre-collegiate academic performance is associated with majoring in STEM (Rask, 2010). Increased expectations of student performance and high requirements for maths and science coursework, therefore, may support socioemotional health during the transition into college. Such possibilities need to be considered more fully by building on what I have done here. Persistence through college, for example, was not considered. Although some research suggests that adolescents who enter college and drop-out do not suffer long-term emotional distress (Reynolds & Baird, 2010), our research highlights a subset of adolescents for whom college-going is associated with poor socioemotional health. We need to know more about how the match in curriculum across the transition to college might matter for the socioemotional health of those who do not persist.

Second, why was consistency or disjuncture across academic setting not related to trajectories of socioemotional wellbeing? Perhaps going to college is

less about the academic setting from which one comes and more about the relationships and support that individuals have to deal with an important life course transition. When faced with risk, youth may draw on protections that buffer against that risk, so that two youth in the same situation fare quite differently. This buffering could apply to socioemotional adjustment during the transition into college in general or more particularly to the role of match/mismatch in shaping adjustment during this transition (Steinberg, Brown & Dornbusch, 1996). Possibly self-selection into college occurs. Adolescents with better developed socioemotional coping skills may be more likely to go to college and also more likely to experience a smooth transition. Likewise, self-selection into academic settings and curricular pathways may also occur. For example, youth on increasing trajectories of depressive symptoms in high school who transition into college may be less likely to transition from advanced maths or science to a STEM major. Future studies need to better account for this potential bias, including by leveraging fixed effects and instrumental variable designs. Further, while the focus of the current study is on adolescents who enter college after high school, non-college-goers may face risks for socioemotional health when making similar transitions into work or family life at this developmental stage. More broadly, therefore, research should consider how settings and experiences that match or mismatch across various simultaneous transitions may be associated with socioemotional risks for a more diverse group of young people.

An additional limitation of the current study was the potential for measurement error in the academic setting and curricular position variables. Sensitivity analyses considered different thresholds for the dichotomisation of academic settings. When high school competitiveness and college selectivity were dichotomised at one standard deviation above the mean, multinomial logistic regression results suggested that youth in highly competitive high schools who transition to highly selective colleges were at significantly lower risk of membership in Slight-Increasing and High-Decreasing trajectories. Using this dichotomisation, however, resulted in an insufficient number of respondents in the high competitive to low selective environments.

Given that earning a college degree has lifelong social, economic, and health returns and given how many adolescents attend college in pursuit of these returns (Mirowsky & Ross, 2003), studying what happens during the transition into college is important. This importance extends beyond the economic and educational literatures into research on adolescent health, and this study contributes to that goal. Understanding which adolescents are best positioned to capitalise on advantages (or reverse disadvantages) of their early years and elucidating health implications of these transitional experiences can promote the future prospects of today's youth not only by encouraging adolescents' more immediate wellbeing, but also by comprehending how educational influences and transitions contribute to longer-term health and mortality.

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References

Adelman, C. (1999). "Answers in the tool box: Academic intensity, attendance patterns, and bachelor's degree attainment." Washington, DC: Government Printing Office. U.S. Department of Education, Office of Educational Research and Improvement.

Adelman, C. (2006). *The toolbox revisited: Paths to degree completion from high school through college.* Washington, DC: U.S. Department of Education. < www.ed.gov/rschstat/research/pubs/toolboxrevisit/index.html>.

Arnett, J.J. (2015). *Emerging adulthood: The winding road from the late teens through the twenties.* New York, NY: Oxford University Press. 2nd ed. https://doi.org/10.1093/oxfordhb/9780199795574.013.9

Benner, A.D. (2011). "Latino adolescents' loneliness, academic performance, and the buffering nature of friendships." *Journal of Youth and Adolescence* 40:556–67. https://doi.org/10.1007/s10964-010-9561-2

Berryman, S. E. (1983). *Who will do science? Trends, and their cause in minority and female representation among holders of advanced degrees in science and mathematics.* New York, NY: Rockefeller Foundation.

Bray B.C., Lanza S.T., Tan X. (2015). "Eliminating bias in classify-analyze approaches for latent class analysis." *Structural Equation Modeling* 22: 1-11. https://doi.org/10.1080/10705511.2014.935265

Bronfenbrenner, U., & Morris, P. (1998). "The ecology of developmental processes." In W. Damon (Ed.), *Handbook of child psychology, Vol. 1* (pp.993–1028). New York: Wiley.

Burkam, D.T., and Lee, V.E. (2003). "Mathematics, foreign language, and science coursetaking and the Nels:88 transcript data." *NCES 2003-01*, Washington, DC: U.S. Department of Education, National Center for Education Statistics.

Cavanagh, S.E., Riegle-Crumb, C., & Crosnoe, R. (2007). "Puberty and the education of girls." *Social Psychology Quarterly* 70:186–98. https://doi.org/10.1177/019027250707000207

Crosnoe, R., Riegle-Crumb, C., and Muller, C. (2007). "Gender, Self-Perception, and Academic Problems in High School." *Social Problems* 54: 118-138. https://doi.org/10.1525/sp.2007.54.1.118

Eccles, J.S., Midgley, C., Wigfield, A., Buchanan, C.M., Reuman, D., Flanagan, C., and Iver, D.M. (1993). "Development during adolescence: The impact of stage-environment fit on young adolescents' experiences in schools and in families." *American Psychologist* 48: 90-101. https://doi.org/10.1037/0003-066X.48.2.90

Elder, G.H., Jr. (1998). "The life course as developmental theory." *Child Development* 69:1-12. https://doi.org/10.1111/j.1467-8624.1998.tb06128.x

Frank, K.A., Muller, C., Schiller, K.S., Riegle-Crumb, C., Mueller, A.S., Crosnoe, R., & Pearson, J. (2008). The social dynamics of mathematics coursetaking in high school. *American Journal of Sociology* 113: 1645–96. https://doi.org/10.1086/587153

George, L.K. (1993). Sociological perspectives on life transitions. *Annual Review of Sociology* 19:353-373. https://doi.org/10.1146/annurev.so.19.080193.002033

Goldin, C., & Katz, L.F. (2008). *The race between education and technology*. Cambridge, Mass., Harvard University Press.

Harris, K.M., Halpern, C.T., Whitsel, E., Hussey, J., Tabor, J., Entzel, P.,& Udry, J.R. (2009). The National Longitudinal Study of Adolescent Health: Research Design. Retrieved June 5th 2011. (http://www.cpc.unc.edu/projects/addhealth/design).

Jacob B.A., & Wilder, T. (2010). Educational expectations and attainment. NBER Work.Pap. No. 15683, Natl. Bur. Econ. Res. https://doi.org/10.3386/w15683

Johnson, M.K., Crosnoe, R., & Elder, G.H., Jr. (2011). Insights on Adolescence from a Life Course Perspective. *Journal of Research on Adolescence* 21: 273-80. https://doi.org/10.1111/j.1532-7795.2010.00728.x

Kroger, J. (2007). *Identity development: Adolescence through adulthood*. Thousand Oaks, CA: Sage. 2nd ed.

Mirowsky, J., & Ross, C.E. (2003). *Education, social status, and health*. New Brunswick, N.J.: Aldine Transaction.

Muller, C., Pearson, J., Riegle-Crumb, C., Requejo, J., Frank, K., Schiller, K.S., Raley, R.K., Langenkamp, A.G., Crissey, S., Mueller, A.S., Callahan, R., Wilkinson, L., & Field, S. (2007). *National Longitudinal Study of Adolescent Health: Wave III Education Data*. Chapel Hill: Carolina Population Center, University of North Carolina at Chapel Hill.

Muthén, L.K., & Muthén, B.O. (1998-2006). *Mplus user's guide. Fourth edition*. Los Angeles, CA: Muthén & Muthén.

Perreira, K.M., Deeb-Sossa, N., Harris, K.M., & Bollen, K. (2005). What are we measuring? An evaluation of the CES-D across race/ethnicity and immigration generation. *Social Forces* 83: 1567-1602. https://doi.org/10.1353/sof.2005.0077

Rask, K. (2010). Attrition in STEM fields at a liberal arts college: The importance of grades and pre-collegiate preferences. *Economic of Education Review,* 29: 892-900. https://doi.org/10.1016/j.econedurev.2010.06.013

Reynolds, J.R., Stewart, M., MacDonald, R., & Sischo, L. (2006). Have adolescents become too ambitious? High school seniors' educational and occupational plans 1976 to 2000. *Social Problems,* 53: 186-206. https://doi.org/10.1525/sp.2006.53.2.186

Reynolds, J. R., & Baird, C. L. (2010). Is there a downside to shooting for the stars? Unrealized educational expectations and symptoms of depression. *American Sociological Review,* 75:151-172. https://doi.org/10.1177/0003122409357064

Riegle-Crumb, C., Muller, C., Grodsky, E., Langenkamp, A.G., & Pearson, J. (2008). *National Longitudinal Study of Adolescent Health: Wave III Education Data Post-Secondary*. Chapel Hill: Carolina Population Center, University of North Carolina at Chapel Hill.

Schneider, B., & Keesler, V.A. (2007). School reform 2007: Transforming education into a scientific enterprise. *Annual Review of Sociology,* 33:197-217. https://doi.org/10.1146/annurev.soc.33.040406.131731

Schneider, B., Swanson, C., & Riegle-Crumb, C. (1997). Opportunities for learning: course sequences and positional advantages. *Social Psychology of Education* 2:25–53. https://doi.org/10.1023/A:1009601517753

Shouse, R.C. (1996). Academic Press and Sense of Community: Conflict and Congruence in American High Schools. *Research in Sociology of Education and Socialization* 11:173-202.

South, S., Haynie, D., & Bose, S. (2007). Student mobility and school dropout. *Social Science Research* 36:68–94. https://doi.org/10.1016/j.ssresearch.2005.10.001

Staff, J., & Kreager, D.A. (2008). Too cool for school? Violence, peer status and high school dropout. *Social Forces* 87:445–71. https://doi.org/10.1353/sof.0.0068

StataCorp. (2011). *Stata statistical software: Release 12*. College Station, TX: StataCorp LP.

Steinberg, L., Brown, B., & Dornbusch, S. (1996). *Beyond the classroom: Why school reform has failed and what parents need to do.* New York: Simon & Schuster.

Linkable administrative files: Family information and existing data

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Abstract

Linkable administrative data have facilitated research incorporating files from various government departments. Examples from Canada, Australia, and the United Kingdom highlight the possibilities for improving such work. After expanding on comparisons of linkable administrative data with several famous studies, we forward suggestions on improving research design and expanding use of family data. Certain characteristics of administrative data: large numbers of cases, many variables for each individual, and information on parents and their children, provide building blocks for implementing these proposals.

Traditional longitudinal epidemiological approaches can be modified to facilitate a quasi-experimental perspective. Incorporating multiple research designs within the same project handles threats to validity more easily. Family data provide a number of opportunities for both same-generation and intergenerational research. Risk factors associated with a number of conditions can be studied. Bad events can affect all family members, and cross-sectoral information can extend analyses beyond health to include educational outcomes. Parent/child linkages suggest several lines of research exploring within-family relationships.

Complicated data call for family identification systems to estimate project practicality. Manitoba administrative data are presented to illustrate one such system. Problems in maintaining core data element – such as marital status – have been highlighted. The productivity and potential of cross-sectional, longitudinal, and life course research using existing information have emphasised the value of investments in such work.

Keywords

Linkable data; research strategies; information rich settings; international; primary data; longitudinal studies; family studies; small areas

Introduction

Increasingly, scholars around the developed world use record linkage and data routinely collected by administrative bodies for service rather than research purposes to create information-rich environments. These are environments where researchers can leverage linkable, individual-level information on the health, socioeconomic, social, and biological characteristics of virtually the entire population of a jurisdiction to support a wide variety of studies (Brook, Rosman, & Holman, 2008; Jutte, Roos, & Brownell, 2011). Information-rich environments have made it possible to study regional differences in health and health care delivery, specific diseases and interventions, child development, and aging. Policy-relevant issues associated with education, poverty, children taken into out-of-home-care by protective services, and social housing have also been explored (Public-Academic Research Colloquium Leveraging Administrative Data for Social Policy, 2016). Epidemiology and pharmacoepidemiology have been emphasised in pioneering studies using linked registers from Sweden, Denmark, Norway, and Finland (Mortensen, 2013). These information-rich environments are spreading. A recent listing noted 267 data linkage centers in 34 countries (International Population Data Linkage Network, 2016). After supporting earlier studies using linked databases, United Kingdom funders have invested £100 million in four Centers of Excellence in health informatics, four Administrative Data Research Centers focusing on social and economic datasets, and a Clinical Practice Research Datalink (Lyons, Ford, Moore, & Rodgers, 2014). Australia has made major efforts to develop appropriate linkage infrastructure for health research, policy and planning (Smith et al., 2011). Analysts in various states and provinces have stressed the desirability of merging information across different government departments (Cowan, 2015; Williams, McClellan, & Rivlin, 2010). State-level activity in Florida has led to new research on neonatal health and cognitive development (Figlio, Guryan, Karbownik, & Roth, 2014). Recent work with American de-identified tax records has examined neighbourhood effects both on intergenerational mobility and on income and life expectancy (Chetty, Hendren, Katz, & Lawrence, 2016a; Chetty et al., 2016b).

This expansion of research based on administrative data has provided analytic files which, for some applications, equal or outperform the best known primary data collection approaches (Johnson & Schoeni, 2011; Levy & Brink, 2005; Power, Kuh, & Morten, 2013). Record linkage provides a cost-effective means for creating 'wide' data files with many variables capturing information on significant aspects of individual lives across the life course. In addition, researchers using administrative data on the entire population have access to information on individuals difficult to include in routine survey research – e.g., those living in rural/remote regions, those residing in poor neighborhoods, etc. Because an entire population is typically available, a very large number of cases can be analysed, often over long periods of time. For example, by linking birth registers with a wide variety of administrative data, scholars can conduct sibling, twin, and family analyses, sometimes across generations, to study a wide range of health and social issues. Such characteristics of administrative data create possibilities for going considerably beyond the usual observational before/after comparisons.

Many strengths of administrative data are largely underutilised and not well understood. For example, several data linkage conferences highlighting a diverse set of projects included only six clinical trials, five natural and quasi-experiments, and just three sibling analyses out of approximately 700 presentations (Exploiting Existing Data for Health Research International Conference, 2013; International Data Linkage Conference, 2012; International Health Data Linkage Conference, 2014). The number of (primarily observational) projects is encouraging but many additional opportunities could be explored. Following Hand (2016), "sharing and linking behavioral data, both public and private, holds tremendous promise for improved public policy" and advancing medical and social science research.

This paper builds on extensive experience with databases organised in the Canadian province of Manitoba to illustrate the potential of administrative data. Comparisons are made to deal with the

following questions: What features of linkable administrative data expand the opportunities for research? What characteristics of these data can facilitate better analysis? How can family information not only improve design but expand the number of opportunities? What are common limitations of administrative data?

Table 1 compares common characteristics of information-rich environments built from linkable administrative data with those of several famous long-term studies based on primary data collection – the Panel Study on Income Dynamics (PSID), the British Birth Cohorts, and the Framingham Study (Johnson & Schoeni, 2011; Levy & Brink, 2005; Power et. al., 2013). As can be seen, administrative data have several strengths relative to longitudinal primary data collection. A central advantage is the ability to cost-effectively update files on a regular (often annual) basis. This automatically facilitates construction of birth cohorts, longitudinal follow-up, growth in the number of individuals available for study, and new information on life events and family relationships. New research opportunities follow such expanded information.

Table 1. Comparing Linkable Administrative Data and Longitudinal Primary Data

Relevant characteristics	Linkable administrative data (Specific sites in Canada, United Kingdom, Australia, Scandinavia, United States)	Longitudinal primary data (Panel Study on Income Dynamics, British Birth Cohorts, Framingham Study)
Number of cases	Often more than one million	Several thousand or smaller
Populations	Often built on registry of an entire population or a specific group (e.g., Medicare enrollees)	Subjects sampled and tracked
Record linkage	Critical to expand scope of information and check data quality	Very useful to expand scope of information
Files typically linked	Health, geographic, housing, child protection, justice, interventions, and other files	Health utilisation, genomic data, and other files
New data and updating	Routine arrival of updates (often annually) Access to new files is negotiated	New data must be collected and merged with existing data
'Nonusers'	Individuals in population, but not in substantive file, often of interest	Such analyses not relevant
Loss to follow-up	Attrition by out of area migration	Attrition by nonresponse
Design and analysis		
Time	Information provided at relatively short intervals (from daily to annually)	Information must be collected (typically annually or at longer intervals)
Longitudinal	Number of years will vary with site; tracking from birth possible	Number of years will vary with site; tracking for many years from birth possible
Place	Often specified to postal code level	Often specified to address
Life events	Information may be available from registry or other sources for different ages	Information collected if part of design; often available for different ages
Interventions and evaluations	Longitudinal data allow double pretest designs and long follow-up	Constrained by *N*; detailed information may be available for specific conditions (Framingham).
Statistical methods	Modeling and family fixed effects analyses can partially compensate for omitted variables	Analyses often use standard approaches; complicated samples sometimes integrated
Sibling identification	Sibling and twin studies facilitated	Sibling studies facilitated if part of design
Quantity of information/individual	Many variables/individual ('wide data') but defined for administrative purposes	Generally fewer variables/individual but may be better targeted
Variables and indices	Using nonstandard variables to create meaningful indices is time-consuming	Defined by researchers; scaling may be relatively easy
Diagnoses	Testing for data quality necessary	Vary considerably with study
Health providers	Provider information to aid measurement	Provider information may be available
Individual follow-up	Before and after an event	Before and after an event
Limitations	Important information may be omitted or available only for a subpopulation	Important information likely to be collectable for entire sample if part of design
Data collection and quality	Data collection and access out of investigators' control; frequent quality checks needed	Investigators control data collection, access, and quality
Family Information		
Spousal identification	Can help to understand determinants of need/demand for aging services	Many analyses constrained by *N*
Constructing families over time	Family data may allow ethnic group identification to facilitate community and geographic comparisons	Many analyses constrained by *N*; special samples can be drawn
Risk factors	Wide range of factors can be analysed	Specific risk factors may be relevant
Bad events	Effects on family members can be studied	Analyses often constrained by N
Child development	Analyses of dyads and triads within families possible	Some dyadic and triadic comparisons possible

Part of Table 1 was presented in Roos et al. (2008).

Organising information

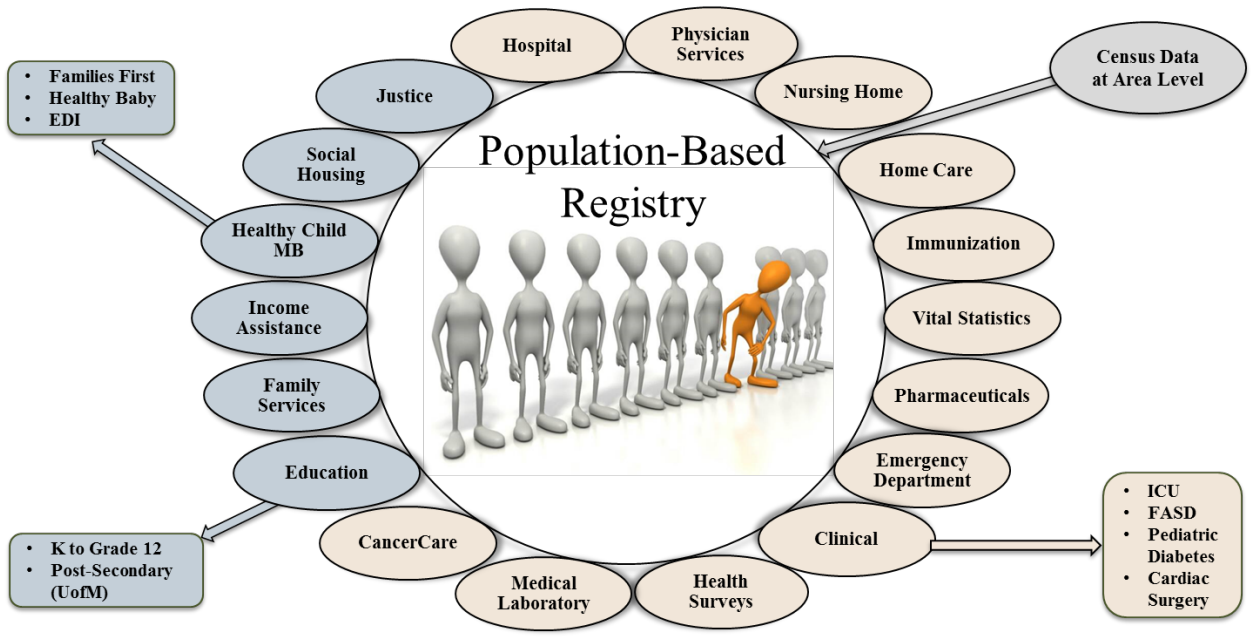
The Whole Population

Because government departments typically collect data on everyone using their systems, researchers working with administrative data can benefit from having registries comprising the entire population (i.e., population-based), whether they are readily available (Canada, Wales) or have to be built more laboriously from multiple sites (Australia) (Ford et al., 2009; Roos & Roos, 2011; Stanley, Glaubert, McKenzie, & O'Donnell, 2011). Information on population-based births, deaths, marital status, migration, and place of residence allows building such registries. A few groups, such as individuals in federal prison or in the military, may not be included. Registries also enable population-based analyses of non-users, providing otherwise unavailable information about who does not receive preventive measures (cervical cancer screening, childhood immunisations, at-risk family screening) or who is not enrolled in school (Brownell et al., 2006; Gupta, Roos, Walld, Traverse, & Dahl, 2003). With registries typically based on a whole (or good approximation to a whole) population, bias associated with dealing with unrepresentative population subsets is minimised.

