THE GERONTOLOGICAL SOCIETY OF AMERICA®

OXFORD

Editor's choice

Special Issue: Aging Alone? International Perspectives on Social Integration and Isolation

Kinlessness Around the World

Ashton M. Verdery, PhD,[1,*] Rachel Margolis, PhD,[2] Zhangjun Zhou, MA,[1] Xiangnan Chai, MA,[2] and Jongjit Rittirong, PhD[3]

[1]Department of Sociology and Criminology, The Pennsylvania State University, University Park. [2]Department of Sociology, University of Western Ontario, London, Canada. [3]Institute for Population and Social Research, Mahidol University, Salaya, Phutthamonthon, Thailand.

*Address correspondence to: Ashton M. Verdery, PhD, Department of Sociology and Criminology, The Pennsylvania State University, Oswald Tower, University Park, PA 16802. E-mail: amv5430@psu.edu

Abstract

Objectives: The first and second demographic transitions have led to profound changes in family networks. However, the timing and extent of these transitions vary widely across contexts. We examine how common it is for contemporary older adults to lack living kin and whether such individuals are uniformly disadvantaged around the world.

Methods: Using surveys from 34 countries that together contain 69.6% of the world's population over age 50 and come from all regions of the world, we describe the prevalence and correlates of lacking immediate kin. We examine macro-level demographic indicators associated with the prevalence of kinlessness as well as micro-level associations between kinlessness and sociodemographic and health indicators.

Results: There is great variation in levels of kinlessness, from over 10% with neither a spouse nor a biological child in Canada, Ireland, the Netherlands, and Switzerland to levels below 2% in China and the Republic of Korea. There are strong macro-level relationships between kinlessness and lagged or contemporaneous fertility, mortality, and nuptiality measures and more marginal relationships with other demographic forces. Micro-level associations between kinlessness and respondent attributes are varied. The kinless are more likely to live alone than those with kin in all countries. In most countries, they have equivalent or worse self-rated health and lower education, although there are notable exceptions. There is substantial variation in the gender composition of the kinless population.

Discussion: As demographic changes affecting kinlessness continue, we expect the scale of the kinless population to grow around the world.

Keywords: Cross-cultural study, Demography, Family structure, Kinship

In general, studies find that the sizes of people's social networks decline during older ages through the loss of friend, coworker, and acquaintance ties, leaving older adults with networks dominated by kin (Ajrouch, Blandon, & Antonucci, 2005; Antonucci & Akiyama, 1987; Cornwell, Laumann, & Schumm, 2008; Fredrickson & Carstensen, 1990; Marsden, 1987; McPherson, Smith-Lovin, & Brashears, 2006; Shaw, 2005). Until recently few studies have considered the population of older adults who do not have any living kin (Margolis & Verdery, 2017; Verdery & Margolis, 2017). Older adults with no living immediate kin types have been referred to as "kinless" or "elder orphans" (Carney, Fujiwara, Emmert, Liberman, & Paris, 2016). Research on these groups highlights that older adults without kin in the United States are numerous and tend to be disadvantaged with poor self-rated health and elevated rates of disability (Margolis & Verdery, 2017). They are also more likely to be socioeconomically disadvantaged, with lower wealth than their peers with living kin, and they are much more likely to live alone (Margolis & Verdery,

2017). These findings corroborate prior ethnographic work that suggests that populations without living family members are some of the most disadvantaged and isolated members of society (Klinenberg, 2002, 2012).

Previous work on kinless older adults is concentrated in the United States (Carney et al., 2016; Margolis & Verdery, 2017), where the kinless population is growing rapidly because of population aging and other demographic changes (Verdery & Margolis, 2017). Yet, neither the demographic trends that predict rising rates of kinlessness nor the sociological theories that link kinlessness to socioeconomic disadvantage or poor health are limited to the United States. Long-term changes in fertility, marriage, and mortality affect the size of the subpopulation of older adults lacking immediate kin; processes that should operate around the world. Although the first and second demographic transitions took hold earliest in Europe and North America, low fertility, childlessness, and increases in the prevalence of non-marriage and divorce are spreading to more and more global regions (Zaidi & Morgan, 2017). These changes should increase kinlessness. However, there are countervailing trends. Mortality declines increase the probability of having kin alive at different ages (Uhlenberg, 1996), and increases in remarriage among older adults offset some of the effects of increasing divorce (Livingston, 2014). The growing importance of non-marital partnerships and step-family relations may also blunt the effects of increasing kinlessness, although the potential scope of these effects is limited because many older adults in non-marital partnerships and with step-children also have biological children and are thus not kinless (Brown, Lee, & Bulanda, 2006; Lin, Brown, Cupka, & Carr, 2017; Wachter, 1995).