Figure 1 shows several types of data files linkable with a population registry. This Canadian provincial repository has been used for hundreds of published studies over the past forty years.

Figure 1

A deidentified population research data repository (Manitoba)



Ties with CancerCare are relatively recent. Cadham refers to the Cadham Provincial Laboratory. Healthy Child Manitoba encompasses several provincial programs, including testing involving the EDI (Early Development Instrument).

Wide data files created through record linkage

Repositories such as Manitoba's have typically been started with health information and expanded as other data sets became available. Having many descriptors for each individual ('wide' data files) facilitates work in several ways (National Research Council, 2013). Population-based indices can be created by combining files using techniques developed by Mosteller & Tukey (1977) (Roos et al., 2013). Data cleaning is a significant issue that has been treated elsewhere, and some general tools have been developed (Smith et al., 2015). Close relations with data providers facilitate ensuring quality.

Merging with clinical databases containing details on diseases increases opportunities to build good measures and provide long-term follow-up (Bernstein et al., 2016). Both sites based on linkable administrative data and those anchored in primary data have been continually working to add files and to expand the range of topics covered (Morris, 2015; Smith et al., 2011). Bringing in new files from other agencies or clinical investigators increases research opportunities but, often takes years of negotiations ('smiling persistence') (Borghol et al., 2012).

Large N

The large numbers of cases and variables available using administrative data facilitate both observational and interventional research. An investigator can focus on low prevalence conditions or rare events and still find enough cases for study.

Longitudinal nature

Both observational studies and quasi-experiments benefit from longitudinal data generated by the periodic updating of administrative files. Evaluating the long-term impact of health and educational interventions is an important application of such data (Murnane & Willett, 2011). The large N and ability to track individuals over long periods can be most useful in studies of the developmental origins of adult disease.

Locating individuals

Information as to where each individual in a population resides is very valuable in judging exposure to many variables. A highly influential American research program has been built on geographic variation in medical care (Wennberg, 2010), while Shadish (2013) has stressed the importance of control groups based on local conditions.

Sibling, twin, family analyses.

Parents, particularly mothers, can generally be specified through linkage of registries and hospital data to support more detailed work on families. Information on mothers and children allows specification of half-siblings. As discussed later, the more detailed the family information, the more possibilities for better casual inference.

Particular unexploited characteristics of administrative data can strengthen analytic approaches. Murnane and Willett (2011) have emphasised using multiple perspectives in worrying about selection bias. There are many types of selection bias. In the causal inference literature, "selection bias" is concerned with threats to internal validity and refers to systematic differences (both observed and unobserved) between those who select into the exposure state and those who select into the unexposed state. Murname and Willett's (2011, p. 330) concern is that "selection into treatments is as likely to be based on unobserved variables as on observed variables, and this source of bias remains despite the best efforts at statistical adjustment". Better research depends on "pattern-matching", on probing hypotheses using designs with different limitations to deal with various threats to internal validity (Jaffee, Strait, & Odgers, 2012; Steiner, Cook, Shadish, & Clark, 2010). Observational studies and quasi-experiments use design features to rule out many plausible, alternative explanations for an association but ensuring equivalence of the groups being compared is difficult, if not impossible. A pattern based on consistent results, a triangulation of evidence using different methods, allows more robust casual inference (Gage et al., 2016).

Multiple perspectives are particularly important because biases posed by unmeasured variables affect almost all observational studies. Without special circumstances (such as autocorrelated variables), typically less than 30% of the variance in social outcomes is handled by measured predictors (Roos et al., 2013). Measured relationships between risk factors and outcomes of interest tend to be spuriously high because statistical adjustment to deal

with potential confounders "will usually be incomplete. Not only must all confounders be measured, but confounders must suffer from no measurement error" (Gage et al., 2016, p. 569); moreover, confounders must be included in the model with the correct functional form (e.g., linear vs. higher-ordered terms or as an interaction term). The many possible predictors, family linkages, and 'wide' data files often available in administrative data increase the variables and approaches available to attempt "to control for selection bias in causal research based on observational data" (Murnane & Willett, 2011). The different approaches to selecting comparison groups presented below are often relatively easy to implement with administrative data.

Comparison groups using geographical information

Several studies comparing randomised trials with different quasi-experiments have shown careful selection of covariates to often lead to better adjustment than using more covariates or relying on a particular form of data analysis (such as propensity scores or analysis of covariance) (Pearl, 2009; Shadish, Cook, & Campbell, 2002). Such 'careful selection' may well involve choosing the closest available neighbours (Cook, Shadish, & Wong, 2008; Lyons et al., 2014). Some jurisdictions will have geographic information that facilitates using such sophisticated methods as linear programming to select appropriate neighbours (Roos, Walld, & Witt, 2014).

Comparison groups using propensity scoring

Propensity score methods use analytic techniques to compare individuals exposed to an event of interest to those unexposed but demonstrably comparable on a wide range of observed factors. These methods often "group individuals on a range of characteristics that pre-date their exposure to a given risk factor of 'treatment'" (Jaffee et al., 2012, p. 7). One Manitoba project linking with Statistics Canada surveys used over 200 covariates to construct propensity scores which were then used to identify a group of smokers comparable to a group of non-smokers on these covariates; these two groups were then compared vis-à-vis their health service use to identify those differences attributable to smoking (Martens et al., 2015).

Propensity score methods have been steadily improving and provide many advantages. However, available covariates must well describe selection processes; Shadish (2013) also advocates the "use of comparison groups that are from the same location with very similar focal characteristics." Results from clinical trials often are found to diverge from those generated using propensity scores (Murnane & Willett, 2011; Sturmer, Glynn, Rothman, Avorn, & Schneeweiss, 2007). For example, meta analyses of randomised clinical trials on invasive cardiac management found 8-21% improvements in survival after AMI; two propensity score methods using American Medicare data showed a substantially greater effect (a 50% improvement) (Stukel et al., 2007).

Comparison groups using instrumental variables

Geographic information is also particularly useful for instrumental variable analyses, analyses "which identify an unconfounded proxy (an 'instrument') for the exposure of interest and assess the association between that and the outcomes to remove the biases of unmeasured confounding" (Gage et al., 2016, p. 580). Geographic variation in rates often provides the instrument. Robust instrumental variable analysis has been shown to provide unbiased estimates of causal effects. For example, in the Stukel et al. (2007) research, instrumental variable analysis, with geographical variation in the rates of invasive cardiac management providing the instrument, produced results close to those of the clinical trials.

Comparison groups using family data

Often underutilised family data can facilitate incorporating multiple comparisons within a single project. Observational studies based on comparing family members represent stronger designs for causal inference than traditional epidemiological studies. These family fixed-effects approaches are able to adjust for unobserved family-level factors that may confound the relationship between exposure and outcome. "Confounds due to passive gene-environment correlations" occur because "the same gene variants that influence how parents behave with their children may be transmitted to children and influence children's behaviour or abilities" (Jaffee et al., 2012, p. 274). Since children typically grow up within the same family, sibling designs help correct

for error from omitted parental variables (such as income, which may affect the outcomes) and substantially reduce confounding in tests of casual hypotheses (Lahey & D'Onofrio, 2010). D'Onofrio, Lahey, Turkheimer, and Lichtenstein (2013) argue against traditional comparison of unrelated individuals in observational studies, explaining how details on family genetic relationships can help deal with different threats to interpretation.

Siblings share many experiences (and varying degrees of genetic similarity), but these experiences may occur at different times in the developmental process (Turkheimer & Waldron, 2000). Such "natural experiments" based on family relationships rely on enough sibling pairs differing from each other on important, measured predictors. Analyses of human capital in Canada, Scandinavia, and Florida focusing on 'sibship' (defined as having the same mother) have used administrative data, information on siblings and twins, long periods of follow-up, and very large numbers of cases (Black, Devereaux, & Salvanes, 2007; Figlio et al., 2014; Oreopoulos, Stabile, Walld, & Roos, 2008). As discussed later, specifying fathers is difficult in many administrative databases. This paper builds on information on mothers and children for the discussion of family relationships; thus, half-siblings form the basis for much of the discussion. The Scandinavian data have sometimes been able to study relatives "differing in both their genetic connectedness and the extent to which they were reared together" (Bjorklund et al., 2005). The power of these family-based designs to rigorously examine casual inferences will vary with the amount of information available (D'Onofrio et al., 2013).

For example, although smoking during pregnancy is a risk factor for offspring conduct issues, normal multivariable approaches appear insufficient. Several sibling fixed-effects analyses have shown that siblings "differing in their exposure to tobacco smoke in utero showed no differences in externalising behaviour" up through adolescence and into adulthood (Jaffee et al., 2012, p.10). In another analysis, Mortensen (2013) compared birth weights of children of Danish women differing in education with birth weights of children of their sisters (and cousins) also differing in education. Education appeared to be a much less important influence than would have been thought without the "children of sisters and cousins" comparisons.

Families and generations

Several information-rich environments and two of the well-known primary data collection efforts (the Framingham Study and the Panel Study of Income Dynamics) (D'Agostino et al., 2008; Johnson & Schoeni, 2011) facilitate making comparisons across generations within the same family. The Family Connections Genealogical Project in Western Australia has actively utilised this capacity and the large *N* for focused genetic epidemiological research (Brameld et al., 2014). The Danish Family Relations Database has been used to study how a number of diseases cluster in families (Boyd et al., 2009; Oyen et al., 2012).

Information across multiple generations may be gathered in at least two ways in administrative repositories. At the start of a government system (such as health insurance coverage) a defined population is typically entered into the database. If a registry organises individuals into families, older and younger family members will be noted. Wives and husbands are likely to be specified; informed assumptions about mothers and fathers can be made. Secondly, as a system continues over the years, children are born, individuals die, and people move in and out of the relevant jurisdiction. This presents the opportunity to develop birth cohorts and, in repositories combining registries and birth records, to specify mothers accurately.

Figure 2 diagrams the three generations of available Manitoba data. Much of the family research using these data has analysed individuals labeled as Generation 2. However, recent hip fracture studies have gone back to Generation 1 (Yang et al., 2016) while ongoing analyses incorporate Generations 2 and 3. With fewer divorces and more parents being married, information on fathers (at least married male parents) is easier to obtain for work based on Generation 1. With each birth cohort averaging between 12 and 16 thousand individuals, and loss-to-follow-up from birth to age 65 ranging from 1-1.5% annually, large numbers of cases are readily accumulated for multi-generational research. New individuals entering the province increase the N available for shorter-term observational or interventional studies.

Figure 2. Simplified overview of Manitoba generational information in repository

Generation 1	Parents of those born in 1970 and later (Health info from 1970 on; information from birth not available for parents)	
Generation 2	Born in 1970-1978 period in Manitoba; born in 1979 and subsequently (Health info from 1970 on; Education info for those born 1979 and after)	**New individuals entering Manitoba**
Generation 3	Children of those born from 1970 on in Manitoba (Health info from birth; Education info for those born 1979 and after)	

Each information-rich environment has characteristics facilitating certain types of research. Various registries are likely to have different strengths and weaknesses vis-a-vis identifying family relationships. Intergenerational analyses and large numbers of cases can be especially useful for creatively identifying subsamples, highlighting risk factors, studying bad events, and understanding child development.

Creatively identifying samples

Family data generated from a population registry can help with ethnic identification; Manitoba researchers have used such information to specify members of First Nations (North American Indian) communities, Metis (descendants of First Nations and Whites), and French Canadians. For example, registration of children in Status Verification files (to be considered First Nations benefitting from 'Treaty' status) often takes several years. Once a single family member has been specified from these files and registry data, parents and children could be noted as belonging to a particular minority group. In a 'mixed marriage', this would lead to errors but there has been no other way to proceed (Martens et al., 2011). Another project used enrollment in Francophone schools (run by the Franco-Manitoban School Division) for identifying French Canadian children who could then be linked to their families.

Highlighting risk factors

Risk factors for many medical conditions have a family component. Linkable administrative data can advance such research by: 1) noting conditions for which parental history can help indicate risk of the condition in their children, and 2) including siblings in addition to parents. Administrative and survey data are generally comparable in predicting hip fracture risk among the adult children of parents checked for their fracture history (Lix et al., 2017). Suggestions have been generated to help improve a widely adopted clinical tool (the World Health Organization's FRAX measure) to quantify patient fracture risk. Framingham researchers have generated a number of cardiovascular risk algorithms, but administrative data allow looking at a wider range of conditions. Scandinavian investigators have been particularly active in studying atrial fibrillation, mental health, and cancer (D'Agostino et al., 2008; Mortensen, 2013). Finally, risk might be incorporated in evaluation of screening programs, such as those for breast and prostate cancer. Administrative data may allow examining population coverage of such programs; a cost-benefit perspective suggests looking at how well screening works among those at higher risk (Gupta et al., 2003).

Studying adverse events

Most families will experience adverse events over the years; linked files from various agencies can help define events and specify outcomes. Such events will impact the mental health, life chances, and financial prospects of other family members. The importance of such shocks seems likely to vary with a family's socioeconomic status, geographic location, and so forth. For example, although the effects of accidents (such as concussions) can be studied just using diagnostic information from individuals in one or more databases, adverse events probably have wider impacts. Death of one family member (by suicide or automobile) has been explored in terms of its impact on other family members (Bolton et al., 2013; Bolton et al., 2014). Children's injuries may (or may not) affect parental health (Enns et al., 2016). Extending the research to examine longer-term effects would be very feasible. Additional worthwhile projects include looking at maternal and child outcomes when a child is taken into care by a government agency and examining family outcomes when one family member has had a serious medical diagnosis. Cross-sectoral information is particularly valuable; adverse events may affect the educational achievement (in addition to mental health) of younger family members.

Understanding child development

Population-based linkages directed toward studying parent-child interaction suggest many opportunities. In Manitoba, developmental patterns of mother and child can be studied from the birth of the mother and that of the child. Beginning in 1979, both health and educational information are present and accessible over 37 years. Various combinations of mother and child dyads can be constructed to assure adequate numbers of cases. For example, approximately 9,000 mother-child pairs can currently be followed up to age 15. This number will increase substantially over the coming years. Facilitated by the large N and many years of follow up, age comparisons can be coordinated. For example, a mother's health in her first ten years of life can be compared to that of her children during their first decade, expanding on the family history literature (Cunliffe, 2015; Dhiman, Kai, Horsfall, Walters, & Qureshi, 2014).

More generally, the analysis of dyadic and triadic relationships within large numbers of families is becoming increasingly practical. Recent Manitoba work examines the associations among mother—sibling1—sibling2; the influence of a mother's teen pregnancy is compared with that of an older sister's on the probability of a younger sister's teen pregnancy (Wall-Wieler, Roos, & Nickel, 2016a). Propensity scoring created control groups as equivalent as possible. A second paper looks at the effects of an older sister's experience with pregnancy (terminated versus continued to child birth) on the outcomes of a younger sister's pregnancy.

Additional parental variables can be incorporated into longitudinal observational studies using multiple birth cohorts (Currie, Stabile, Manivong, & Roos, 2010; Oreopoulos et al., 2008). For example, maternal mental health at various developmental stages may well influence long-term outcomes, even after controlling for a number of other measures. Maternal participation in various perinatal programs can also be used in the analysis. Three major outcomes include: infant health at birth, one-year mortality, and health and educational achievement at age 15. As noted below, study design is sensitive to the availability of different data sets.

Limitations

Tradeoffs

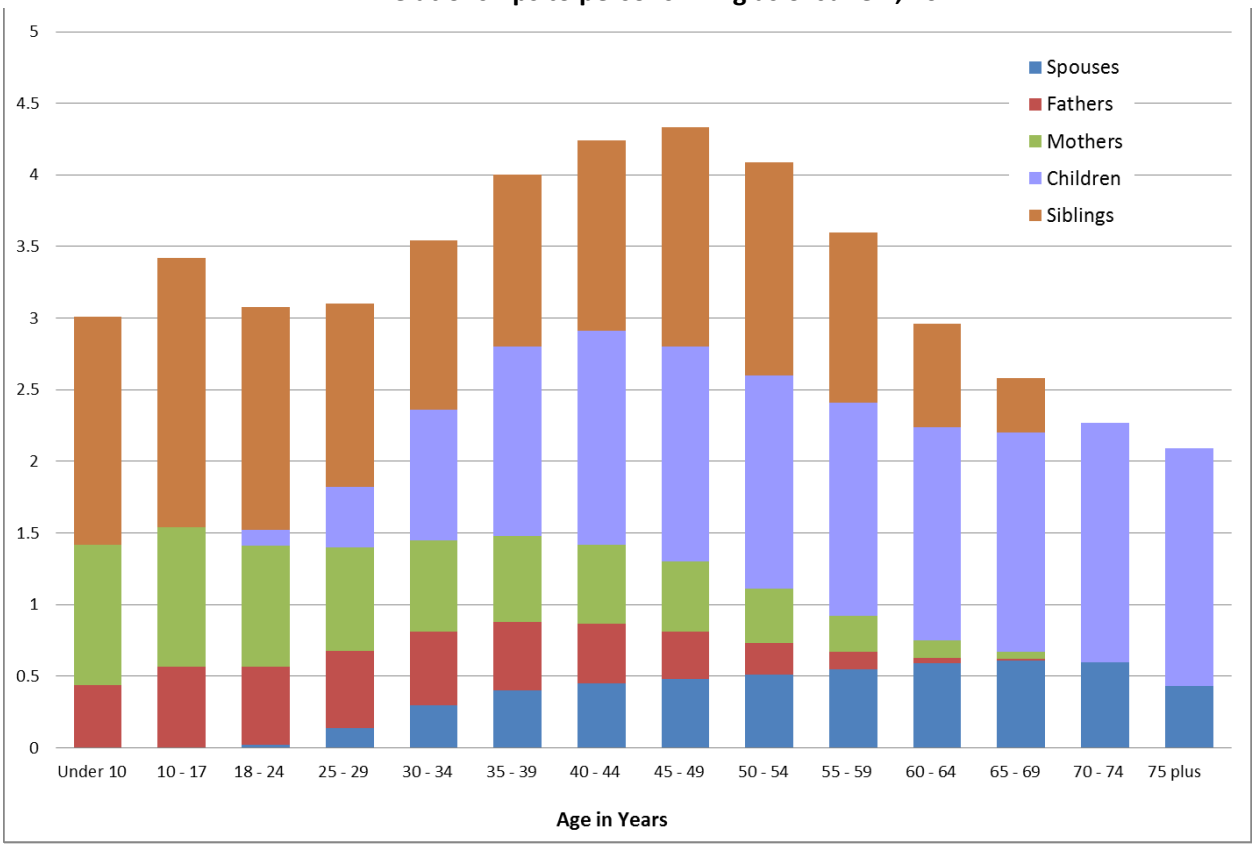
New data sets are always welcome but they typically provide new variables for only more recent years. Thus, in Manitoba, population-based information on Employment Income Assistance (similar to welfare) and on Child and Family Services (regarding serious family issues) is only available after 1995. Incorporating such information affects the birth cohorts chosen, the number of individuals studied, and the number of years of follow-up. Work examining the influence of an older sister's teenage pregnancy on a younger sister focused on younger sisters from age 16 to 19. Including adolescents aged 14 and 15 in the main analyses would have meant foregoing a grade nine educational achievement measure (girls were too young) and the Child and Family Services information (present for only a limited number of years). This decision did reduce the number of younger sisters available. However,

sensitivity testing using only those covariates available in both samples showed few differences.

Practicality

Family identification mapping systems (developed by both the Panel Study of income Dynamics and the Manitoba Centre for Health Policy) can help assess project practicality by specifying the mean number of family members associated with any individual. On average, each 35-39 year old in Manitoba (approximately 80,000 in 2014) has almost five family members who can be linked to in the database—this includes one sibling, 1.5 children, a mother, and a father and approximately 40% to a spouse. Given the initiation of the registry in 1970, siblings over 19 could not be specified; this led to the 'disappearance' of siblings in the older age groups. Figure 3 suggests another problem: fathers of younger children are becoming increasingly difficult to identify.

Figure 3. Manitoba registry – Mean number of specifiable family members by age relationships to persons living as of June 1, 2014



Nonstandard and omitted variables

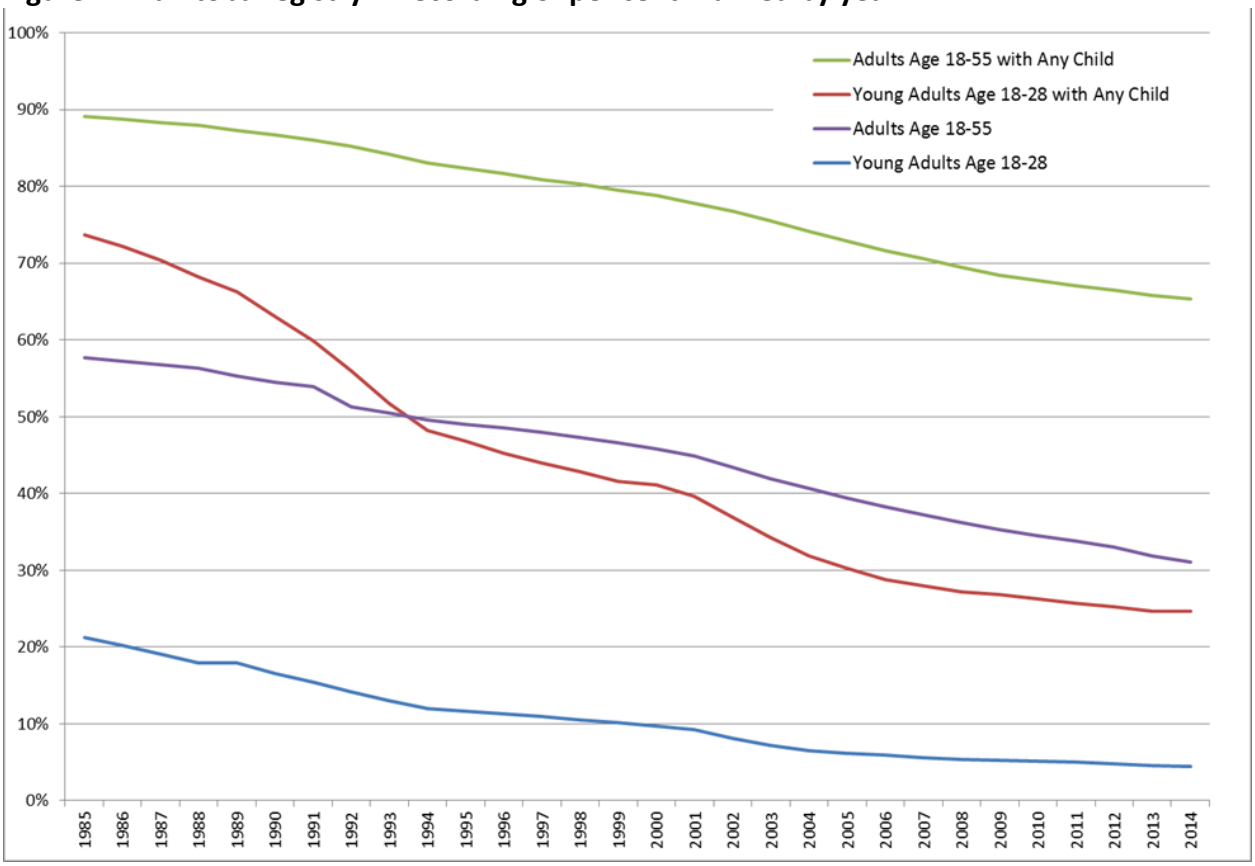
Certain types of measures, including an individual's socioeconomic status, are often not present in administrative data; several interrelated techniques can partially deal with such omitted information. As noted earlier, sibling analyses play a major role in handling omitted variables and better controlling for unmeasured risk factors. Multi-level modeling is generally helpful, while statistical tests for omitted variables are possible. Finally, the variance explained in Manitoba research compares favorably with that explained in the Framingham Study and the Panel Study of Income Dynamics (D'Agostino et al., 2008; Roos et al., 2013; Wall-Wieler, Roos, Chateau, & Rosella, 2016b).

Researchers have long discussed the substitution of small area data on socioeconomic status for (often unavailable) variables describing parental education and household income in considerable detail (Krieger, Waterman, Chen, Rehkopf, & Subramanian, 2016). Area-based socioeconomic measures are widely available but their appropriateness depends on the topic under study, the size of the areas providing information, the heterogeneity of the area's population, and other factors. Canadian analyses may be based on census areas or six-digit postal codes (considerably smaller than American census tracts). In at least some provinces small area data have been shown to approximate individual level measurement. (Mustard, Derksen, Berthelot, & Wolfson, 1999; Pampalon, Hamel, & Gamache, 2009; Schuurman, Bell, Dunn, & Oliver, 2007; Roos et al., 2013; Subramanian, Chen, Rehkopf, Waterman, & Krieger, 2006). One set of American researchers has used a group of individual measures plus neighbourhood income to create an index of family socioeconomic status that performs well (Figlio et al., 2014).

Social change, government policy, and data quality

Recent changes in society and in government data collection have combined to present significant challenges to the Manitoba family data (Roos et al., 2013). With more couples having children outside of marriage, the meaning of such important measures as marital status may be changing. Moreover, since 1996 the role of marital status and family number has become deemphasised in managing the provincial Pharmacare reimbursements. The ability to readily identify fathers has steadily deteriorated (Figure 4). Over 31% of recent mothers appear as Not Married on the registry but Not Single Parent on provincial Families First surveys. Statistics Canada tabulations suggest many of the mothers not responding to the surveys headed single parent families. Here, other linkable files such as various Manitoba surveys containing information on marital status or partners—plus better access to Vital Statistics files—may allow improvements in these data. The maintenance of such 'core data elements'– elements used across studies and across disciplines – has been a critical feature of both the Panel Study of Income Dynamics and the Framingham Study. The inability to mandate such elements as part of the core information represents a real weakness of administrative data.

Figure 4. Manitoba registry – Recording of per cent married by year



Discussion

Administrative data provide a wide range of opportunities. The capacity to organise family structure, health, and residential mobility information for large numbers of cases across various intervals can expand 'life course epidemiology'. Tracking the occurrence of family events (deaths, divorces), diagnoses, and childhood moves can help assess their importance on later health and social outcomes (Currie et al., 2010). Life course epidemiology pioneered in the United Kingdom has traditionally used survey information to evaluate the possible effects of changes in one or two variables (Viner et al., 2015). Five time-varying measures have been incorporated in ongoing Manitoba work using administrative data to study high school graduation and externalising mental health conditions.

One analysis of the impact of early life events based on administrative data can be directly compared with work relying on primary data. Manitoba short- and long-term outcomes have been tracked over 18 years incorporating several measures of health at birth (birth weight, Apgar scores, and gestational length) and different outcomes (education, health, employment assistance) (Oreopoulos et al., 2008). Investigators using the Panel Study of Income Dynamics to study early life benefit from survey information on pregnancy intentions, family income data over the life course, and the ability to follow birth cohorts well into adulthood (Johnson & Schoeni, 2011). PSID outcomes include health (both childhood and adult) educational achievement (total years of schooling), and several labor market measures (annual income, hours worked, and hourly wages). Full siblings (particularly in recent years) can be better distinguished by primary data collection. Administrative data research (in Manitoba and Scandinavia) has been able to incorporate twin analyses and information on child health at various life stages (Black et al., 2007; Currie

et al., 2010; Oreopoulos et al., 2008). Both administrative and primary data have the potential to measure important within-family differences (but using different variables).

Possibilities and missing pieces

Many linkable data sets are neglected or only partially utilised. Considerable research potential has been lost because of an inability to receive permission to link, or funding limitations. Expensive, large-scale surveys can be underused by researchers wanting to employ data linkage. For example, Statistics Canada has incorporated 'permission to link' items in many of its community health surveys; typically, over 90% of the responses are affirmative. Surveys (often including questions on respondent and parental education, obesity, and activity level) have been available for linkage to administrative data for many provincially approved projects for several years. Even in small provinces, combining these periodic surveys can provide over 50 thousand respondents. Although access for investigator-initiated research building on these high-quality data sets has been problematic, changes at the federal level may facilitate future studies.

Political constraints can limit important research efforts. In Australia, a Population Health Research Network across states/territories has been funded "to facilitate linkage between jurisdictional data sets, and between these data sets and research data sets, using demographic data" (Smith et al., 2011). However, Australian states do not automatically hold population registries and obtaining partial substitutes (such as voter registries) from the Dominion Bureau of Statistics has often been difficult. Under these constraints, much Australian work has focused on hospital information held by the states. This may change with recent efforts to make welfare data more accessible (Cowan, 2015).

Information-rich environments excel in the breadth of data available for work across many disciplines. The demand for studies using these environments seems likely to grow. However, in Canada only three provinces have developed large, relatively accessible population databases. Several others have cooperated on specific projects such as CNODES, the Canadian Network for Observational Drug Effect Studies (Suissa et al., 2012). Start-up costs are not inconsiderable; high levels of cooperation among ministries and university researchers are essential to provide both timely data and necessary economies of scale.

Linkable administrative data have generated widespread interest; international linkage networks continue to expand across fields (International Population Data Linkage Network, 2016). In just one example noted by Gage et al. (2016), if access to large cohort datasets continues to increase and such information can be linked to genomic research, existing information becomes more valuable. The breadth of possible work multiplies the possibilities.

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References

Bernstein, C.M., Banerjee, A., Targownik, L., Singh, H., Burchill, C., Chateau, D., & Roos, L.L. (2016). Caesarean delivery is not a risk factor for the development of inflammatory bowel disease: A population-based analysis. Clinical Gastroenterology and Hepatology, *14*(1), 50-57. https://doi.org/10.1016/j.cgh.2015.08.005

Bjorklund, A., Jantti, M., & Solon, G. (2005). Influences of nature and nurture on earnings variation: A report on a study of various sibling types in Sweden. In: S. Bowles, H. Gintis, M. Osborne Groves (Eds). Unequal Chances: Family Background and Economic Success. Princeton, NJ: Princeton University Press (pp. 145-164).

Black, S.E., Devereux, P.J., & Salvanes, K.G. (2007). From the cradle to the labor market? The effect of birth weight on adult outcomes. Quarterly Journal of Economics, *122*(1), 409-439. https://doi.org/10.1162/qjec.122.1.409

Bolton, J.M., Au, W., Leslie, W.D., Martens, P.J., Enns, M.W., Roos, L.L., Katz, L.Y., Wilcox, H.C., Erlangsen, A., Chateau, D., Walld, R., Spiwak, R., Seguin, M., Shear, K., & Sareen, J. (2013). Parents bereaved by offspring suicide: a population-based longitudinal case-control study. JAMA Psychiatry, *70*(2), 158-167. https://doi.org/10.1001/jamapsychiatry.2013.275

Bolton, J.M., Au, W., Walld, R., Chateau, D., Martens, P.J., Leslie, W.D., Enns, M.W., & Sareen, J. (2014). Parental bereavement after the death of an offspring in a motor vehicle collision: A population-based study. American Journal of Epidemiology, *179*(2), 177-185. https://doi.org/10.1093/aje/kwt247

Borghol, N., Suderman, M., McArdle, W., Racine, A., Hallett, M., Pembrey, M., Hertzman, C., Power, C., & Szyf, M. (2012). Associations with early-life socio-economic position in adult DNA methylation. International Journal of Epidemiology, *41*(1), 62-74. https://doi.org/10.1093/ije/dyr147

Boyd, H.A., Poulsen, G., Wohlfahrt, J., Murray, J.C., Feenstra, B., & Melbye, M. (2009). Maternal contributions to preterm delivery. American Journal of Epidemiology, *170*(11), 1358-1364. https://doi.org/10.1093/aje/kwp324

Brameld, K.J., Dye, D.E., Maxwell, S., Brisbane, J.M., Glasson, E.J., Goldblatt, J., & O'Leary, P. (2014). The Western Australian family connections genealogical project: Detection of familial occurrences of single gene and chromosomal disorders. Genetic Testing and Molecular Biomarkers, *18*(2), 77-82. https://doi.org/10.1089/gtmb.2013.0254

Brook, E.L., Rosman, D.L., & Holman, C.D.J. (2008). Public good through data linkage: Measuring research outputs from the Western Australian data linkage system. Australian Journal of Public Health, *32*(1), 19-23. https://doi.org/10.1111/j.1753-6405.2008.00160.x

Brownell, M. Roos, N.P., Fransoo, R., Roos, L.L., Guevremont, A., MacWilliam, L., Yallop, L., & Levin, B. (2006). Is the class half empty? Socioeconomic status and educational achievement from a population-based perspective. IRPP Choices, *12*(5), 1-30.

Chetty, R., Hendren, N., Katz, L.F., & Lawrence, F. (2016a). The effects of exposure to better neighborhoods on children: New evidence from the moving to opportunity experiment. American Economic Review, *106*(4):855-902. https://doi.org/10.1257/aer.20150572

Chetty, R., Stepner, M., Abraham, S., Lin, S., Scuderi, B., Turner, N., Bergeron, A., & Cutler, D. (2016b). The association between income and life expectancy in the United States, 2001-2014. Journal of the American Medical Association, *315*(6), 1750-1766. https://doi.org/10.1001/jama.2016.4226

Cook, T.D., Shadish, W.R., & Wong, V.C. (2008). Three conditions under which experiments and observational studies produce comparable casual estimates: New findings from within-study comparisons. Journal of Policy Analysis and Management, *27*(4), 724-750. https://doi.org/10.1002/pam.20375

Cowan, P. (2015). House of Reps approves release of de-identified welfare data. Itnews. Available at: http://www.itnews.com.au/news/house-of-reps-approves-release-of-de-identified-welfare-data-410375.

Cunliffe, V.T. (2015). Experience-sensitive epigenetic mechanisms, developmental plasticity, and the biological embedding of chronic disease risk. Wiley Interdiscip Rev Syst Biol Med, *7*(2), 53-71. https://doi.org/10.1002/wsbm.1291

Currie, J., Stabile, M., Manivong, P., & Roos, L.L. (2010). Child health and young adult outcomes. Journal of Human Resources, *45*(3), 517-548. https://doi.org/10.1353/jhr.2010.0013

D'Agostino, R.B. Sr., Vasan, R.S., Pencina, M.J., Wolf, P.A., Cobain, M., Massaro, J.M., & Kannel, W.B. (2008) General cardiovascular risk profile for use in primary care: The Framingham Heart Study. Circulation, *117*(6), 43-53. https://doi.org/10.1161/circulationaha.107.699579

D'Onofrio, B.M., Lahey, B.B., Turkheimer, E., & Lichtenstein, P. (2013). Critical need for family-based quasi-experimental designs in integrating genetic and social science research. American Journal of Public Health;*103*(Suppl 1), S46-S55. https://doi.org/10.2105/AJPH.2013.301252

Dhiman, P., Kai, J., Horsfall, L., Walters, K., & Qureshi, N. (2014). Availability and quality of coronary heart disease family history in primary care medical records: implications for cardiovascular risk assessment. PLoS One, *9*1, e81998. https://doi.org/10.1371/journal.pone.0081998

Enns, J., Gawaziuk, J.P., Khan, S., Chateau, D., Bolton, J.M., Sareen, J., Stone, J., Doupe, M., & Logsetty, S. (2016). Mental and physical health outcomes in parents of children with burn injuries as compared with matched controls. Journal of Burn Care and Research, *37*(1), e18-26. https://doi.org/10.1097/BCR.0000000000000309

Exploiting Existing Data for Health Research International Conference. (2013). St. Andrews, Scotland, August 28-30.

Figlio, D.N., Guryan, J., Karbownik, K., & Roth, J. (2014). The effects of poor neonatal health on children's cognitive development. American Economic Review *104*(12), 3921-3955. https://doi.org/10.1257/aer.104.12.3921

Ford, D.V., Jones, K.H., Verplancke, J-P., Lyons, R.A., John, G., Brown, G., Brooks, C.J., Thompson, S., Bodger, O., Couch, T., & Leake, K. (2009). The SAIL databank: Building a national architecture for e-health research and evaluation. BMC Health Services Research, *9*, 157. https://doi.org/10.1186/1472-6963-9-157

Gage, S.H., Munafo, M.R., & Davey Smith, G. (2016). Causal inference in developmental origins of health and disease (DOHaD) research. Annual Review of Psychology *67*, 567-580. https://doi.org/10.1146/annurev-psych-122414-033352

Gupta, S., Roos, L.L., Walld, R., Traverse, D., & Dahl, M. (2003). Delivering equitable care: Comparing preventive services in Manitoba, Canada. American Journal of Public Health, *93*(12), 2086-2092. https://doi.org/10.2105/AJPH.93.12.2086

Hand, D.J. (2016). Editorial: 'Big data' and data sharing. Journal of the Royal Statistical Society: Series A (Statistics in Society), *179*, 629-631. https://doi.org/10.1111/rssa.12185

International Data Linkage Conference. (2012). Advancing Knowledge for Better Health and Social Outcomes. Perth, Western Australia, May 2-4.

International Health Data Linkage Conference. (2014). Data Linkage for Better Public Policy, Vancouver, British Columbia, April 28-30.

International Population Data Linkage Network. (2016). Wales, United Kingdom, Available at: https://www.ipdln.org/.

Jaffee, S.R., Strait, L.B., & Odgers, C.L. (2012). From correlates to causes: Can quasi-experimental studies and statistical innovations bring us closer to identifying the causes of antisocial behavior? Psychological Bulletin, *138*(2), 272-295. https://doi.org/10.1037/a0026020

Johnson, R.C., & Schoeni, R.F. (2011). The influence of early-life events on human capital, health status, and labor market outcomes over the life course. B.E. Journal of Economic Analysis and Policy, *11*(3), 2521. https://doi.org/10.2202/1935-1682.2521

Jutte, D.P., Roos, L.L., & Brownell, M. (2011). Administrative record linkage as a tool for public health research. Annual Review of Public Health, *32*, 91-108. https://doi.org/10.1146/annurev-publhealth-031210-100700

Krieger, N., Waterman, P.D., Chen, J.T., Rehkopf, D.H., & Subramanian, S.V. (2016). Geocoding and monitoring US socioeconomic inequalities in health: An introduction to using area-based socioeconomic measures. The Public Health Disparities Geocoding Project monograph. Boston, MA: Harvard School of Public Health. Available at: https://www.hsph.harvard.edu/thegeocodingproject/.

Lahey, B.B., & D'Onofrio, B.M. (2010). All in the family: Comparing siblings to test casual hypotheses regarding environmental influences on behavior. Current Directions in Psychological Science, *19*(5), 319-323. https://doi.org/10.1177/0963721410383977

Levy, D., & Brink, S. (2005). Change of Heart: Unraveling the Mysteries of Cardiovascular Disease. New York, NY: Vintage Books.

Lix, L.M., Leslie, W.D., Yang, S., Yan, L., Walld, R., Morin, S.N., Majumdar, S.R., & Roos, L.L. (2017). Accuracy of offspring-reported parental hip fractures: a novel population-based parent-offspring record linkage study. American Journal of Epidemiology, 185 <needs to be italicized> (10), 974-981. https://doi.org/10.1093/aje/kww197

Lyons, R.A., Ford, D.V., Moore, L., & Rodgers, S.E. (2014). Use of data linkage to measure the population health effect on non-health-care interventions. Lancet, *383*(9927), 1517-1519. https://doi.org/10.1016/S0140-6736(13)61750-X

Martens, P., Nickel, N., Forget, E., Lix, L., Turner, D., Prior, H., Walld, R., Soodeen, R.A., Rajotte, L., & Ekuma, O. (2015). The Cost of Smoking: A Manitoba Study. Winnipeg, MB: Manitoba Centre for Health Policy.

Martens, P.J., Bartlett, J.G., Prior, H.J., Sanguins, J., Burchill, C., Burland, E., & Carter, S. (2011). What is the comparative health status and associated risk factors for the Metis? A population-based study in Manitoba, Canada. BMC Public Health, *11*, 814. https://doi.org/10.1186/1471-2458-11-814

Morris, A. The Farr Institute. (2015). Who are we and how to engage. Presentation at: Digital Health Assembly: Open Innovation Conference, Cardiff, UK, February 11, 2015.

Mortensen, L.H. (2013). Socioeconomic inequality in birth weight and gestational age in Denmark 1996-2007: Using a family-based approach to explore alternative explanations. Social Science and Medicine, *76*(1), 1-7. https://doi.org/10.1016/j.socscimed.2012.08.021

Mosteller, F., & Tukey, J.W. (1977). Data Analysis and Regression: a Second Course in Statistics. Reading, MA: Addison-Wesley.

Murabito, J.M., Pencina, M.J., Nam, B.H., D'Agostino, R.B. Sr., Wang, T.J., Lloyd-Jones, D., Wilson, P.W., & O'Donnell, C.J. (2005). Sibling cardiovascular disease as a risk factor for cardiovascular disease in middle-aged adults. Journal of the American Medical Association, *294*(24), 3117-3123. https://doi.org/10.1001/jama.294.24.3117

Murnane, R.J., & Willett, J.B. (2011). Methods Matter: Improving Casual Inference in Educational and Social Science Research. New York, NY: Oxford University Press.