Kinlessness may be especially important for the health and well-being of older adults in economies that lack formal pension systems and in societies where non-familial elder care is rare. For instance, recent research finds that kinless older adults in China are highly disadvantaged and receive far less economic support than older adults with living kin (Zhou, Verdery, & Margolis, 2018). Likewise, research on the social networks of older adults in 16 European countries finds that 75% of sample participants' networks are dominated by kin (Litwin & Stoeckel, 2014). On average, people without confidantes, who we suspect are disproportionately kinless, make up 6% of older adult populations in these countries, with substantial variation from place to place, and uniformly have the lowest measures on several indicators of well-being (Litwin & Stoeckel, 2014). Whether such findings generalize to other contexts remains an open question.

In this article, we examine how common it is for contemporary older adults to lack living kin around the world. We use surveys of older adults from 34 countries that together contained 69.6% of the world's population over 50 years old in 2015 (United Nations Population Division, 2015). We explore associations between macro-level demographic factors and kinlessness across the countries we examine, and we test micro-level associations between kinlessness and demographic, socioeconomic, and health indicators. Specifically, we examine the gender composition of each national kinless population and test whether kinless individuals are uniformly disadvantaged compared to those with kin in terms of the propensity to self-report fair or poor health, to have contextually low levels of education, and to live alone after adjusting for age differences. Finally, we make a rough estimate of the size of the contemporary global kinless population given available data.

The Demographic Forces Behind Kin Availability

A growing population of kinless older adults is an anticipatable outcome of population aging and long-running demographic changes in fertility, mortality, and marriage. Historical fertility declines and increases in childlessness and one-child families will lead to contemporary older adults with fewer siblings and fewer children of their own (Verdery, 2015). Following the decline of fertility from high to low during the first demographic transition, fertility rates have continued to decline below replacement level for many countries (Lesthaeghe, 2010). Low levels of fertility during prime childbearing years are likely to lead to higher levels of kinlessness among older adults, net of other factors. The relationship between fertility and kinlessness is especially clear when low fertility is driven by increasing childlessness. However, even in the absence of increased childlessness, lower fertility can be expected to increase kinlessness for two reasons. First, some who are kinless were once parents. Whether parents end up kinless in older adulthood is affected by their likelihood of outliving their children, which is partly a function of how many children they have had. The risks of outliving multiple children are quite low, but with fertility declines these risks increase. The second reason pertains to the age gap between parents and children. Much of the initial fertility decline in the first demographic transition is due to decreases in the age at last birth (Reher, 2011). This pattern will increase the minimum age of older adults' children, and thereby potentially increase kinlessness. For example, the youngest child of an 80-year old whose last child was born at age 45 would be 35 (an age with low mortality risk), but the youngest child of an 80-year old whose last child was born at age 30 would be 50 (an age with higher mortality).

Declines in mortality increase child, spouse/partner, sibling, and parent survival. In countries with higher mortality, recent mortality declines are more concentrated at younger and middle ages, affecting the likelihood of having a living child, spouse, or sibling in older adulthood (Uhlenberg, 1996). Mortality improvements for infants and children are unlikely to affect kinlessness, but mortality improvements through middle age will affect spouse and sibling survival, decreasing the probability of being kinless. In low-mortality countries, recent mortality decline is concentrated in

older ages and will likely reduce spouse, sibling, and parent mortality, and thus would lower kinlessness in the absence of other change (Uhlenberg, 1980). Although mortality decline means more kin remain alive, the magnitude of recent mortality decline is unlikely to be large enough to offset co-occurring changes in partnership and fertility (Coale, 1972). Even though we would generally expect that higher rates of mortality are positively associated with kinlessness, the fact that mortality decline is so intimately tied to fertility decline makes it unclear whether there will be any relationship between levels of mortality and kinlessness.