Mustard, C.A., Derksen, S., Berthelot, J-M, & Wolfson, M.C. (1999). Assessing ecologic proxies for household income: A comparison of household and neighbourhood-level income measures in the study of population health status. Health & Place, *5*(2), 157-171. https://doi.org/10.1016/S1353-8292(99)00008-8

National Research Council. (2013). Frontiers in Massive Data Analysis, Washington, DC: The National Academies Press.

Oreopoulos, P., Stabile, M., Walld, R., & Roos, L.L. (2008). Short, medium, and long term consequences of poor infant health: An analysis using siblings and twins. Journal of Human Resources, *43*(1), 88-138. https://doi.org/10.1353/jhr.2008.0003

Oyen, N., Ranthe, M.F., Carstensen, L., Boyd, H.A., Olesen, S.C., Olesen, S.P., Wolfahrt, J., & Melybe, M. (2012). Familial aggregation of lone atrial fibrillation in young persons. Journal of the American College of Cardiology, *60*(10), 917-921. https://doi.org/10.1016/j.jacc.2012.03.046

Pampalon, R., Hamel, D., & Gamache, P. (2009). A comparison of individual and area-based socio-economic data for monitoring social inequalities in health. Statistics Canada. [accessed 23 Sept 2013]. Available at: http://www.statcan.gc.ca/pub/82-003-x/2009004/article/11035-eng.htm.

Pearl J. (2009). Causality: Models, Reasoning and Inference. 2nd ed. New York, NY: Cambridge University Press. https://doi.org/10.1017/CBO9780511803161

Power, C., Kuh, D., & Morton, S. (2013). From developmental origins of adult disease to life course research on adult disease and aging: Insights from birth cohort studies. Annual Review of Public Health, *34*, 7-28. https://doi.org/10.1146/annurev-publhealth-031912-114423

Public-Academic Research Colloquium: Leveraging Administrative Data for Social Policy. November 29 & 30, 2016. Washington, District of Columbia.

Roos, L.L., Walld, R., & Witt, J. (2014). Adolescent outcomes and opportunities in a Canadian province: Looking at siblings and neighbors. BMC Public Health, *14*(1), 506. https://doi.org/10.1186/1471-2458-14-506

Roos, L.L., Hiebert, B., Manivong, P., Edgerton, J., Walld, R., MacWilliam, L., & de Rocquigny, J. (2013). What is most important: Social factors, health selection, and adolescent educational achievement. Social Indicators Research, *110*(1), 385-414. https://doi.org/10.1007/s11205-011-9936-0

Roos, L.L., Brownell, M., Lix, L., Roos, N.P., Walld, R., & MacWilliam, L. (2008). From health research to social research: Privacy, methods, approaches. Social Science & Medicine, *66*(1), 117-129. https://doi.org/10.1016/j.socscimed.2007.08.017

Roos, N.P., & Roos, L.L. (2011). Administrative data and the Manitoba Centre for Health Policy: Some reflections. Healthcare Policy *6*(Special Issue), 16-28. https://doi.org/10.12927/hcpol.2011.22116

Schuurman, N., Bell, N., Dunn, J.R., & Oliver, L. (2007). Deprivation indices, population health and geography: An evidence of the spatial effectiveness of indices at multiple scales. Journal of Urban Health, *84*(4), 591-603. https://doi.org/10.1007/s11524-007-9193-3

Shadish, W.R. Propensity score analysis: Promise, reality and irrational exuberance. (2013). Journal of Experimental Criminology, *9*(2), 129-144. https://doi.org/10.1007/s11292-012-9166-8

Shadish, W.R., Cook, T.D., & Campbell, D.T. (2002). Experimental and Quasi-Experimental Designs for Generalized Causal Inference. Boston, MA: Houghton Mifflin.

Smith, M., Roos, L.L., Burchill, C., Turner, K., Ostapyk, T., Towns, D.G., Hong, S.P., Jarmasz, J.S., Ginter, J., Martens, P.J., Roos, N.P., Lix, L.M., Brownell, M., Azimaee, M., Soodeen, R.A., Nicol, J.P. (2015). Health services data: Managing the data warehouse: 25 years of experience at the Manitoba Centre for Health Policy. In: B. Sobloev, A. Levy, S. Goring (Eds). Data and Measures in Health Services Research. New York, NY: Springer Science+Business Media.

Smith, M., Semmens, J., Rosman, D., Ford, J., Storey, C., Holman, C.D.J., Fuller, E., & Gray, V. (2011). International health data linkage network. Healthcare Policy, *6*(Special Issue), 94-96. https://doi.org/10.12927/hcpol.2011.22127

Stanley, F., Glaubert, R., McKenzie, A., & O'Donnell, M. (2011). Can joined-up data lead to joined-up thinking? The Western Australian Developmental Pathways Project. Healthcare Policy, *6*(Special Issue), 63-73. https://doi.org/10.12927/hcpol.2011.22120

Steiner, P.M., Cook, T.D., Shadish, W.R., & Clark, M.H. (2010). The importance of covariate selection in controlling for selection bias in observational studies. Psychological Methods, *15*(3), 250-267. https://doi.org/10.1037/a0018719

Stukel, T.A., Fisher, E.S., Wennberg, D.E., Alter, D.A., Gottlieb, D.J., & Vermeulan, M.J. (2007). Analysis of observational studies in the presence of treatment selection bias: Effects of invasive cardiac management on AMI survival using propensity score and instrumental variable methods. Journal of the American Medical Association, *297*(3), 278-285. https://doi.org/10.1001/jama.297.3.278

Sturmer, T., Glynn, R.J., Rothman, K.J., Avorn, J., & Schneeweiss, S. (2007). Adjustments for unmeasured confounders in pharmacoepidemiologic database studies using external information. Medical Care, *45*(Suppl 2), S158-165. https://doi.org/10.1097/MLR.0b013e318070c045

Subramanian, S.V., Chen, J.J., Rehkopf, D.H., Waterman, P.D., & Krieger, N. (2006). Comparing individual- and area-based socioeconomic measures for the surveillance of health disparities: A multilevel analysis of Massachusetts births, 1998-1991. American Journal of Epidemiology, *164*(9), 823-834. https://doi.org/10.1093/aje/kwj313

Suissa, S., Henry, D., Caetano, P., Dormuth, C.R., Ernst, P., Hemmelgarn, B., Lelorier, J., Levy, A., Martens, P.J., Paterson, J.M., Platt, R.W., Sketris, I., Teare, G., & Canadian Network for Observational Drug Effect Studies. (2012). CNODES: The Canadian Network for Observational Drug Effect Studies. Open Medicine, *6*(4), e134-140.

Turkheimer, E., & Waldron, M. (2000). Nonshared environment: A theoretical, methodological, and quantitative review. Psychological Bulletin, *126*(1), 78-108. https://doi.org/10.1037/0033-2909.126.1.78

Viner, R.M., Ross, D., Hardy, R., Kuh, D., Power, C., Johnson, A., Wellings, K., McCambridge, J., Cole, T.J., Kelly, Y., & Batty, G.D. (2015). Life course epidemiology: Recognising the importance of adolescence. Journal of Epidemiology & Community Health, *69*(8), 32-37. https://doi.org/10.1136/jech-2014-205300

Wall-Wieler E, Roos LL, & Nickel N. (2016a). Teenage pregnancy: The impact of maternal adolescent childbearing and older sister's teenage pregnancy on a younger sister. BMC Pregnancy and Childbirth, *16(*1), 120. https://doi.org/10.1186/s12884-016-0911-2

Wall-Wieler, E., Roos, L.L., Chateau, D.G., & Rosella, L.C. (2016b). What predictors matter: risk factors for late adolescent outcomes. Canadian Journal of Public Health, *107*(1), e16-22. https://doi.org/10.17269/cjph.107.5156

Wennberg, J.E. (2010). Tracking Medicine: A Researcher's Quest to Understand Health Care. New York, NY: Oxford University Press.

Williams, D.R., McClellan, M.B., & Rivlin, A.M. (2010). Beyond the affordable care act: Achieving real improvements in Americans' health. Health Affairs, *29*(8), 1481-1488. https://doi.org/10.1377/hlthaff.2010.0071

Yang, S., Leslie, W.D., Yan, L., Walld, R., Roos, L.L., Morin, S.N., Majumdar, S.R., & Lix, L.M. (2016) Objectively verified parental hip fracture is an independent risk factor for fracture: A linkage analysis of 478, 792 parents and 261, 705 offspring. Journal of Bone and Mineral Research. *31*(9), 1753-1759. https://doi.org/10.1002/jbmr.2849

RESEARCH NOTE
Integrating area-based and national samples in birth cohort studies: the case of Life Study

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Abstract

The most recent UK birth cohort study, known as 'Life Study' was a longitudinal study planned to involve some 80,000 babies and comprised two components. The largest, the 'Pregnancy Component' was to consist of around 60,000 pregnant women who were to be recruited when attending for a routine antenatal ultrasound at selected maternity units in England. The other component, the 'Birth Component' was to be a random sample of intended size 20,000 live births across the UK. Recruitment to the cohort was to take place over a period of four years starting in 2015. Innovative sampling procedures had been designed and tested and a synthetic dataset produced with similar characteristics to the anticipated survey data was produced to study the performance of the sampling procedures and explore analysis strategies.

This research note describes the proposed sample design, and discusses how the two components were to be integrated to provide a consistent dataset for users. Approaches to the provision of suitable sampling weights and modelling approaches are also presented. Lessons are drawn for designs of future cohort studies.

Keywords

Cohort studies, longitudinal studies, research design, probability sampling, weighting, attrition, non-response

Introduction

The most recent UK birth cohort study, Life Study, began in 2011 as a longitudinal study of pregnant women and births in the UK with recruitment designed to take place over a four year period. It comprised two components, each representing different sampling and recruitment strategies, data from each of which was to be integrated into a single dataset for interdisciplinary research investigating causal mechanisms while enabling generalisability to the UK population. It was funded principally by the Economic and Social Research Council (ESRC). In July 2015, six months after recruitment had started in the first maternity centre, the ESRC council announced its decision to withdraw funding from October 2016, which was within two weeks of the planned opening of the second centre. (Dezateux, Colson, Brocklehurst & Elias, 2016a). There clearly is interest in understanding why it was decided to close down Life Study, beyond the brief formal statement issued by the funders, and the reader is referred to the summary report from the Life Study Scientific Steering Committee (Dezateux et al., 2016a) for further information. Further discussion of this is not relevant to the purpose of the present research

note which focusses solely on the study design and lessons that may be learnt from this for the future.

This sampling design was substantially the one recommended in two reports to the principal funder (Bynner, Wadsworth, Goldstein, Maughan, Purdon, Michael, 2007; Bynner et al., 2009), as set out in the protocol approved by the principal funder following a competitive process, international peer review and assessment by an independent international scientific panel (Dezateux et al., 2016b). The sampling design was subsequently discussed and refined by a methodology advisory group set up by and reporting to the Life Study Scientific Steering Committee.

One of the components - the 'Birth Component' - was planned as a sample of approximately 20,000 births selected at random, uniformly over the period of recruitment, with the sample being selected from the UK birth register. This component had similar intent to previous UK birth cohort studies - such as those starting in 1946, 1958, 1970 and 2001, namely to recruit a large and representative sample of births from across the UK.

The second component - the 'Pregnancy Component' - was planned as a sample of approximately 60,000 pregnant women approached when attending for routine antenatal ultrasound at maternity units in three geographically defined areas of England. A detailed description of the protocols for both components, including power calculations and sampling strategies, is given elsewhere (Dezateux et al., 2016b). Full documentation of the study questionnaires and materials can be found at https://www.lifestudy.ac.uk/resources, and these will be useful for readers who wish to gain a deeper understanding of the overall rationale and content of the study.

In this research note our concern is to explain the specific rationale for the formal sampling design of the study and to illustrate, using a synthetic dataset, different approaches to handling the integrated dataset by analysts, including the production of weights, the use of models that explicitly incorporate design factors, and procedures for handling missing data.

This two component design of Life Study was motivated by the need to provide information that was both representative of a population in time, for example to provide comparisons with previous birth cohorts sampled from the whole of the UK, as well as to enable scientific information to be collected before birth using innovative measures and approaches in order to provide insight into causal mechanisms underlying child development and health associated with pregnancy characteristics. Both components were conceived of as part of a single study with the aim of creating, as far as was practicable, a harmonised dataset and follow-up occasions. The pregnancy component is important since the biological and other data required are generally only possible to obtain through working in close collaboration with maternity units (as there is no sampling frame for pregnancies) and by setting up dedicated centres in which a wide variety of detailed measurements and observations can be obtained which would not otherwise be possible in a home setting. Previous pregnancy cohorts that have recruited mothers in pregnancy, have successfully used a similar approach, including, in the UK, the Avon Longitudinal Study of Parents and Children (ALSPAC) (Boyd et al., 2013) and the Born in Bradford study (Wright et al., 2013). In Goldstein et al., (2015) there is a detailed discussion around the role of the representativeness of samples and how non-probability based samples can be used to enhance scientific causal modelling objectives when combined with population based data.

Life Study was designed to be interdisciplinary from the outset. Hence it was considered desirable to make data from both components available for analysis as a single integrated dataset as this would provide additional precision for both causal analyses and population estimates. A major objective of Life Study was to enable analyses of causal mechanisms underpinning relationships between a range of exposures and later child outcomes, mostly derived from the larger, more intensively phenotyped, participants in the pregnancy component. The selection of maternity units was informed by the modelling of routine data on births linked to demographic information from the 2011 UK Census. This was undertaken by the Small Area Health Statistics Unit at Imperial College London. The initial criteria used to select potential units included measures of ethnic and social diversity, scale as well as geographical spread of mothers comprising the antenatal population served by each maternity unit.

The remainder of the paper is organised as follows. In the next section, we will briefly refer to the creation of a synthetic dataset created to test

different procedures for data modelling and presentation. Following that there is a section that describes how weights to handle the differential sampling across components and also non-response, can be defined and calculated. The final section describes some analyses, using the synthetic dataset, to illustrate different approaches to statistical modelling.

Developing a synthetic dataset

Given the premature closure of the study, actual study data are not available and hence we report the use of a synthetic dataset produced in order to develop and test sampling and analysis methodology. Since Life Study itself did not proceed beyond the initial pilot stage, we use this synthetic dataset to illustrate the design and analysis issues set out above. We do not address the issue of sampling costs, although in practice this will be important. Birth statistics for England and Wales are produced by the Office for National Statistics (ONS, 2013) and those published for the 2012 calendar year were used to generate a synthetic dataset, based upon marginal and pairwise table distributions. Table 1 lists the variables used.

Table 1. Synthetic dataset variable definitions

Sex
Area of usual residence of the mother (Local Authority District (LAD)) *
Area of usual residence of the mother (Electoral Wards) **
Type of birth registration (Within Marriage, Joint Registrations same address, Joint Registrations different address, Sole registrations)
Age of the mother at birth (years) (Under 20, 20-24, 25-29, 30-34, 35-39, 40-44, 45 and over)
Age of the father at birth (years) (Under 20, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50 and over)
National Statistics Socioeconomic Classification (NS-SEC) (1.1, 1.2, 2, 3, 4, 5, 6, 7, 8) ***
Ethnicity of baby (White, Black, Asian, Others) ****
Number of previous live-born children (0, 1, 2, 3+)
Multiple births (Singletons, Twins, Triplets)
Birth weight (Under 1,500 g, 1,500-1,999, 2,000-2,499, 2,500-2,999, 3,000-3,499, 3,500-3,999, 4,000-4,499, 4,500-4,999, 5,000 and over)
Month of birth (January to December)

* Local authority districts (LAD) is a generic term to describe the 'district' level of local government in the United Kingdom. It includes non-metropolitan districts, metropolitan districts, unitary authorities and London boroughs in England; Welsh unitary authorities; Scottish council areas; and Northern Irish district council areas. We considered 346 LAD in England and Wales.

**Electoral wards/divisions are the key building blocks of UK administrative geography. They are the spatial units used to elect local government councillors in metropolitan and non-metropolitan districts, unitary authorities and the London boroughs in England; unitary authorities in Wales. We considered 8565 Electoral wards in England and Wales with 2012 boundaries.

***1 Higher managerial and professional occupations; 1.1 Large employers and higher managerial occupations; 1.2 Higher professional occupations; 2 Lower managerial and professional occupations; 3 Intermediate occupations; 4 Small employers and own-account workers; 5 Lower supervisory and technical occupations; 6 Semi-routine occupations; 7 Routine occupations; 8 Never worked and long-term unemployed. This uses the combined method based on the most advantaged NS-SEC of either parent rather than just the father's socio-economic classification.

**** White (White British, White Irish and any other ethnic background); Black (African, Caribbean and any other Black background); Asian (Bangladeshi, Indian, Pakistan and any other Asian background); Other (All Mixed groups, Chinese, any other ethnic group). Based on Census categories.

The initial synthetic dataset comprised 2,918,696 records (live births), being the estimated number that would accrue over a four year period, in England and Wales, based on ONS Birth Statistics.

The pregnancy component sample was built as follows. A multivariable logistic model was used to predict the probability of being included in the pregnancy component; as predictors we used four of the variables listed in table 1, namely: ethnicity, SES, maternal age and birth weight. We fixed the coefficients in order to include higher proportions of ethnic minorities, low SES, low maternal age and low birth weight than in the population. The intercept and the coefficients in the reference category of each of the four predictors were set to have a pregnancy component sample equal to 121,802, that is four years live births, which is 4.2% of the total synthetic dataset. As discussed below, with a non-response rate equal to 50% this will result in approximately 60,000 live births, which was the planned sample size of the pregnancy component.

Under the assumption of non-overlap between the two components the target population of the birth component was composed of the remaining 2,796,894 = (2,918,696-121,802) four years' worth of estimated live births in the synthetic dataset. The birth component sample was randomly selected without replacement, to have a sample size equal to 31,941 (sampling fraction equal to 0.0114=31,941 /2,796,894). This sample size was set in order to have an observed sample size of 16,000 for the birth component in England and Wales, with the remainder of the birth component to be sampled from Scotland and Northern Ireland. The total sample size (Pregnancy +Birth, before non-response) was thus equal to 153,743.

Based on the experience of similar large scale cohort studies, an initial conservative estimate of a 50% response rate was assumed for Life Study and so this is assumed for the synthetic dataset, with an oversampling of ethnic minorities as proposed in the Pregnancy component outlined above. After allowing for 50% (randomly occurring) non-response, the final synthetic dataset consisted of approximately 60,000 in the pregnancy and 16,000 in the birth component.

For the pregnancy component we created the equivalent of (post stratified) design weights based upon the distributions in the full dataset. For the purpose of estimating weights any clustering within the pregnancy component is ignored. In this dataset we have a table consisting of 256 cells generated by the four variables, Age of the mother, National Statistics Socioeconomic Classification, infant ethnicity, and Birth weight. The weight for each cell *j* is set to

$$w_j = (\frac{N_j}{N})/(\frac{n_j}{n})$$

where upper case denotes the generated population and lower case the sampled records. Note that the post stratified design weights for the pregnancy component are proportional to $\frac{121{,}802}{2{,}918{,}696} = 0.042$ which reflects the fact that, treated as a stratum of the population it includes only 4.2% of live births. For the birth component the design weights are simply the inverse of the relevant sampling fraction. The weights were scaled to add to the total sample size. Thus, overall the sampling weights have mean of 1 with a computed standard deviation equal to 1.85. This would imply a design effect of 4.42. The term 'design effect' (Kish, 2014) is used in the standard way to mean the ratio of the variance (of the estimate) associated with the actual sample to the variance associated with a simple random sample of the same size.

Non response at the first sweep

The first sweep was planned to be the baseline examination at 28 weeks' gestation for the pregnancy component and at six months after birth for the birth component.

To incorporate possible bias within the synthetic dataset due to non-response, an 'informative' non-response mechanism depending on the available 'auxiliary' data was simulated. A main effects logistic model for the propensity to respond assumed differential responses for the categories of the four auxiliary variables. In particular, coefficients associated with each variable were fixed to have higher proportions of non-response within ethnic minorities, low SES, low maternal age and low birth.

For each of the two components, the final weights have been calculated as the product of sampling (or post stratified design) weights divided by the probability of response, and then scaled to the obtained sample size of 77,202, which differs slightly from the intended size of 76,000.

The resulting weights represent the theoretical weights based upon the known expected values derived from the sampling and non-response

mechanism. We can also compute weights based upon the achieved sample characteristics (after non response adjustment) and the known population values. This can be done directly for each cell of the multiway table (amalgamating very small cells) or via the logistic prediction models described above. The leads to a set of weights with mean 1 and standard deviation 2.03.

The use of weighting and covariate adjustment: efficiency and causal modelling

The data for Life Study essentially were to arise from five basic strata, namely the four constituent countries of the UK (birth component) together with the pregnancy component which was to be drawn from maternity units based in three English National Health Service Trusts. Within each stratum the design was intended to produce a sample where each member had the same selection probability, together with weights that would reflect the proportion of the whole UK population of births together with non-response adjustment, as described above. The design of Life Study required some oversampling for Scotland, Wales and Northern Ireland so that, should separate estimates be required for these countries, they would have an acceptably small standard error. The proposed distribution for the birth sample was as follows: England n=15500, Wales n=1500, Scotland n=1500, Northern Ireland n=1500. This would have resulted in a relative oversampling ratio for Wales, Scotland and Northern Ireland compared to England of 2.0, 1.2 and 2.4 respectively.

Standard data analysis packages will carry out weighted analyses and for many purposes this will be adequate where inference is required for the (national) population. The extent of clustering in the design will allow the calculation of a design effect for the birth component which can be used to adjust standard errors. An alternative is to fit a two-level model where the clusters are level two units, and this is generally to be preferred.

As described above, the design weights are adjusted for differential non-response using post-stratification based upon known population birth characteristics. We discuss the case of missing data and attrition below, but ignoring such possibilities for now, for the purpose of providing descriptive population estimates, the use of these weights is straightforward. We note that the addition of the pregnancy component to the birth component, *for the purpose of providing population estimates*, is estimated to add only between 5% and 10% efficiency, since the pregnancy component provides just 4% of the population of births, which is reflected in the low overall set of weights for this component. Thus, for the design effect of 4.42 quoted above, the effective sample size for estimating the mean, becomes 17,750 (16,841 from the births component + 949 from the pregnancy component). As we have already suggested, such population estimates will be useful, for example, when making comparisons with previous birth cohort studies both in the UK and elsewhere.

When fitting statistical models for the purpose of making causal inferences, we could also use these weights although, as we discuss below, it is both more flexible and more efficient if a full statistical modelling approach is used that treats the post stratification variables, used to derive the weights, as auxiliary variables or covariates within the statistical model. This allows us to incorporate all the information in the pregnancy component data without down-weighting it, so giving an efficient analysis. To illustrate the properties of the two approaches – weighting, or adjusting by strata defined by auxiliary variables – we consider a scenario in which the researcher is interested in analysing a linear relationship between a continuous exposure *x,* for example the duration of breastfeeding in the first six months following birth, and a continuous outcome *y,* for example weight adjusted for height at twelve months. The linear relationship has a coefficient equal to 0.20 within each stratum defined by the design auxiliary variables. We thus have the model

$$y = \alpha + 0.20x + f(z) \qquad (1)$$

where z represents the set of auxiliary variables that not only adjust for the design, but also contain variables such as ethnicity and birthweight that are relevant confounders. For simplicity we assume a main effects model without interactions.

Table 2 shows the results of fitting the model fitting auxiliary variables with and without using weights, for the model given by (1). Note that in deriving these weights we have ignored the post-stratification information provided by the auxiliary variables, and so the results presented give a 'worst case' scenario.

Given the fact of the much larger sample size of the pregnancy component, in analyses of simple

regression models, while the parameter estimates themselves are little changed, in the present case and also more generally, it leads to an increase in efficiency. As shown in table 2 the standard error of the coefficient estimated in the model adjusted for strata design is 0.0024 in the combined dataset and 0.0053 in the birth component alone. Using the weights, since the pregnancy component represents only a small component of the population, the estimated standard error shows that this reduced the efficiency by a factor of 4.5. This illustrates the advantage of a full modelling approach since it allows adjustment for the auxiliary variables relevant to data analyses that explore scientific hypotheses, for example those relevant to causal pathways. Interactions in such models between designated causal variables and the auxiliary variables will also often be of interest, for example in studying whether the causal relationships vary by ethnic group, mother's age, etc. As here, it is often the case when auxiliary design variables are used, that these are indeed also relevant for inclusion in the analyst's models of interest. Where one or more such variables are not of interest, but are associated with the response variable(s), and the analyst wishes to have model estimates that average or 'marginalise' over these variables, this is perhaps most readily achieved by omitting those variables from the model and introducing corresponding weights to compensate.

Table 2. Coefficients and standard errors estimated in a linear regression (model 1) adjusted by strata design and auxiliary variables and using weights

	Adjusted by strata/auxiliary variables		Using weights (worst case scenario)	
	Coefficient	S.E.	Coefficient	S.E.
Birth component	0.206	0.0053	0.206	0.0053
Combined	0.201	0.0024	0.205	0.0050

For a discussion of the relative merits and uses of population representative samples see Goldstein et al. (2015).

Models for attrition and item non-response

It is anticipated that there will be some loss of data from the study due to item non-response in the questionnaires, failure to obtain measurements, or to cohort study members not attending subsequent sweeps (attrition). A detailed discussion of how to deal with this is given by Goldstein (2009), but briefly is as follows. As described above, the synthetic dataset incorporates missing data values due to non-response where the failure to respond is a function of the stratification variables and other variables that, in the case of attrition, were available at the first wave of data collection. Although there was not time fully to explore ways of dealing with such missing data, we will describe the overall approach that was intended.

In practice, as a study progresses, those variables associated with the propensity to respond would be identified and then used to adjust for response biases. In the case where a complete record for an individual is missing, for example due to subsequent attrition, a data analyst may wish to use procedures, such as propensity score matching or inverse probability weighting (see for example, Pearl, 2009), or carry out a full imputation modelling, conditioning on the variables associated with propensity to respond. Thus, if an item in a record is missing, a form of multiple imputation is generally recommended so that maximum efficiency can be maintained and bias minimised. Auxiliary variables associated with missingness can be incorporated and missing items and attrition can be handled simultaneously. When using multiple imputation, users will obtain several, typically at least ten, completed multiply imputed datasets. The

model of interest is then fitted to each one and parameter estimates combined according to simple rules (Carpenter & Kenward, 2013). While it is possible to carry out the imputation prior to releasing data for secondary analysis, this does have certain drawbacks, especially since it would be impossible to anticipate all the analyses that users might wish to do and to include all the relevant variables in the imputation. The imputed datasets would therefore not properly reflect the variables in such analyses and this is known to create problems due to a lack of 'congeniality' (Carpenter & Kenward, 2013). Instead, therefore, Life Study was proposing that suitable materials be provided for users to enable them to carry out their own efficient, and theoretically sound, imputation-based analyses. One of these was to have been based upon the proposal by Goldstein, Carpenter & Browne, (2014), who present a Bayesian procedure to carry out such analyses. Appropriate software could be made available to potential users of combined survey datasets as part of an 'access and analysis' package.

If the data are being used to make population estimates then the data records will also have weights attached and these would need to be incorporated. Carpenter and Kenward (2013) discuss how this may be done and further work on this is currently being carried out (Goldstein, Carpenter & Kenward, 2016).

Response rates

A persistent feature, observed internationally, is the decline in response to population surveys. We have discussed how this can be tackled by carrying out adjustments based upon nationally available data, although when the response rate becomes very small this may not become practical. We can often also do this using administrative data for small areas or institutions such as those defined by women attending a set of maternity units. This is likely to be an important future consideration and thus should be a feature of any study design. For components of any study that are intended to represent real populations, there will typically be administrative data that comprehensively cover the population of interest. In the case of Life Study, as described, comprehensive data on live births were available. For components that sample from institutions obtaining such institution-level data may often be problematical, and for such studies ensuring at the planning stage that these are made available is important. This may require, for example in the case of women attending a maternity unit, ethical approval as well as suitable record systems being available.

Acquiring such auxiliary data, while important, does not imply that obtaining high response rates and minimising attrition are unimportant. Concentrating data collection within institutions such as maternity units or schools may often have advantages in promoting high response rates by increasing participant motivation and commitment, and from a scientific point of view can also result in higher quality measures.

Discussion

In this paper we have shared some of the methodological challenges that Life Study encountered. Given its innovative and ambitious design, these challenges had been anticipated and resources allocated to tackling them. The aspects of design and analysis described in the present paper, even though ultimately they could not be followed through, are of more universal applicability and thus, we believe, potentially useful for future studies

In particular, we believe that the two components, as used in Life Study, are mutually enhancing and allow causal analyses to be conducted alongside those requiring population inferences. Advances in data collection technology as well as information technology and statistical methodology now make it feasible to design and implement complex longitudinal cohort studies that move beyond previous designs based upon national or regional populations. While in the past, the latter may have had (relative) simplicity in terms of analysis, and data collection, and been practical in terms of the technology involved, we would contend that they should no longer be viewed as the norm. In particular we consider that locally and institutionally based samples are likely to become a more important feature of large scale longitudinal studies in the future.

Of course, as we have described, embarking on a more complex design does involve a greater level of sophistication in terms of data collection and processing, and the skills and training required involved need to be taken into account. Carrying out preliminary analysis on synthetic data to ascertain how to utilise administrative data, create

weights, and deal with non-response and attrition, is also important and can assist in anticipating and providing for the methodological support needed to ensure successful and full use of the resulting data.

As more administrative datasets become available from a wide variety of sources, the opportunities for complex survey designs, which allow for different data collection instruments associated with different samples whilst facilitating the combination of these samples, will increase. Although the statistical problems such sample design strategies introduce are challenging, there are sound scientific arguments to adopt such approaches.

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References

Boyd A, Golding J,, Macleod J., Lawlor D.A., Fraser, A., Henderson, J., Molloy, L., Ness, A., Ring, S. & Davey Smith, G. (2013). Cohort Profile: the 'children of the 90s'--the index offspring of the Avon Longitudinal Study of Parents and Children. International Journal of Epidemiologgy. 42(1):111-27. https://doi.org/10.1093/ije/dys064

Bynner, J., Wadsworth, M., Goldstein, H., Maughan, B., Purdon, S. & Michael, R. (2007). Scientific case for a new birth cohort study. Report to the Research Resources Board of the Economic and Social Research Council and Appendices. Retrieved from: http://docs.wixstatic.com/ugd/df1448_5bd766445623401b9c4b69e9c8f622dd.pdf

Bynner, J. Wadsworth, M. Goldstein, H. Maughan, B. Lessof, C. Michael, R. (2009). Options for the design of the 2012 birth cohort study, Report to the Research Resources Board of the Economic and Social Research Council and Appendices. Retrieved from: http://docs.wixstatic.com/ugd/df1448_449d3148bd8c4c919fd29edfffe897b5.pdf

Carpenter, J. R. & Kenward, M. G. (2013). Multiple Imputation and Its Application. Chichester: Wiley. https://doi.org/10.1002/9781119942283

Dezateux, C.,Colson, D., Brocklehurst, P. & Elias, P. (2016a). 'Life after Life Study' Report of a Scientific Meeting held at The Royal College of Physicians, London, UK, 14th January 2016. (Life Study Working Papers). Life Course Epidemiology and Biostatistics/ UCL Institute of Child Health: London, UK. https://doi.org/10.14324/000.rp.1485681

Dezateux, C; Knowles, R; Brocklehurst, P; Elias, P; Burgess, S; Colson, D; Elliot, P (2016b). Life Study Scientific Protocol. (Life Study Working Papers). Life Course Epidemiology and Biostatistics/ UCL Institute of Child Health: London, UK. https://doi.org/10.14324/000.rp.1485668

Goldstein, H. (2009). Handling attrition and non-response in longitudinal data. International Journal of Longitudinal and Life Course Studies 1: 63-72.

Goldstein, H., Carpenter, J. R. & Browne, W. J. (2014). Fitting multilevel multivariate models with missing data in responses and covariates that may include interactions and non-linear terms. Journal of the Royal Statistical Society: Series A (Statistics in Society). 177(2), 553-564. https://doi.org/10.1111/rssa.12022

Goldstein, H., Carpenter, J. & Kenward, M. (2016). Bayesian models for weighted data with missing values: a bootstrap approach. (submitted for publication).

Goldstein, H., Lynn, P., Muniz-Terrera, G., Hardy, R., O'Muircheartaigh, C., Skinner, C. & Lehtonen, R. (2015). Population sampling in longitudinal surveys debate. Longitudinal and Life Course Studies, 6, 447 – 475. https://doi.org/10.14301/llcs.v6i4.345

Kish, L. (2014). Survey Sampling. New York, Wiley.

ONS, (2013). Births statistics: Metadata. [viewed 20th January 2014]. Retrieved from: http://www.ons.gov.uk/ons/guide-method/user-guidance/health-and-life-events/

Pearl, J. (2009). Understanding propensity scores. Causality: Models, Reasoning, and Inference (Second ed.). New York: Cambridge University Press. https://doi.org/10.1017/CBO9780511803161

Wright, J., Small, N., Raynor, P., Tuffnell, D., Bhopal, R., Cameron, N., Fairley, L., Lawlor, D.A., Parslow, R., Petherick, E. S., Pickett, K. E., Waiblinger, D. & West, J. (2013). Cohort profile: The Born in Bradford multi-ethnic family cohort study. International journal of epidemiology, 42(4), 978-991. https://doi.org/10.1093/ije/dys112

RESEARCH NOTE
Is there a wage penalty associated with a degree of indecision in career aspirations? Evidence from the BCS70

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Abstract

In this longitudinal study, we test whether varying degrees of indecision about future career choices at age 16 have long-term economic consequences in adulthood, taking into account potential gender differences. Findings from a British cohort born in 1970 indicate that young people who were completely undecided about job choices did experience a wage penalty at age 34 compared to young people who were certain about their job aspirations. This association was significant even after controlling for family socioeconomic status, parental expectations and academic ability at age 16. However, the wage penalty was mediated by educational attainment and part-time employment at age 34. Not being entirely certain about one's future profession by age 16 seems to be part of a career decision making process which does not necessarily incur a wage penalty for most young people, especially if it involves the acquisition of education qualifications.

Keywords

Career indecision; career aspirations; earnings; 1970 British Cohort; Britain

Introduction

There is consistent evidence to suggest that high educational and career aspirations during adolescence increase educational achievement, occupational prestige and wage attainments in adulthood (Mello, 2008; Schoon & Parsons, 2002). There is however relatively little research on labour market outcomes associated with uncertain aspirations. The few extant studies have shown that young people with uncertain career aspirations experience more problems at labour market entry and a wage penalty in adulthood (Sabates, Harris, & Staff, 2011; Staff, Harris, Sabates, & Briddell, 2010; Yates, Harris, Sabates, & Staff, 2011). However, to our knowledge, no studies have yet examined whether degree of career indecision matters for wage attainment in adulthood.

In order to understand the role of uncertainty in vocational development we can focus on Super's theory of career development. According to Super (1980), adolescents start to understand their own abilities, skills and interests and thus experience a stage of career exploration which is influenced by their experiences in school, home and work (Super, 1980). It is during this stage that there is an

increase in uncertainty as well as indecisiveness, which reduces as young people crystallise their aspirations concerning career pathways with specific actions for skill acquisition. Previous research has shown that some young people are eager to make their first career decisions and are completely certain about what they want to do in the future, most have a more general idea about the direction they would like to take and others are uncertain about their future job trajectories (Gati, Kleiman, Saka, & Zakai, 2003). Research has further shown that this degree of indecision and uncertainty can be problematic in the labour market as it could lead to young people's floundering, moving from one job to another without a clear trajectory (Kerckhoff, 1998).

In this study, we investigate whether career decision-making at compulsory school-leaving age has long-term socioeconomic consequences in adulthood. More specifically, this study (i) measures different degrees of career indecision; and (ii) investigates whether the degree of indecision, along with level of aspiration, are associated with wage attainment in adulthood among males and females. We draw on evidence from the 1970 British Cohort Study (BCS70), which reached compulsory school leaving age (i.e., age 16) in the mid-1980s, following a major economic recession at the beginning of the decade. Since women generally have lower occupational status and wage attainment than men despite having higher educational qualifications and higher aspirations (Corrigall & Konrad, 2007; Mello, 2008; Schoon & Polek, 2011; Scott, Crompton & Lyonette, 2010), we examine males and females separately.

We investigate the role of covariates measured at age 16, including indicators of parental social status and financial hardship, parental education expectations, as well as adolescent's ethnicity, academic ability and school engagement – all of which have been associated with both occupational aspirations and later educational and occupational outcomes (Croll, Attwood, Fuller, & Last, 2008; Gutman, Sabates, & Schoon, 2014; Gutman & Schoon, 2012; Mau & Bikos; 2000; Schoon, 2010).

Given the strong associations between career aspirations and educational attainment (Mello, 2008) and between level of education and wage attainment (Blanden, Gregg & Macmillan, 2013), we further examine whether educational attainment by age 34 acts as a potential mediator between early career indecision and wage attainment in adulthood. We also include part-time employment as a control variable to account for gendered employment and the fact that part-time employment itself carries a wage penalty (Connelly & Gregory, 2009).

Method

Data

Data for this study come from the BCS70, which comprises over 17,000 individuals who were born in Britain during a week in April, 1970. The sample used here was followed up subsequently at ages five, 10, 16, 26, 30 and 34. The analysis of this study is based on 5,318 cohort members with complete information on career aspirations at age 16 and wage attainment at age 34. BCS experienced some sample loss between multiple survey waves. In 1986, there was a teacher's strike that affected data collection for more than half of cohort members. Studies examining potential response bias found that all school children were affected in the same way and that the demographic characteristics of the sample at age 16 remained representative of the target population (Shepherd, 1997). Regarding selection bias at age 34, Vignoles, de Coulon, & Marcenaro-Gutierrez (2011) demonstrated that correcting for it does not change the general direction of results.

Measures

Wages

Our outcome variable is wage attainment at age 34. The net hourly wage was calculated from cohort members' income net of all deductions from taxes, contributions to National Insurance, union dues, and pension, and additions resulting from overtime, bonuses, commissions and tips. In addition, if a respondent was employed in both a full-time and part-time job, only the wages of the full-time job were considered to calculate the hourly wage. Those who were self-employed and those only in part-time jobs (less than 30 hours per week) were also included.

Degree of indecision in career aspirations

Our main explanatory variable is the degree of indecision in career aspirations. At age 16, cohort members were asked to report the kind of jobs, they would like to do later on in life. There were

several pre-formulated response alternatives, including professional/managerial occupations, teaching and administrative posts, and semi-skilled or unskilled jobs. One option was 'cannot decide' from which we identified cohort members who were completely uncertain or undecided about their future careers. A follow up question was "can we now ask whether there is an actual job which you would like to do within the trade industry or profession in which you hope to work". From these two questions we generated a variable that combined socioeconomic level of career aspiration and level of career detail (i.e., how specific young people were about the job they wanted to do within the industry or profession). From these two questions we devised a variable measuring degree of indecision.

The socioeconomic level of career aspirations was classified according to the Registrar General Social Classification into professional and managerial occupations, skilled manual and non-manual occupations and semi-skilled and unskilled occupations (see Standard Occupational Classification, 1991). Young people who aspired to professional or managerial jobs, teaching, nursing and trained clerical professional (e.g., legal, medical, administrative) were classified into professional/managerial occupations. Young people who aspired to administrative work, agriculture or fishing industry, craftsman, IT, health or transport workers or HM forces were classified into skilled occupations. In line with other studies, we combined skilled manual and skilled non-manual occupations into one category (Sabates et al., 2011; Schoon & Parsons, 2002). Finally, young people who aspired to work as maintenance, restaurant or shop workers as well as those on manufacturing or personal services, were classified as in semi-skilled/unskilled occupations.

Within each of these socioeconomic levels, we classified level of career detail into three categories: high, low and no detail provided. The first category contains young people who gave occupations with specific roles, for example "science teacher", "civil engineer" or "plumber" ('high detail' in Table 1). The second category contains young people who were broad in their responses about jobs and only provided a general direction, for example "teacher", "engineer" or "trade" ('low detail' in Table 1). The third category contains young people who specified the sector or industry but did not answer the question about the specific job they wanted to do ('no detail' in Table 1). Finally, a fourth category was those young people who positively responded "I cannot decide" to the question about the kind of jobs they wanted to do in the future.

Covariates at age 16

These include parental social status and parental expectations as well as adolescents' academic ability and later educational attainment. For parental social status, we measured the Registrar General Social Class Scale (RGSC) based on the occupation of the parent holding the job with the highest socioeconomic status, age at which parents left full-time education, and family material hardship, measured by parent assessment of the family financial situation. For parental expectations, we identified parents who expected their children to continue in education after the age of 16.

For adolescent's ethnicity we differentiate between white and non-white British. For adolescent's ability, we include a relative measure of academic performance where teachers compared cohort members to children of similar age (1= top 5%; 7 = bottom 5%). We include a standardised test score in mathematics measured at age 16. Self-concept of ability at age 16 was constructed as a standardised index from cohort members' responses to five questions (alpha = .72) such as "I am clever". School disengagement at age 16 was a mean of cohort members' responses to five questions (alpha = .79) such as "School is a waste of time". Educational attainment at age 34 consists of a six point scale (0 = no qualifications, 1 = below CGSE-level qualifications, 2 = O-level, or GCSE equivalent, 3 = A-Level or equivalent, 4 = university degree or equivalent, 5 = post-graduate degree). Part-time employment at age 34 is coded as 1 = part-time; 0 = full-time.

Imputation

In order to address potential bias resulting from item-missing data, we used multiple imputation—program ICE in STATA version 10. We imputed five datasets, with all of the independent measures included in the imputation procedure (Rubin, 1996). The estimates for the five combined data sets were analysed using Rubin's rule (Rubin, 1987).