In places where the proportion of currently married adults is declining, because of lower marriage rates and increased cohabitation and divorce at older ages, kinlessness at older ages will be particularly high. It is useful to think about such changes in line with the concept of the second demographic transition (Lesthaeghe, 2010; Lesthaeghe & Moors, 1995), which some argue can be measured by increases in the mean age at marriage, declines in rates of first marriage, and rising divorce rates (Zaidi & Morgan, 2017). Since the 1970s, the mean age at marriage has increased worldwide, with an average of 2 years postponed for union formation across all regions (Ortega, 2014). In all Western countries, the proportion of people who never marry has increased (Cherlin, 2014; Van de Kaa, 2002). The divorce rate has also increased in almost all industrialized countries since the 1980s and 1990s (Van de Kaa, 2002). In South and East Asia, ongoing marriage squeezes resulting from skewed sex ratios at birth, male preferences for younger brides, and smaller birth cohorts mean that increasingly more men in these countries will never marry (Guilmoto, 2012). For East Asian countries, rates of first marriage are declining dramatically and increasing ages of first marriage are one of the region's most striking family trends (Raymo, Park, Xie, & Yeung, 2015). In contrast, the increase in divorce rates has been more recent in these countries. For example, the crude divorce rate in Korea began increasing around 1990 and peaked at 3.4 in 2003 (Park & Raymo, 2013; Raymo et al., 2015). In China, it increased from 0.3 in 1979 to approximately 0.9 in 1999, then it rose rapidly to 1.6 in 2007 (Wang & Zhou, 2010). For Southeast Asian countries including Malaysia and Thailand, consistent with the trend in delayed marriage, there have been sharp increases in the proportion of women who remain single at ages 30–34 and 40–44 from 1970 to 2000 (Jones, 2007). At present, such patterns do not indicate high levels of older adult kinlessness in these countries, but they may portend future increases if marriage is foregone and not simply delayed.

Marriage and childlessness also interact to produce kinlessness in older age. Childlessness is rising in every region of the world, but the onset and pace of these increases have been far from uniform (Frejka, 2017; Glaser et al., 2006; Gobbi, 2013; Kreager & Schröder-Butterfill, 2005; Kreyenfeld & Konietzka, 2017; Schröder-Butterfill & Kreager, 2005). Starting with the 1950 birth cohort, childlessness increased dramatically in many parts of Europe, such as West Germany, Austria, Switzerland, and the Netherlands (Sobotka, 2017). More recently, rapidly increasing proportions of women ended their reproductive years childless in Southern and Eastern European countries. However, childlessness trends in Europe are not uniform, remaining at comparatively low levels in Belgium, France, and the Scandinavian countries (Kreyenfeld & Konietzka, 2017). Among non-European countries, childlessness has also been increasing among recent birth cohorts in Japan (Frejka, Jones, & Sardon, 2010; Raymo et al., 2015) and the United States (Frejka, 2017).

In many contexts where childbearing takes place almost exclusively in marriage, childlessness is intimately connected to non-marriage. Research in East Asia has documented the effects of non-marriage on childlessness trends: between 1980 and 2010, the proportion of adults who never married at age 50 increased from 2.6% to 20.2% in Japan, from 0.4% to 5.8% in Korea, and from 5.0% to 10.1% in Taiwan (Raymo et al., 2015); almost all children are born to married mothers in these countries. Substantial increases in non-marriage are also expected in India (Guilmoto, 2012), which is another place where childbearing almost exclusively occurs in marriage, so we expect increases in childlessness there as well. In other regions such as Latin America, where marriage and childbearing are less closely coupled (see below), there are no documented increases in childlessness at the end of childbearing years. However, there are trends that suggest childlessness could soon rise quickly in this region, including increased postponement of first births and a growing share of women who have not transitioned to motherhood by their early 30s (Rosero-Bixby, Martín, & Martín-García, 2009). Unfortunately, data on childlessness are sparse, especially among men, but one way to examine it indirectly is to focus on the context of childbearing, the share of children born to married parents. Increasing diversity in the context of childbearing is a core component of the second demographic transition. In countries where almost all births occur in marriage, unmarried adults will be highly likely to be childless and thus kinless. In countries where childbearing contexts are more heterogeneous, we expect a weaker link between marriage trends and kinlessness.

Gender is a final important issue when considering demographic change and kin availability. In most societies, women live longer than men and marry men older than themselves, which means that in many contexts the older kinless population is likely to be dominated by women. However, in contexts with ongoing marriage squeezes, such as India and China (Guilmoto, 2012), men have much lower probabilities of marrying and having children than women and older adult kinlessness may be more common among men. Another reason to consider the gender dimensions of kinlessness is that evidence from the United States suggests that lacking living family is more challenging and has more serious consequences for men than women (Klinenberg, 2002).