Analytic Plan

Linear regression was used to estimate three models. In the first model, we estimated the association between occupational aspirations and degree of indecision and wages, as a set of dummy variables defining highest occupational class and maximum certainty about occupational choice as the reference category. In the second model, we included the age 16 covariates. In the third model, we included highest educational qualifications and part-time employment in adulthood at age 34. Separate estimations were performed for males and females.

Results

Table 1 shows the descriptive statistics for the variables included in the model. Women generally earned less than men, reported higher occupational aspirations at age 16 and were less uncertain in their aspirations. Women were also less disengaged from school than men, had lower scores on the maths test, and reported a lower self-concept of their ability. Women were more likely to be in part-time employment at age 34.

Table 2 shows results from the model estimating the relationship between aspirations at age 16 and wage return in adulthood (at age 34). Column [1] shows the raw relationship with the inclusion of ethnicity but without the inclusion of any other covariates. Results show that there is a clear wage gradient in the level of aspirations for both males and females, whereby those who aspired to professional/managerial jobs when they were 16 achieved higher wages at age 34 than those who aspired to skilled jobs, semi-skilled/unskilled jobs and those who were completely uncertain. Among males, the downward wage gradient is most prominent for those with semi/unskilled, high detailed aspirations. Females have a clearer wage gradient than males, with those were who were undecided about their aspirations at age 16 achieving, on average, the lowest wages in adulthood.

When the age 16 covariates were introduced, the relationship between aspirations and wages in adulthood was significantly reduced as shown in Column [2]. Being completely uncertain regarding one's career aspirations remained significantly associated with a wage penalty for both males and females, though at a reduced level. Among women there still appeared to be some wage differentials in adulthood according to the degree of indecision in their teenage aspirations. In particular, we found that women who aspired to semi-skilled/unskilled occupations, and who provided only a broad direction or no detail about which occupations they wanted to enter had lower wages compared to women who aspired to professional/managerial jobs and gave detailed job information. Statistically significant factors in predicting wage attainment for males included age at which father left education, household financial hardship, teacher-rated ability and exam score at age 16. Significant factors in predicting wage attainment for females included family SES, age at which mother left education, teacher-rated ability and exam score at age 16.

In the final model, the inclusion of achievement of educational qualifications and part-time employment by age 34 more than completely accounts for the wage gradient according to the degree of indecision in their career aspirations among men (see Column [3]). For both men and women, the initial wage differential between those who were completely uncertain about their future and those who aspired to professional/managerial jobs is only marginally significant at the 10% level. For women who aspired to semi-skilled/unskilled jobs, but gave no details of the type of job that they aspired to the wage penalty, remains statistically significant when compared with that for women who aspired to professional/managerial jobs and provided high detail about the kind of job they aspired to.

Figure 1 shows the estimated relationship between the logarithm of wage attainment in adulthood and career aspirations at age 16, based on the final model. Importantly, we focus on the prediction of wages for young people who aspired to professional/managerial, skilled or semi-skilled/unskilled occupations separately and for each of these levels of aspirations we also included the prediction according to the level of detail provided about specific jobs. The main aim of this figure is to visualise if there are any wage differentials according to the degree of detail provided about the job that young people aspired to during adolescence. As it can be seen, for both men and women there is no apparent wage penalty linked to levels of detail about specific jobs within career aspirations. For instance, the average predicted wage in adulthood for men who aspired

to professional/managerial occupations, and who provided a high degree of detail on the kind of jobs, is similar to that of men who also aspired to professional/managerial occupations, but who provided a low degree of detail about specific jobs. Similarly, there is little evidence of a wage differential between men who aspired to professional/managerial occupations and who gave no response to the kind of job within these professions. Similar results hold for women who aspired to professional/managerial occupations, for men and women who aspired to skilled occupations, and for men and women who aspired to semi-skilled/unskilled occupations. The level of detail provided about specific jobs is not associated with wage penalties once the broad occupational aspiration as well as family background, highest academic attainment and whether in full or part-time work are accounted for.

Discussion

This study expands previous research suggesting a wage penalty attached to uncertain career aspirations at age 16 by examining if the degree of indecision matters too. Findings indicate that complete uncertainty about one's future job was significantly associated with a wage penalty for both men and women, even when family background, parental expectations and academic ability at age 16 were taken into account. However, educational attainment and part-time employment at age 34 mediated the association between uncertain career aspirations and adult wage attainment. Aiming high was associated with higher wages, but within this, being specific about what job one would like to do seemed to offer no significant wage benefit in adulthood. There was however a wage penalty for women who as teenagers aspired to a semi-skilled/unskilled occupation without providing any details about the job they wanted to do, suggesting that women may be at a greater disadvantage than males in terms of their future wage attainment when they have low or no aspirations as adolescents.

In terms of limitations, our analyses are descriptive and thus one must be cautious in drawing any causal inferences. A further limitation is that mediating factors, such as peer influence, mentoring, labour market opportunities and especially, employment experience prior to age 34, were not examined. Another possible limitation is measurement of wage attainment at age 34, when many women tend to be transiently employed in part-time jobs which have their own pay penalty (Connelly & Gregory, 2009) and when selection biases occur around child-bearing for women (Neuburger, Kuh & Joshi, 2011). In addition, there may be a concern regarding selectivity into the different occupational aspiration groups at age 16, given some determinants of aspirations were not captured by the covariates. Lastly, there are also issues in drawing firm conclusions about the associations between career aspirations at age 16, when most young people make the decision whether to remain in education or to leave school, and later wage attainment. The experience leading to outcomes in employment of young school leavers compared with those on a higher education route in the UK is likely to be radically different. Future research may examine how career aspirations predict labour market outcomes using groups defined by different career pathways.

In conclusion, our findings enable us to think about the role of uncertainty in vocational development. Super's theory of career development (1980) suggested the stage of 'exploration' which recognises that young people, between ages 16 and 24, start to crystallise an occupational aspiration as they try different options during school, part-time jobs and volunteering. However, Super's theory is primarily directed at young people on the normative US route of college attendance following high school in the 1980s. Since career options in the modern labour market are becoming broader, there is an increasing demand for young people to become very knowledgeable about the different career options during this stage of 'exploration'. Our results suggest that young people who are completely uncertain about their career aspirations may be at a disadvantage in today's global economy. However, our findings also show no significant impact on income potential for young people who remain somewhat flexible with their career choices at age 16, as long as they aimed high and had some indication of the industry of their future career trajectory. Accordingly, the focus of career counsellors may be best placed on those young people who are completely uncertain about their future career choices when they approach

compulsory school leaving age. Attention may also be placed on raising the ambitions of young females who do not have high aspirations and to help them to formulate a choice by providing information and a better understanding of pathways to employment.

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References

Ashby, J. S. & Schoon, I. (2010). Career success: The role of teenage career aspirations, ambition value and gender in predicting adult social status and earnings. *Journal of Vocational Behavior, 77*(3), 350-360. https://doi.org/10.1016/j.jvb.2010.06.006

Blanden, J., Gregg, P. and Macmillan, L. (2013) 'Intergenerational Persistence in Income and Social Class: The Impact of Within-Group Inequality'. *Journal of Royal Statistical Society: Series A*, 176(2): 541-563. https://doi.org/10.1111/j.1467-985X.2012.01053.x

Connolly, S. & Gregory, M. (2009). The part-time pay penalty: earnings trajectories of British women. *Oxford Economic Papers, 61*, 76-97. https://doi.org/10.1093/oep/gpn043

Corrigall, E. A. & Konrad, A. M. (2007). Gender role attitudes and careers: A longitudinal study. *Sex Roles, 56*(11), 847-855. https://doi.org/10.1007/s11199-007-9242-0

Croll, P., Attwood, G., Fuller, C., & Last, K. (2008). The structure and implications of children's attitudes to school. *British Journal of Educational Studies*, *56*(4), 382-399. https://doi.org/10.1111/j.1467-8527.2008.00420.x

Gati, I., Kleiman, T., Saka, N. & Zakai, A. (2003). Perceived benefits of using an Internet-based interactive career planning system. *Journal of Vocational Behavior*, *62*, 272-286. https://doi.org/10.1016/S0001-8791(02)00049-0

Gutman, L. M., Sabates, R., & Schoon, I. (2014). Uncertainty in educational and career aspirations. In I. Schoon and J. S. Eccles (Eds.), *Gender differences in aspirations and attainment* (pp. 161-181). Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9781139128933.011

Gutman, L. M. & Schoon, I. (2012). Uncertain career aspirations: Gender differences among adolescents living in England. *Journal of Vocational Behavior*, *80*(3), 608-618. https://doi.org/10.1016/j.jvb.2012.02.002

Kerckhoff, A. C. (1998). Transition from school to work in comparative perspective. In M.T. Hallinan (Ed.), *Handbook of the Sociology of Education* (pp. 453-474). The Netherlands: Kluwer Academic/Plenum.

Mau, W. C., & Bikos, L. H. (2000). Educational and vocational aspirations of minority and female students: A longitudinal study. *Journal of Counseling & Development*, *78*(2), 186-194. https://doi.org/10.1002/j.1556-6676.2000.tb02577.x

Mello, Z. R. (2008). Gender variation in developmental trajectories of educational and occupational expectations and attainment from adolescence to adulthood. *Developmental Psychology, 44*(4), 1069-1080. https://doi.org/10.1037/0012-1649.44.4.1069

Neuburger, J., Kuh, D., & Joshi, H. (2011). Cross-cohort changes in gender pay differences in Britain from 1972 to 2004: accounting for selection into employment using wage imputation. *Longitudinal and Life Course Studies Vol 2, No 3*, 260-285.

Rubin, D. B. (1987). *Multiple imputation for nonresponse in surveys*. New York: John Wiley & Sons. https://doi.org/10.1002/9780470316696

Rubin, D. B. (1996). Multiple imputation after 18+ years. *Journal of the American Statistical Association, 91*, 473–489. https://doi.org/10.1080/01621459.1996.10476908

Sabates, R., Harris, A. & Staff, J. (2011). Ambition gone awry: The long-term socioeconomic consequences of misaligned and uncertain ambitions during adolescence. *Social Science Quarterly*, *92*(4), 959-977. https://doi.org/10.1111/j.1540-6237.2011.00799.x

Schoon, I. (2010). Planning for the Future: Changing Education Expectations in Three British Cohorts. *Historical Social Research-Historische Sozialforschung, 35*(2), 99-119.

Schoon, I. & Parsons, S. (2002). Teenage aspirations for future careers and occupational outcomes. *Journal of Vocational Behavior, 60*(2), 262-288. doi: 10.1016/jvbe.2001.1867

Schoon, I. & Polek, E. (2011). Teenage career aspirations and adult career attainment: The role of gender, social background and general cognitive ability. *International Journal of Behavioral Development, 35*(3), 210-217. https://doi.org/10.1177/0165025411398183

Scott, J., Crompton, R. & Lyonette, C. (Eds.). (2010). *Gender inequalities in the 21st century*. Cheltenham, UK: Edward Elgar. https://doi.org/10.4337/9781849805568

Shepherd, P. (1997). Survey and response. In J. Bynner, E. Ferri, & P. Shepherd (Eds.), *Getting on, getting by, getting nowhere. Twenty-something in the 1990's* (pp. 129-136). Aldershot, U.K.: Ashgate.

Staff, J., Sabates, R., Harris, A. & Briddell, L. (2010) Uncertainty in early occupational aspirations: Role exploration or floundering? *Social Forces, 89*(2), 659-684. https://doi.org/10.1353/sof.2010.0088

Standard Occupational Classification. (1991). *Social classifications and coding methodology*, Vol. 3, London: OPCS/HMSO.

Super, D.W. (1980) A life-span, life-space approach to career development. *Journal of Vocational Behaviour, 16,* 282-298. https://doi.org/10.1016/0001-8791(80)90056-1

Vignoles, A., de Coulon, A. & Marcenaro-Gutierrez, O. (2011). The value of basic skills in the British labour market. *Oxford Economic Papers, 63*(1)*,* 27-48. https://doi.org/10.1093/oep/gpq012

Yates, S., Harris, A., Sabates, R. & Staff, J. (2011). Early occupational aspirations and NEETs: a study of the impact of uncertain and misaligned aspirations and social background on young people's entry into NEET status. *Journal of Social Policy, 40*(3), 513-534. https://doi.org/10.1017/S0047279410000656

Table 1. Descriptive statistics for variables by gender using imputed data (BCS70)

Variables	Description	Men mean (sd)	Women mean (sd)	Sig. Diff
Outcome (Adulthood)				
Log Hourly Wage (age 34)	Take home pay after all deductions from taxes	2.12 (0.49)	1.98 (0.45)	**
Aspirations & Uncertainty (age 16)				
Professional/managerial & High Detail	Professional/managerial career aspirations & high degree of detail	11.3	14.9	**
Professional/managerial & Low Detail	Professional/managerial career aspirations & low degree of detail	4.6	7.9	**
Professional/managerial & No Detail	Professional/managerial career aspirations & no detail	9.3	9.6	
Skilled & High Detail	Skilled labour aspirations & high degree of detail	25.7	25.9	
Skilled & Low Detail	Skilled labour aspirations & low degree of detail	14.1	14.1	
Skilled & No Detail	Skilled labour aspirations & no detail	13.2	10.5	*
Semi-skilled/unskilled & High Detail	Semi-skilled/unskilled labour aspirations & high degree of detail	5.4	2.5	**
Semi-skilled/unskilled & Low Detail	Semi-skilled/unskilled labour aspirations & low degree of detail	4.0	3.4	*
Semi-skilled/unskilled & No Detail	Semi-skilled/unskilled labour aspirations & no detail	4.2	3.6	*
Uncertain	Uncertain career aspirations	8.3	7.6	*
Mediator Variables (educational attainment at age 34)				
Educational Attainment (age 34)	Highest education attained by youth, six point scale 0=no qualifications to 5=post-graduate qualifications	3.05 (1.11)	3.02 (1.12)	
Part time Employment (age 34)	Whether in part time employment	5.5	25.0	**
Predictor Variables (parental social status & parental expectations)				
High Family SES (I&II)	Highest parental occupation (professional/managerial)	39.3	37.5	
Middle Family SES (III)	Highest parental occupation (skilled)	48.4	49.6	
Low Family SES (IV&V)	Highest parental occupation ()	12.3	12.9	

Age mother left school	Age at which mother left full-time education	16.4 (1.77)	15.9 (1.71)	
Age father left school	Age at which father left full-time education	16.1 (2.59)	16.2 (2.35)	
Family financial hardship	Family was troubled by financial situation in 1985	10.1	9.8	
Parental expectations	Parents who expected cohort member to attend HE (%)	18.5	17.9	
Predictor Variables (child's ability and engagement)				
Academics (teacher rated)	Teacher rated of academic performance and underlying ability compared to other students of similar age (1 = rated high, 7= rated low)	3.36 (1.29)	3.34 (1.28)	
Math score	Standardised test scores for math	0.16 (1.03)	0.11 (0.98)	**
Self-concept of ability	Standardised index of perceptions on school abilities	0.11 (0.98)	-0.05 (0.87)	**
School disengagement	Standardized index of responses (1=not true; 3=very true): (a) I feel school is largely a waste of time (b) I think home-work is a bore; (c) Difficult to keep my mind on my work; (d) I never take school work seriously; (e) I do not like school; (f) there is no point in planning for the future you should take things as they come	0.07 (0.89)	-0.07 (0.92)	**
Ethnicity	Non British White	5.9	4.9	

Note: n = 3,037 for women & 2,281 for men. *p < .05, two-tailed. **p < .01, two-tailed. For continuous variables t-test is used and for dichotomous variables chi-squared test.

Table 2. Unstandardised regression coefficients and standard errors relating aspirations at age 16 to wage attainment in adulthood by gender

	Men			Women		
VARIABLES	[1]	[2]	[3]	[1]	[2]	[3]
Age 16 Aspirations (Reference Professional/managerial & High Detail)						
Professional/managerial & Low Detail	-0.041	-0.007	0.021	-0.043	-0.011	-0.016
	[0.057]	[0.050]	[0.063]	[0.045]	[0.043]	[0.041]
Professional/managerial & No Detail	-0.001	-0.012	-0.021	-0.053	-0.064	-0.072
	[0.057]	[0.053]	[0.059]	[0.056]	[0.055]	[0.041]
Skilled & High Detail	-0.232**	-0.058	-0.042	-0.183**	-0.064	-0.05
	[0.044]	[0.042]	[0.044]	[0.032]	[0.035]	[0.028]
Skilled & Low Detail	-0.268**	-0.088	-0.039	-0.202**	-0.087	-0.085
	[0.062]	[0.059]	[0.051]	[0.042]	[0.045]	[0.037]
Skilled & No Detail	-0.276**	-0.065	-0.028	-0.203**	-0.077	-0.059
	[0.066]	[0.065]	[0.055]	[0.038]	[0.040]	[0.033]
Semi-skilled/unskilled & High Detail	-0.362**	-0.109	-0.066	-0.237**	-0.059	-0.066
	[0.077]	[0.069]	[0.060]	[0.061]	[0.061]	[0.058]
Semi-skilled/unskilled & Low Detail	-0.293**	-0.065	-0.098	-0.221**	-0.083*	-0.11
	[0.070]	[0.068]	[0.086]	[0.046]	[0.047]	[0.061]
Semi-skilled/unskilled & No Detail	-0.349**	-0.074	-0.044	-0.354**	-0.134**	-0.131*
	[0.072]	[0.077]	[0.067]	[0.055]	[0.055]	[0.053]
Uncertain	-0.357**	-0.135*	-0.112	-0.430**	-0.146*	-0.123
	[0.069]	[0.073]	[0.072]	[0.078]	[0.071]	[0.072]
Ethnicity	0.097	0.092	0.092	0.093	0.092	0.092
	[0.075]	[0.073]	[0.073]	[0.092]	[0.089]	[0.089]
Educational Attainment (age 34)			0.032*			0.033*
			[0.011]			[0.006]
Part-time Employment (age 34)			-0.177*			-0.099**

			[0.061]			[0.024]
Middle Family SES (vs. High SES)		-0.012	-0.031		-0.051*	-0.042
		[0.030]	[0.044]		[0.022]	[0.027]
Low Family SES (vs High SES)		-0.084	-0.024		-0.077*	-0.076
		[0.040]	[0.105]		[0.037]	[0.041]
Age father left school		0.013*	0.013		0.006	0.009
		[0.005]	[0.006]		[0.004]	[0.006]
Age mother left school		0.007	0.008		0.021*	0.009
		[0.007]	[0.009]		[0.006]	[0.011]
Household financial hardship (age 16)		-0.077*	-0.083		-0.025	-0.035
		[0.031]	[0.071]		[0.043]	[0.041]
Parental expectations (age 16)		-0.008	-0.004		0.008	0.001
		[0.050]	[0.032]		[0.028]	[0.030]
Teacher rated ability (age 16)		-0.070*	-0.052*		-0.064*	-0.054*
		[0.022]	[0.016]		[0.023]	[0.017]
Test scores (math age 16)		0.064*	0.058*		0.064*	0.059*
		[0.020]	[0.028]		[0.016]	[0.020]
Own perception of ability (age 16)		0.021	0.017		0.031	0.016
		[0.026]	[0.024]		[0.027]	[0.017]
School disengagement (age 16)		-0.025	-0.022		0.005	0.011
		[0.015]	[0.025]		[0.009]	[0.012]
Constant	2.298**	2.005**	1.886**	2.139**	1.845**	1.912**
	[0.042]	[0.139]	[0.175]	[0.028]	[0.187]	[0.149]
R^2	0.07	0.25	0.29	0.07	0.22	0.26
Observations	2281	2281	2281	3037	3037	3037

Note: Numbers in brackets are robust standard errors. Columns [2] and [3] include all predictor variables listed in Table 1. Parameter estimates use Rubin's rule for combining estimates from imputed datasets. *$p < .05$, two-tailed. **$p < .01$, two-tailed.

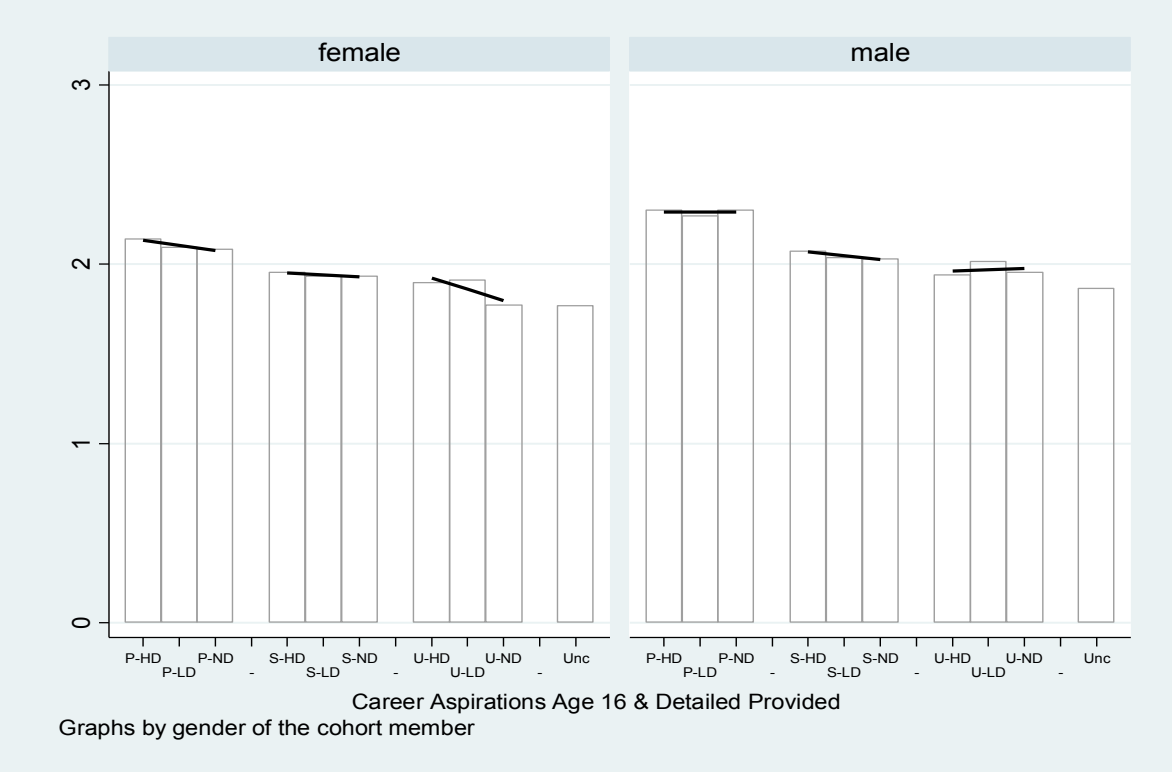

Figure 1. Estimated wage differential in adulthood according to degrees of uncertainty in career aspirations during adolescence by gender using the BCS70 data

Labels for aspirations are "P" Professional/managerial, "S" Skilled, "U" Semi-skilled/unskilled and "Unc" Uncertain. Labels for the level of detail or degrees of uncertainty within the range of aspirations are denoted by "HD" for High Detail; "LD" for Low Detail and "ND" for No Detail. Lines indicate best fitted prediction of the wage differential according to degrees of uncertainty in career aspirations at age 16.

STUDY PROFILE
Journeys Home: Tracking the most vulnerable

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Abstract

In 2010 the Australian Government commissioned The Melbourne Institute of Applied Economic and Social Research at the University of Melbourne to undertake "Journeys Home (JH): A Longitudinal Study of the Factors Affecting Housing Stability". The broad aim of JH was to improve the understanding of, and policy responses to, the diverse social, economic and personal factors related to homelessness and the risk of becoming homeless. Importantly, JH is one of the first longitudinal studies of homeless people that both draws it sample from a wide population and includes people who are vulnerable to homelessness. This paper provides a brief summary of the JH survey, discussing its aims, survey design, data collection process, and response outcomes over its six waves of data collection. It also highlights some of the initial research that has been published utilising the data since its release.

Keywords

Australia, Journeys Home, longitudinal surveys, homelessness

Introduction

The Australian Bureau of Statistics (ABS) estimated that on Census night in 2011 there were just over 105 000 people in Australia that were homeless, broadly defined (ABS, 2012). For many of these people the homelessness experience may have been brief, but for others it could have marked the beginning of a lifetime of housing instability and insecurity. Ultimately, homelessness is a dynamic process, the analysis of which requires examination of flows into and out of different housing states. This, in turn, requires longitudinal data tracking individuals over time. Unfortunately, while many countries, including Australia, are serviced by a suite of longitudinal survey data collections with national coverage, the homeless are usually under-represented if not excluded entirely. Household panel studies, for example, typically restrict their initial sample to residents of private households, while all longitudinal studies do a poor job of tracking the homeless who, almost by definition, are a group that will be difficult to maintain contract with. And in any case, the sample sizes in most longitudinal studies, while often large, are still not large enough to adequately cover such a specific and relatively small sub-population.

Previous studies of the homeless that have employed a longitudinal design have thus drawn their samples from specific locations or from relatively narrow groups of homeless individuals, such as those accessing shelters or those living on the streets (see Allgood, Moore & Warren, 1997; Culhane & Kuhn, 1998; Hwang et al., 2011; Wong & Piliavin, 1997). To our knowledge, no serious attempt had ever been made to follow a large sample of persons that could be described as representative of the homeless population at a

nation-wide level. But a study that began with a national representative sample of the homeless would still be far from ideal. This is because, as already noted, homelessness is a fluid state, and as result any sample restricted to homeless persons would provide very little additional insight (compared to a cross-section survey) about the processes associated with entry into homelessness.

It was against this background that the Australian Government Department of Social Services (DSS) (formerly the Department of Families, Housing, Community Services and Indigenous Affairs), in 2010, commissioned The Melbourne Institute of Applied Economic and Social Research (at the University of Melbourne) to undertake *Journeys Home: A Longitudinal Study of the Factors Affecting Housing Stability*. The broad aim of *Journeys Home* (JH) was to improve the understanding of, and policy responses to, the diverse social, economic and personal factors related to homelessness and the risk of becoming homeless. A key feature of JH was the identification of a representative sample of individuals experiencing housing insecurity more broadly, rather than one restricted to persons identified as homeless at a specific point in time. To our knowledge, there have only been two other large-scale longitudinal studies that included both people at risk of homelessness and people currently experiencing homelessness (Hwang et al., 2011; Shinn et al., 1998), and even these were restricted to residents in particular cities.

This paper provides a brief summary of the JH survey, discussing its aims, survey design, data collection process, and response outcomes over its six waves of data collection. It also highlights some of the initial research that has been published utilising the data since its release.

Before proceeding, however, there is the matter of defining what is meant by 'homelessness'. This is an issue about which there has been considerable debate, both in Australia (Chamberlain & MacKenzie, 2014) and elsewhere (Jacobs, Kemeny & Manzi, 1999). Such debates, however, while highly relevant to how the data collected in JH are used, are not central to the collection process. Essentially, the approach used here is to identify a sample of highly disadvantaged people and then collect data from those people that will allow data users to apply their own definition of homelessness. Researchers will thus be able to define homelessness based on whether the respondent is roofless or houseless, on the degree of housing security, or on the adequacy of accommodation.

Survey design

Aims

As already noted, JH was originally conceived as a tool for enabling research that would improve understanding of the diverse social, economic and personal factors that are related to homelessness and housing insecurity. It was designed to assist policy makers, academics and service providers to understand the needs and experiences of vulnerable Australians in the field of housing and to assist with the provision of services to people who have living and housing challenges.

Particular research questions that JH was designed to address include:

- What characteristics are associated with people identified as homeless?
- What factors are associated with instability/stability in housing tenancy or occupancy?
- What are the protective factors, including familial and psychosocial, for staying out of homelessness?
- What are the key intervention points for preventing chronic homelessness?
- What are the triggers for any changes from being at-risk of homelessness to becoming homeless, including movement between levels of homelessness?
- What are the factors that are important in the road out of homelessness?
- What are the risk factors for persistent homelessness?

Questionnaire content

The survey instrument in each wave was designed with a view to identifying the housing circumstances of sample members (defined below), measuring other outcomes associated with housing difficulties, and capturing information about factors that influence transitions between different housing situations. Table 1 summarises the topic areas that were included in each of the survey waves. Both retrospective and contemporaneous information about individuals' attributes and behaviour were collected in wave 1. Thereafter data was mainly collected on contemporaneous information.

The instrument covered the following broad topic areas in wave 1:

- Personal details: such as age, gender, Indigenous status, marital status, children, education, and geographic mobility.
- Employment and voluntary work: including work history, current employment status and working arrangements, job search behaviour, and use of employment services.
- Housing and living arrangements: including current housing and living standard situation, housing tenure and costs, accommodation standards, search for alternative accommodation, and housing history.
- Support services and networks: including information about family, friends, acquaintances, and the welfare services that respondents use, and the level of support respondents receive from these different sources.
- Health and wellbeing: including physical and mental health, usage of health services, substance use, life satisfaction, and expectations for the future.
- Family history while growing up: including questions on who sample members lived with and who cared for them during adolescence, the home environment, and experiences with institutional care.
- Contact with the justice system: including questions about periods spent in detention / prison, and more ongoing contact with police and the legal system.
- Exposure to violence: including physical violence, sexual violence and threats of violence while growing up, since turning 18, and in the last six months.
- Financial situation: including income sources and levels, debts, other indicators of financial stress, and gambling behaviours.

In designing the instrument, and especially the section on housing and living arrangements, primacy was given to the objective of collecting data that would not constrain researchers to using any one specific definition of homelessness. Thus data were collected on the type of accommodation and place in which people lived, the stability of those arrangements, the security of tenure, and the quality of accommodation.

An important feature of the design was the inclusion of a question seeking the consent of respondents to link their survey responses to administrative records on their receipt of government income support payments. Obtaining consent both obviates the need to have to ask any questions of respondents about such payments and provides highly accurate information about respondents' income support payments history (back to July 2002). In total, 98.3% of the responding sample agreed to their survey answers being linked to these records.

The instrument used in subsequent waves differs from the wave 1 instrument in its focus on changes in respondents' circumstances since the previous interview (which was, on average, a six-month period), and in the removal of all questions about the respondents' histories prior to the survey commencing. Included in this was an accommodation calendar designed to capture details of all housing transitions that occurred since the previous interview. Specifically, respondents were asked about the timing of all of their moves into and out of particular types of accommodation in 10-day blocks.

As highlighted in Table 1, additional content was included in wave 5 on personality, mobile phone use, diet and food security, and in wave 6 on cognitive ability, marital history, parental relationships, quality of sleep, and internet use.

Sample design

A key challenge for a study of this kind is to identify a sample of people that is representative of a broader population of people vulnerable to homelessness. As explained in more detail in both the Melbourne Institute of Applied Economic and Social Research (2012) and Wooden et al. (2012), the JH sample was drawn from the Research Evaluation Database (RED) developed by the Australian Government department responsible for employment. The RED, in turn, is drawn from the customer database of Centrelink, the government program that delivers income support payments to persons on low incomes or with other characteristics (e.g., disability, and caring responsibilities) targeted for financial assistance. It contains payment records, together with a range of personal details, for all Centrelink income support customers. Given that the large majority of homeless people in Australia receive Centrelink income support payments, it follows that this sampling frame provides much wider coverage of the homeless population than previous studies utilising other samples and sampling methods.

The main problem with this approach, however, is that the population in receipt of income support payments is very large (4.75 million at 27 May 2011), most of whom will not have experienced homelessness at any point in their life. Drawing a small random sample of this population would thus generate few insights into the homelessness experience. Fortunately, since 1 January 2010, Centrelink's customer database also identifies clients who have been flagged by Centrelink staff as being 'homeless' or 'at risk of homelessness'. This provided an initial target population of 42,336 persons.

Centrelink's internal homelessness awareness training material (which is not publicly available) defined a person as being 'homeless' if he or she:

> is without conventional accommodation (e.g., sleeping rough, squatting, or living in a car); or lives in, or moves frequently between, temporary accommodation arrangements (e.g., with friends or extended family, emergency accommodation, or youth refuges).

While a person who is 'at risk' of homelessness is one that:

> lives medium to long term in a boarding house, caravan park or hotel, where accommodation is not covered by a lease; lives in accommodation which falls below the general community standards which surround health and wellbeing, such as access to personal amenities, security against threat, privacy and autonomy; is facing eviction; or lives in accommodation not of an appropriate standard which may be detrimental to their physical and mental well-being, or where they have no sense of belonging or connection (e.g., Indigenous Australians living in crowded conditions or disconnected from their land, family/kin, spiritual and cultural beliefs and practices).

Note that in many definitions of homelessness (e.g., that embedded in the European Typology of Homelessness and Housing Exclusion; Edgar & Meert, 2006), the group that Centrelink describes as 'at risk of homelessness' would in fact be defined as homeless.

As discussed in Scutella, Johnson, Moschion, Tseng and Wooden (2013), the flagging process is intended as a way of providing targeted service delivery for people who are homeless or at risk of becoming homeless. It relies on customers who use Centrelink services to be prepared to disclose details of their personal situation to departmental staff. Most obviously, customers who both engage more frequently with Centrelink staff and are prepared to disclose details of their personal situation are more likely to be flagged. As a result, the non-flagged group will include some people who are homeless or at risk of homelessness. The Centrelink homeless indicator is thus not appropriate by itself for enumerating the homeless population, nor was it ever intended for this purpose.

We therefore augmented the target population with a group of Centrelink customers selected using statistical techniques that identify income support recipients that have not been flagged as homeless (or at risk of homelessness) but nevertheless have characteristics similar to those that have been. More specifically, we estimated a logistic regression model predicting the probability of being flagged as homeless or at risk of homelessness, with the predictor variables drawn from the RED. We then, somewhat arbitrarily, defined as in-scope those persons whose predicted probability of being flagged was in the top two per cent of all income support recipients who were not already flagged (n=95,755). This group includes persons who should have been flagged as homeless or at risk of homelessness, as well as other persons who might be described, at least in a statistical sense, as vulnerable to homelessness. (Further details, including results of the logistic estimation procedure, are reported in Melbourne Institute of Applied Economic and Social Research, 2012.)

Cost constraints also dictated that the sample had to be clustered. Clusters were formed based on the geo-coded address and postcode information available in the RED, with clusters defined to have a 10km radius in the major cities and a 20km radius in regional centres. Further, to be eligible for inclusion, each cluster had to have at least 45 flagged persons if in a major city, or at least 65 flagged persons if in a regional centre or rural location. This resulted in 200 eligible clusters. These clusters were then further stratified into eight groups: Sydney, Melbourne, Brisbane, Perth, Adelaide, other major cities, one regional centre in the Northern Territory, and all remaining locations. Within each strata, clusters were randomly selected with a probability proportional to their size, and within each selected cluster individuals randomly

selected from each of the three groups: (i) Centrelink customers flagged as 'homeless'; (ii) Centrelink customers flagged as 'at risk of homelessness'; and (iii) other Centrelink customers identified as being vulnerable to homelessness.

The initial selected sample comprised 4,913 persons distributed across 36 distinct locations or areas. Only 2,992 cases, however, were actually issued to field. Some cases were deemed out of scope after selection (e.g., because they had a Centrelink record that indicated they were not willing to participate in research studies), while many others were held in reserve in the event of poor response (which as discussed below, did not eventuate). Of the group issued to field, 273 were subsequently determined to be out of scope (because they had moved out of the designated survey interview area prior to fieldwork commencing, were away for the entire survey period, were in prison or another institution on a long-term basis, were young people living at home with their parents, or had died). This left us with an effective sample of 2719. A summary of the evolution of the sample is provided in Table 2.

Data collection

Survey mode

The principal mode of data collection was face-to-face interviews using a questionnaire delivered by a computer tablet console. The telephone was used in some cases where that was the sample member's preferred mode or the person had moved to a location outside the reach of the interviewer network. Just 1.6% (n=26) of completed interviews were undertaken by telephone in wave 1. In subsequent waves, however, this proportion was higher given sample member mobility. By wave 6, 18.9% of completed interviews had been undertaken by telephone.

Fieldwork period and frequency

The fieldwork for wave 1 was conducted over a 12-week period from September to November 2011. Five further waves were conducted at roughly six-month intervals.

Pilot testing

The survey instruments and fieldwork procedures were pilot tested and amended prior to the main survey commencing. Fieldwork for the pilot test took place over a five-week period in May 2011 and involved a sample drawn from six cluster areas: two in the Melbourne metropolitan area, two in the Sydney metropolitan area, and two in regional Victoria.

Pre-field approach

Approximately two weeks prior to the beginning of fieldwork all selected sample members were sent a letter informing them of their selection into the study and encouraging them to participate. Accompanying this letter was a brochure that provided more information about the study, including how sample members came to be selected, the voluntary nature of participation, and details on confidentiality.

Interviewers and interviewer support

All interviews were conducted by professional interviewers employed by Roy Morgan Research (RMR), the organisation sub-contracted to undertake the fieldwork. Interviewers and sample members were supported by a telephone support group, who staffed project-specific free-call telephone numbers. During fieldwork these numbers were staffed from 8 am to 10 pm, seven days a week.

Making contact and tracking

The initial set of contact details for all sample members in wave 1 came from the information contained on the Centrelink customer database. Importantly, this information was updated at subsequent waves and assisted with tracking survey respondents. The administrative records typically included a home address (available for 89% of selected sample members), a postal address (94%), and a mobile number (80%). It sometimes also included a home (landline) phone number (just 12%) and a telephone number for an alternative contact (10%). The original sample file was provided by the relevant Australian Government department to RMR on 29 July 2011, with a further sample update provided just prior to fieldwork commencing and two more during fieldwork. This process was replicated in subsequent waves, with sample updates provided both prior to, and during, fieldwork.

A number of anchor points were collected from all survey participants at the conclusion of their wave 1 interview. This included details of the respondents' current and expected address, alternative phone numbers, and the contact details of friends and/or family. This information, in addition to updated contact information from the

Centrelink customer database, was used to locate sample members in subsequent waves.

In making contact with sample members, interviewers were expected to follow a set of protocols. These included:

- Approaching respondents who would be difficult to locate early in the fieldwork period (e.g., those with no fixed address, or known to move around).
- Making at least three face-to-face attempts for respondents with known addresses, with each attempt made at different times of the day and week.
- If the sample member does not appear to be 'home' at the time of approach, leaving a calling card with interviewer details in a place they were likely to find it.
- When arriving at a residence and it is found that the target respondent no longer lives there, make enquiries with current residents and neighbours about the sample members whereabouts.
- After three face-to-face attempts, or earlier if it becomes apparent that the respondent will not be found at the address provided, using other available contact details provided for the respondent. This may include a telephone or SMS to the target respondent or approaching an alternative contact.
- Collecting contact information from people who are most likely to know where the target respondent has moved to if they change address (for instance, neighbours).
- Approaching local service providers to see if they can assist.

Incentives

All sample members were offered a $40 incentive each time they agreed to be interviewed. In the case of face-to-face interviews, the incentive was provided as cash and paid immediately after the sample member agreed to participate.

Interview length

The intent was that the average interview would take 50 minutes in wave 1 and 40 minutes in subsequent waves. The actual average interview length in wave 1 was almost one hour (59.7 minutes), and ranged from a low of 24.6 minutes to a high of 166.8 minutes. In subsequent waves average interview lengths varied from 31.6 minutes in wave 3 to 40.3 minutes in wave 6.

Ethics approval

All survey protocols, instruments and materials were approved by the University of Melbourne Behavioural and Social Sciences Human Ethics Sub-Committee.

Response and sample characteristics

Wave 1 response

Table 3 provides a breakdown of wave 1 fieldwork outcomes. Completed interviews were obtained from 1676 of the 2719 persons determined as in-scope. We also retained six of the 14 terminations in the responding sample. These were cases where the termination of interview did not result in the sample member requesting not to be reapproached in the future, where the termination was not the result of English language problems, and where a substantial amount of data was collected prior to the termination. The usable sample thus numbered 1,682 cases, giving a response rate of 61.9%.

This response rate compares favourably with both other studies that sample from seriously disadvantaged populations (O'Callaghan et al., 1996; Randall & Brown, 1996; Weitzman, Knickman, & Shinn, 1990) and with the rates reported for the initial wave of panel surveys of the general population. The Household, Income and Labour Dynamics in Australia (HILDA) Survey, the German Socio-economic Panel study, and the UK Understanding Society study, for example, reported wave 1 household response rates of 66%, 61% and 57% respectively (Watson & Wooden, 2014).

A problem for all voluntary surveys is that non-respondents may be systematically different from respondents. To assess this we report, in Table 4, figures on the distribution of the responding sample by selected known sample member characteristics (as recorded in the RED) and how they compare with equivalent distributions for the attempted in-scope sample. In addition, we also report corresponding figures for the wider population of Centrelink clients.

It should be immediately apparent that the JH sample is markedly different from the broader income support population. In large part, this reflects the almost total absence of Age Pension recipients from the JH sample. On average, JH sample members are relatively young and are

relatively more likely to be male, single, an Indigenous Australian, to have previously spent time in prison, and to be recorded as having experienced mental illness. So not only are JH respondents a very disadvantaged cohort in comparison with the general population, they are also a particularly vulnerable cohort within the income support sub-population.

More important is the evidence of response bias presented in Table 4. Thus men, while still representing the largest fraction of the responding sample, were relatively less likely to respond than women. This is a result common to many surveys. Other statistically significant differences in wave 1 response were uncovered with respect to: age (both the very young – under 21 – and older persons – 45 to 64 – were most likely to respond); the presence of dependent children (persons with children had much higher response rates than those without children); whether an ex-offender (with ex-offenders being less likely to respond); and benefit type. Differences with respect to Indigenous status, country of birth, marital status, whether a respondent had a recorded history of psychological problems, and recent residential mobility, however, were all statistically insignificant. Furthermore, there is little evidence that the most vulnerable – those flagged by Centrelink as homeless – are any more difficult to contact than the unflagged population. Indeed, response rates are actually slightly higher for the homeless group (61.1% vs 57.1%). That said, within this homeless group there is considerable heterogeneity, and it may be that response rates are much lower for some sub-groups (e.g., the rough sleepers).