The Current Study

We address global variability in the prevalence of kinlessness, how historical and contemporary macro-level demographic contexts are associated with kinlessness, and the characteristics of the kinless population at the micro-level in terms of demographic, social, economic, and health indicators. Because there is substantial global variability in the timing and pace of different demographic changes, it is valuable to consider associations between lagged macro-level indicators of those phenomena and societal levels of kinlessness. Such understandings will help researchers contextualize cross-sectional snapshots of kinlessness, which can help to elaborate on the likely future unfolding of kinlessness around the world. Likewise, it is important to understand the characteristics of the kinless population and to test whether the kinless are uniformly disadvantaged compared to their counterparts with living kin across different settings.

Data

We use a diverse group of national studies from around the world to provide the broadest possible characterization of the size and characteristics of the older adult population lacking kin. To the best of our ability, we have sought to include sources that cover parts of understudied regions like Africa, Southeast Asia, and Latin America. We use 15 data sets that cover 34 countries. Table 1 presents the countries and data sets we examine. Supplementary Appendix A contains more information about each data set. Table 1 also shows the respective size in 2015 of the population ages 50 years old and above in each country that we examine, which indicates that, together, our data sources come from countries that constitute 69.6% of the contemporary global population of older adults. From each source, we use the most recent survey year that is nationally representative of the older adult population to get the most current estimates of kinlessness (for countries lacking representative data, we use the most recent available year). Data analysis for this project was reviewed and found exempt by the Institutional Review Board of The Pennsylvania State University.

Measures

We examine two measures of kinlessness. The constraints of available data present challenges for studies of the kin resources available to older adults, challenges that are multiplied when attempting to study such issues cross-nationally. For instance, although grandchildren, step-children, and many others may be important sources of support for older adults in different contexts, few surveys measure such ties. We focus on widely available measures of the availability of a spouse, children, and siblings. Supplementary Appendix B overviews the definitions of micro-level variables used in each survey such as whether children include non-biological children or whether spouses and partners can be separated. Our first measure, "kinless1," examines those who have neither a spouse nor a living child. When possible, we define those with spouses as those in legally recognized marriages and do not include partners. Our second measure of kinlessness, "kinless2," is a subset of those who are kinless by the first definition with the additional restriction that they also have no living siblings. Not all surveys have usable measures of sibling status, so we are unable to estimate kinless2 prevalence in every country.

We examine five lagged or contemporaneous macro-level factors that may predict countries' levels of kinlessness. These are markers of different demographic changes associated with the first and second demographic transitions, and they also represent different potential pathways to kinlessness through, for instance, non-marriage and childlessness compared to divorce and child mortality. We focus on macro-level indicators that are broadly available and simple to calculate from official statistics; see Supplementary Appendix C for notes and data sources regarding these. First, we examine two components associated with the first demographic transition: the total fertility rate when current older adults were in their prime childbearing years (measured 35 years prior to the survey year), and remaining years of life expected at age 60 which reflects older adult mortality (measured in the survey year). Next, we consider three indicators that are more closely associated with the second demographic transition: the proportion of women age 50 who had ever married (measured 10 years prior to the survey date to capture cohort prevalence of non-marriage for contemporary older adults), the crude divorce rate (measured 25 years prior to the survey date to capture prime divorce years for current older adults), and the "legitimacy ratio" (Hartley, 1975), which is the proportion of births occurring to married women (measured 35 years prior to the survey date to capture childbearing contexts during contemporary older adults' prime childbearing years). These measures capture increasing diversity in family formation. The crude divorce rate and the proportion of women married at age 50 measure how people exit marriage or never enter it to begin with. The proportion of births that occur to married mothers reflects the context of childbearing. In countries where almost all births occur within marriage, non-marriage will be a critically important factor in determining who ends up kinless.

We also examine micro-level associations between individual kinlessness and four attributes: being male (compared to female), being in poor or fair self-rated health (compared to good, very good, or excellent self-rated health), living alone (compared to living with others), and whether the respondent has low education for the given national context (compared to not having contextually low education). In examining these factors, we take age into account, which is measured by respondent reports of age at last birthday. More information on the coding of these variables in each survey is available in Supplementary Appendix B.