Overall, and despite the presence of a number of statistically significant differences, the characteristics of the responding sample mostly do not seem to be so different from the initial selected sample to suggest response bias is a major problem. However, weights have been constructed to enable data users to account for observable response bias.

Response rates in follow-up waves

Attempts were made to re-approach all 1, 682 JH participants in the five follow-up waves of the study. A summary of response outcomes from waves 2 through 6 is provided in Table 5. As shown, re-interview rates were quite high and only fell slowly over the six waves. Thus by the sixth wave, two and half years later, almost 84 per cent of the initial responding sample were still being interviewed.

These follow up rates are very high compared to other Australian studies targeting disadvantaged populations. For example, the Longitudinal Study of Reconnect Clients achieved a follow-up response rate of 57.1 per cent (RPR Consulting, 2003), the Residents Outcomes Study achieved a re-interview rate of 40% (Thomson Goodall Associates, 2001), and a study of single homeless men in Sydney achieved a re-interview rate of just over 40% (Mission Australia, 2012). Indeed, JH's response rates also surpass those recorded in Australia's general population panel survey, the HILDA Survey, which two years on (i.e., in wave 3) was only able to reinterview 82% of its initial sample of respondents (Watson & Wooden, 2012, Table 1, p. 376).

The success of the fieldwork company in gaining cooperation from sample members is even more remarkable when account is taken of the number of persons that were not able to be approached due to death, imprisonment or being overseas. In wave 6, a total of 65 out of the initial 1,682 wave 1 respondents were identified as out-of-scope. This includes 25 persons known to have died, 25 persons that were in prison or some other institution, and 15 persons reported to be overseas.

As with initial response, we do not expect attrition to be random. But contrary to expectations, rates of attrition between wave 1 and wave 6 are slightly lower among the two groups initially flagged as homeless (15.9% and 15.1%) than the unflagged group (18.7%). That said, rates of sample loss were much higher among those identified as rough sleepers in wave 1 – 25.6% of this group did not participate in wave 6. More generally, regression models of the probability of responding, both in all waves and at the final wave (and reported in Melbourne Institute of Applied Economic and Social Research, 2014), reveal that cases that attrit differ in a number of significant ways from those that respond. In particular, cases of attrition were significantly more likely among Indigenous persons, ex-offenders, persons that moved off income support during the study, and (not surprisingly) persons who moved to a location outside the original interview regions. The magnitudes of such differences, however, are not very large, and as a result the demographic composition of the wave 6 responding sample looks very similar to that of the wave 1 responding

sample (compare columns 3 and 4 in Table 4). Nevertheless, longitudinal response weights have been constructed to help data users account for any potential non-response bias.

Research

Data access

Confidentialised unit-record data files are available to licensed data users subject to the approval of DSS. Four different data releases are available depending on user needs and their ability to meet security requirements: a general release file, an overseas release file, a limited release file, and a limited+RED release file. For domestic users, the general release file is the most commonly used, as it has the least stringent security requirements. It also includes data on income support payments (e.g., amount received per week, duration in receipt of income support, and type of income support payment) which, for those respondents that consent, come from administrative Centrelink records. This file, however, does not include individuals' detailed geographic information nor does it include any information about their income support histories. (A further additional 90 derived variables derived from the RED are provided in the limited+RED release.) Unfortunately, all of the variables derived from the linked administrative data are required to be withheld from the overseas release file.

Application forms and fact sheets detailing data access and security requirements can be downloaded from the JH website at: http://melbourneinstitute.unimelb.edu.au/journeys_home/research/dataaccess.html.

Weights

As previously mentioned, the data files include a series of weights that adjust for the differential probability of selection into the sample and the differential probability of response, both at wave 1 and in subsequent waves. Details about how these response rates are constructed can be found in Technical Reports available on the JH website (Melbourne Institute of Applied Economic and Social Research 2012, 2014).

Research output

The JH data has already facilitated a number of research articles from both the domestic and the international research community, and has recently been reviewed by Ribar (2017). The early research utilising JH data can be separated into three strands: i) causes of homelessness and homeless experiences; ii) consequences of homelessness; and iii) other outcomes among an at-risk population.

Included in the first strand of research are studies that examine specific individual causes of homelessness, such as substance use and experiences of violence (Diette & Ribar, 2015; McVicar, Moschion, & van Ours, 2015); structural causes of homelessness, such as how local housing and labour markets affect risks of homelessness (Johnson, Scutella, Tseng, & Wood, 2015); and, general analyses of what drives homeless durations (Scutella, Johnson, Moschion, Tseng, & Wooden, 2013; Cobb-Clark, Herault, Scutella, & Tseng, 2016).

McVicar et al. (2015) and Diette and Ribar (2015) also examined substance use and exposure to violence as consequences of homelessness, and therefore are also relevant within the context of the second strand of research. In addition, Herault and Ribar (2016) investigated how homelessness may lead to food insecurity, and Cobb-Clark and Zhu (2015) the consequences of childhood experiences of homelessness for adult employment.

Finally, there are those studies that are not focused on homelessness directly but utilise JH to examine issues that are relevant to a particularly vulnerable population. These include Keane, Magee and Lee (2015) and Keane, Magee and Kelly (2016), which made use of the retrospective data in Journeys Home to examine the relationship between adverse childhood experiences (and, in the latter, complex childhood trauma) and adult alcohol problems, victimisation, and homelessness.

Conclusion

This paper has summarised the design and outcomes of the Journeys Home study, a longitudinal survey of a nationally representative sample of those vulnerable to homelessness. JH, being one of the first of its kind, was quite an ambitious study given the challenges in both identifying and tracking such a vulnerable population group. On all counts, however, it should be regarded as a success. With the aid of an administrative tool, a particularly vulnerable population was identified and a representative sample drawn. Fieldwork was an overwhelming success, with response rates consistently exceeding expectations. And initial data usage has facilitated research in a number of important areas that

improve understanding of both the causes of homelessness (and the risk of becoming homeless) and its consequences.

The success of the project can be attributed to a combination of factors including the commitment of the fieldwork company and interviewers, the provision of a cash incentive payment, and the six-month follow-up period. Primarily, however, it was the ability to link with the administrative records of participants that proved the most valuable. Not only did this ensure that much valuable information about participants was available for eligible researchers to explore, but it also enabled interviewers to receive pre-fieldwork updates on changes to the contact details of participants. As recipients of Centrelink payments have an incentive to keep their contact details current to ensure continued payment of their income support, these updates helped ensure that the most mobile and, arguably, most vulnerable participants were able to be tracked over the full survey period.

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References

ABS [Australian Bureau of Statistics] (2012). *2011 Census of Population and Housing: Estimating homelessness*. ABS cat. no. 2049.0. Canberra: ABS.

Allgood, S., Moore, M., & Warren Jr., R.S. (1997). The duration of sheltered homelessness in a small city. *Journal of Housing Economics, 6*(1), 60–80. https://doi.org/10.1006/jhec.1997.0204

Chamberlain, C., & MacKenzie, D. (2014). Definition and counting: Where to now? In C. Chamberlain, G. Johnson & C. Robinson (Eds.), *Homelessness in Australia: An introduction* (pp. 71-99). Sydney: UNSW Press.

Cobb-Clark, D., Herault, N., Scutella, R., & Tseng, Y. (2016). A journey home: What drives how long people are homeless? *Journal of Urban Economics*, *91*, 57–72. https://doi.org/10.1016/j.jue.2015.11.005

Cobb-Clark, D., & Zhu, A. (2015). Childhood homelessness and adult employment: The role of education, incarceration, and welfare receipt. *Melbourne Institute Working Paper Series no. 18/15*. Melbourne: Melbourne Institute of Applied Economic and Social Research, University of Melbourne.

Culhane, D. & Kuhn, R. (1998). Patterns and determinants of public shelter utilization among homeless adults in New York City and Philadelphia. *Journal of Policy Analysis and Management, 17*(1), 23–44. https://doi.org/10.1002/(SICI)1520-6688(199824)17:1<23::AID-PAM2>3.0.CO;2-J

Diette, T. & Ribar, D. (2015). A longitudinal analysis of violence and housing insecurity. *Melbourne Institute Working Paper Series no. 20/15*. Melbourne: Melbourne Institute of Applied Economic and Social Research, University of Melbourne.

Edgar, B, & Meert, H. (2006). *Fifth review of statistics on homelessness in Europe*. Brussels; European Federation of National Organisations Working with the Homeless.

Herault, N. & Ribar, D. (2016). Food insecurity and homelessness in the Journeys Home survey. *Melbourne Institute Working Paper Series no. 15/16*. Melbourne: Melbourne Institute of Applied Economic and Social Research, University of Melbourne.

Hwang, S.W., Aubry, T., Palepu, A., Farrell, S., Nisenbaum, R., Hubley, A. M., Klodawsky, F., Gogosis, E., Hay, E., Pidlubny, S., Dowbor, T., & Chambers, C. (2011). The health and housing in transition study: A longitudinal study of the health of homeless and vulnerably housed adults in three Canadian cities. *International Journal of Public Health*, *56*(6), 609–623. https://doi.org/10.1007/s00038-011-0283-3

Jacobs, K., Kemeny, J., & Manzi, T.(1999). The struggle to define homelessness: A constructivist approach. In S. Hutson & D. Clapham (Eds.), *Homelessness: Public policies and private troubles* (pp. 11-28). London: Cassell.

Johnson, G., Scutella, R., Tseng, Y., & Wood, G. (2015). *Entries and exits from homelessness: A dynamic analysis of the relationship between structural conditions and individual characteristics*. AHURI Final Report No.248. Melbourne: Australian Housing and Urban Research Institute.

Keane, C., Magee, C., & Kelly, P. (2016). Is there Complex Trauma Experience typology for Australian's experiencing social disadvantage and low housing stability? *Child Abuse and Neglect, 61*, 43–54. https://doi.org/10.1016/j.chiabu.2016.10.001

Keane, C., Magee, C., & Lee, J. K. (2015). Childhood trauma and risky alcohol consumption: A study of Australian adults with low housing stability. *Drug and Alcohol Review*, *34*(1), 18–26. https://doi.org/10.1111/dar.12177

McVicar, D., Moschion, J., & van Ours, J. (2015). From substance use to homelessness or vice versa? *Social Science and Medicine, 136–137*, 89–98. https://doi.org/10.1016/j.socscimed.2015.05.005

Melbourne Institute of Applied Economic and Social Research (2012). *Sample, fieldwork, response and weighting*: *Journeys Home wave 1 technical report*. Report prepared for the Australian Government Department of Social Services. Melbourne: Melbourne Institute of Applied Economic and Social Research, University of Melbourne.

http://melbourneinstitute.unimelb.edu.au/__data/assets/pdf_file/0004/2202835/JourneysHome_W1_Technical_Report.pdf

Melbourne Institute of Applied Economic and Social Research (2014). *Fieldwork, response and weighting: Journeys Home wave 6 technical report*. Report prepared for the Australian Government Department of Social Services. Melbourne: Melbourne Institute of Applied Economic and Social Research, University of Melbourne.

http://melbourneinstitute.unimelb.edu.au/__data/assets/pdf_file/0007/2202865/Scutella_et_al_Journeys_Home_Research_Report_W6.pdf

Mission Australia (2012). *The Michael Project, 2007-2010: New perspectives and possibilities for homeless men.* Sydney: Mission Australia. Accessed 31 January 2017 from: http://www.socialvalueuk.org/app/uploads/2016/03/the%20michael%20project%20report.pdf

O'Callaghan, B., Dominian, L., Evans, A., Dix, J., Smith, R., Williams, P., & Zimmeck, M. (1996). *Study of homeless applicants*. London: HMSO, Department of the Environment.

Randall, G., & Brown, S. (1996). *From street to home: An evaluation of Phase 2 of the Rough Sleepers Initiative*. London: HMSO.

Ribar, D.C. (2017). Early research findings from Journeys Home: Longitudinal Study of Factors Affecting Housing Stability. *Australian Economic Review*, *50*(2), 214–219. https://doi.org/10.1111/1467-8462.12215

RPR Consulting (2003). *Longitudinal Survey of Reconnect Clients: Statistical report of the Longitudinal Survey of Reconnect Clients*. Canberra: FaHCSIA. Accessed 7 March 2017 from: http://nla.gov.au/nla.arc-56957.

Scutella, R., Johnson, G., Moschion, J., Tseng, Y., & Wooden, M. (2013). Understanding lifetime homeless duration: Investigating wave 1 findings from the Journeys Home project. *Australian Journal of Social Issues*, *48*(1), 83–110. https://doi.org/10.1002/j.1839-4655.2013.tb00272.x

Shinn, M., Weitzman, B., Stojanovic, D., Knickman, J., Jimenez, L., Duchon, L., James, S., & Krantz, D. (1998). Predictors of homelessness among families in New York City: From shelter request to housing stability. *American Journal of Public Health*, *88*(11), 1651–57. https://doi.org/10.2105/AJPH.88.11.1651

Thomson Goodall Associates (2001). *Residents outcomes research study*. Report prepared for the Interagency Working Party on Crisis Accommodation and funded by the Victorian Department of Human Services. Melbourne: Thomson Goodall Associates.

Watson, N. & Wooden, M. (2012). The HILDA survey: A case study in the design and development of a successful household panel study. *Longitudinal and Life Course Studies*, *3*(3): 369–381. https://doi.org/10.1111/rssa.12024

Watson, N. & Wooden, M. (2014). Re-engaging with survey non-respondents: Evidence from three household panels. *Journal of the Royal Statistical Society: Series A*, *177*(2), 499–522.

Weitzman, B., Knickman, J. & Shinn, M. (1990). Pathways to homelessness among New York City families. *Journal of Social Issues*, *46*(4): 125–140. https://doi.org/10.1111/j.1540-4560.1990.tb01802.x

Wong, Y. & Piliavin, I. (1997). A dynamic analysis of homeless-domicile transitions. *Social Problems, 44*(3), 408–23. https://doi.org/10.2307/3097185

Wooden, M., Bevitt, A., Chigavazira, A., Greer, N., Johnson, G., Killackey, E., Moschion, J., Scutella, R., Tseng, Y. & Watson, N. (2012). Introducing Journeys Home. *Australian Economic Review*, *45*(3), 368–78. https://doi.org/10.1111/j.1467-8462.2012.00690.x

Table 1: Topic areas included in JH survey instrument

	Wave					
	1	**2**	**3**	**4**	**5**	**6**
Personal details						
Marital status	X	X	X	X	X	X
Children	X	X	X	X	X	X
Children's education and care						X
Demographic background	X					
Education and schooling	X	X	X	X	X	X
Marital history						X
Personality					X	
Parent relationships						X
Employment and voluntary work						
Paid employment	X	X	X	X	X	X
Job search activity	X	X	X	X	X	X
Volunteering	X	X	X	X	X	X
Housing and living arrangements						
Current housing / living arrangements	X	X	X	X	X	X
Accommodation standards and overcrowding	X	X	X	X	X	X
Accommodation search	X	X	X	X	X	X
Housing and homelessness history	X					
Recent accommodation changes		X	X	X	X	X
Support services and networks						
Friends and family	X	X	X	X	X	X
Access and use of support services	X	X	X	X	X	X
Difficulty accessing health care services						X
Mobile phone usage					X	
Internet usage						X
Health and wellbeing						
Sexual preference	X					
Physical and mental health	X	X	X	X	X	X
Substance use	X	X	X	X	X	X
Substance use history	X		X			
Life satisfaction	X	X	X	X	X	X
Sleep						X
Psychological resources						
Personal control / Impatience impulsivity						X
Risk and time preferences						X
Cognitive ability						X
Diet and food security					X	
Contact with the justice system	X	X	X	X	X	X
Exposure to violence						
Physical violence	X	X	X	X	X	X
Sexual assault	X	X	X	X	X	X
Threats of violence	X					

Table 1 (cont'd)

	Wave					
	1	**2**	**3**	**4**	**5**	**6**
Income and financial stress						
Financial stressors	X	X	X	X	X	X
Gambling and betting	X	X	X	X	X	X
Gambling history						X
Government income support	X	X	X	X	X	X
Other sources of income	X	X	X	X	X	X
Debt	X	X	X	X	X	X

Table 2: The evolution of the JH sample (by sub-sample)

	Sub-sample (% distribution)			Total (N)
	Flagged as homeless	Flagged as at risk of homelessness	Vulnerable	
Starting population	19.6	11.1	69.3	138 091
Population after clustering	20.5	11.9	67.7	110 616
Sample selected	35.0	33.3	31.7	4 913
Sample issued	35.0	33.9	31.1	2 992
Final in-scope sample	34.9	34.5	30.6	2 719

Table 3: Wave 1 call outcomes

Sample outcome	Number	%
Total sample issued	2992	
Less out-of-scope	273	
Total in-scope sample	2719	100.0
Completed interviews	1676	61.6
Terminations	14	0.5
Incapable	22	0.8
Refusal	369	13.7
Other non-response		
Contact made[a]	138	5.1
Non-contact and all calls made	316	11.6
Moved to unknown address	184	6.8

Note: a This group is dominated cases where interviews were unable to be scheduled or conducted within the fieldwork period. It also includes some cases that moved following the initial contact and hence with whom contact was lost.

Table 4: Population and sample member characteristics (%)

Characteristic[a]	Income support population[b] (n=4,830,357)	Attempted in-scope sample (n=2719)	Respondents, w1 (n=1682)	Respondents, w6 (n=1406)
Centrelink homelessness flag				
Homeless	0.6	34.9	34.5	34.7
At risk of homelessness	0.3	34.5	37.3	37.8
No flag (but vulnerable)	2.0	30.6	28.2	27.5
Gender				
Male	43.1	58.8	54.6	53.8
Female	56.9	41.2	45.4	46.2
Age group				
15-17	3.4	11.4	12.6	12.3
18-20	4.7	14.3	14.9	15.1
21-24	5.5	12.8	12.1	12.2
25-34	9.5	23.0	21.6	21.3
35-44	9.7	20.7	19.7	19.8
45-54	9.1	12.8	14.0	14.2
55-64	12.5	4.1	4.5	4.6
65+	45.6	0.9	0.7	0.5
Indigenous status				
Non-Indigenous	95.9	82.3	82.8	82.7
Indigenous	4.1	17.7	17.2	17.3
Country of birth				
Australia	68.4	87.1	87.3	87.9
English speaking country	9.6	5.8	6.1	6.1
Non-English speaking country	22.0	7.2	6.6	6.0
Marital status				
Single	58.7	93.6	93.0	92.6
Married	36.4	0.7	0.7	0.6
De facto	4.3	5.1	5.7	6.2
Unknown	0.7	0.6	0.5	0.6
Has dependent children				
No	84.7	86.2	83.6	82.4
Yes	15.3	13.8	16.4	17.6
Benefit type				
Not on income support	1.6	2.7	2.6	2.7
Students	7.8	5.8	6.2	6.3
Youth Allowance (other)	1.8	16.8	18.0	17.9
New Start Allowance	11.7	42.4	38.7	38.3
Disability support Pension	16.7	21.6	22.1	22.0
Parenting payment	9.2	8.2	10.0	10.5
Other	51.3	2.6	2.5	2.4
Ex-offender				
No	98.1	80.6	82.5	83.4
Yes	1.9	19.4	17.5	16.6

Table 4 (cont'd)

Characteristic[a]	Income support population[b] (n=4,830,357)	Attempted in-scope sample (n=2719)	Respondents, w1 (n=1682)	Respondents, w6 (n=1406)
Ever recorded psychological / psychiatric problem				
No	89.0	60.5	60.1	59.4
Yes	11.0	39.5	40.0	40.6
Numbers of recorded changes in home address in past year				
0	82.9	18.8	18.2	17.7
1	12.3	28.0	28.2	28.7
2	3.1	24.4	24.5	24.4
3+	1.7	28.9	29.1	29.2

Notes: a All characteristics are as recorded in the RED on the 27th May 2011.
b Those who were on income support at any time between 30th April 2011 and 27th May 2011.

Table 5: Response outcomes, waves 2 to 6

Outcome	Wave 2		Wave 3		Wave 4		Wave 5		Wave 6	
	N	%	N	%	%	%	N	%	N	%
Interview[a]	1529	90.9	1478	87.9	1456	86.6	1425	84.7	1406	83.6
Out of scope[b]	22	1.3	44	2.6	50	3.0	49	2.9	65	3.9
Non-contact	69	4.1	70	4.2	84	5.0	78	4.6	84	5.0
Other non-response[c]	62	3.7	90	5.4	92	5.5	130	7.7	127	7.6
TOTAL SAMPLE (W1 respondents)	1682	100.0	1682	100.0	1682	100.0	1682	100.0	1682	100.0

Notes: a Includes completed and terminated interviews.

b Out of scope includes persons who: have died; are overseas; are in prison; or are in some other institution.

c This category includes outcomes classified as: refusal, incapable, and contact made but no interview resulted. This includes persons who refused at previous waves and indicated they no longer wish to be approached at future waves.

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INTRODUCTION

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STUDY PROFILE

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