Table 1. Countries and Data Sets Examined With Number and Global Percentage of Older Adults Living in Each Country in 2015

Country	Data set	Population ages 50+ (thousands)	Percent of world population ages 50+
Austria	SHARE	3,412	0.2%
Belgium	SHARE	4,287	0.3%
Canada	CGSS	13,462	0.8%
China[a]	CHARLS	399,873	24.2%
Costa Rica	CRELES	1,158	0.1%
Croatia	SHARE	1,705	0.1%
Czech Republic	SHARE	3,979	0.2%
Denmark	SHARE	2,161	0.1%
Estonia	SHARE	510	0.0%
France	SHARE	24,537	1.5%
Germany	SHARE	35,266	2.1%
Greece	SHARE	4,441	0.3%
Hungary	SHARE	3,710	0.2%
India	LASI	231,906	14.1%
Indonesia	IFLS	45,618	2.8%
Ireland	TILDA	1,431	0.1%
Israel	SHARE	2,026	0.1%
Italy	SHARE	25,789	1.6%
Japan	JSTAR	57,616	3.5%
Luxembourg	SHARE	187	0.0%
Malaysia	MFLS	5,594	0.3%
Mexico	MHAS	22,539	1.4%
Netherland	SHARE	6,511	0.4%
Poland	SHARE	13,972	0.8%
Portugal	SHARE	4,272	0.3%
Republic of Korea	KLoSA	17,342	1.1%
Russian Federation	RLMS	50,741	3.1%
Slovenia	SHARE	826	0.1%
South Africa	HAALSI	8,896	0.5%
Spain	SHARE	18,006	1.1%
Sweden	SHARE	3,664	0.2%
Switzerland	SHARE	3,155	0.2%
Thailand	SOPT	20,539	1.2%
United States	HRS	109,470	6.6%
World	NA	1,649,473	69.6%

Notes: See text for data set descriptions; population sizes drawn from the United Nations Population Division (2015). See Supplementary Appendix A for data set descriptions.

[a]China's population total includes Macau and Hong Kong.

Methods

First, we show the population prevalence of the two definitions of kinlessness among older adults for each country in Table 2. When possible, we weight data to be representative of the older adult population ages 50 and above in each country and year (see notes to Table 2 for exceptions). Next, we examine five macro-level factors associated with the demographic forces that lead to kinlessness and test how they vary with each country's percentage of older adults lacking a spouse and biological children (Figures 1–4), or the national equivalent (see Supplementary Appendix B); we present this information visually and with bivariate regression coefficients and fit statistics.

Last, we examine the micro-level characteristics that are associated with kinlessness across countries. Figure 5 charts the age-adjusted logit coefficients from country-specific logistic regressions of dichotomous measures of being male, in fair or poor self-rated health, having contextually low education, and living alone on a linear age variable and a kinlessness variable that is coded 1 if the respondent lacks a spouse and biological children (i.e., kinless1), or the national equivalent (see Supplementary Appendix B), and is coded 0 if they are not kinless. We use survey estimation procedures including weights and adjustments for survey design factors where appropriate. We focus on age-adjusted differences between the kinless and those with

Table 2. Weighted Percent Kinless According to Two Definitions, by Country and Year

Country	Year	N	% with no spouse or child (kinless 1)	SE	% with no spouse, child, or sibling (kinless 2)	SE
Ireland (IRL)	2010	8,163	10.98	0.41	NA	NA
Switzerland (CHE)	2015	2,778	10.48	0.73	0.13	0.08
Netherlands (NLD)[a]	2013	4,127	10.25	1.30	0.20	0.08
Canada (CAN)	2011	12,229	10.21	2.74	NA	NA
Italy (ITA)	2015	5,225	9.99	0.61	0.57	0.13
Austria (AUT)	2015	3,368	9.27	0.69	0.19	0.08
Estonia (EST)	2015	5,559	8.70	0.48	0.42	0.11
Belgium (BEL)	2015	5,724	8.59	0.56	0.45	0.10
Germany (DEU)	2015	4,354	8.31	0.56	0.13	0.07
Poland (POL)	2015	1,807	8.24	0.97	0.46	0.19
Croatia (HRV)	2015	2,447	8.14	0.71	0.76	0.23
Luxembourg (LUX)	2015	1,548	7.91	0.94	0.29	0.17
Spain (ESP)	2015	5,583	7.45	0.70	0.18	0.07
United States (USA)	2010	15,142	7.22	0.21	1.34	0.09
Greece (GRC)	2015	4,831	7.17	0.42	0.43	0.11
France (FRA)	2015	3,888	7.04	0.48	0.09	0.05
Slovenia (SVN)	2015	4,198	6.91	0.58	0.18	0.08
Sweden (SWE)	2015	3,884	6.78	0.61	0.04	0.03
Hungary (HUN)[a]	2011	2,999	6.05	0.84	1.02	0.38
Thailand (THA)	2014	69,894	6.00	0.09	0.68	0.03
Denmark (DNK)	2015	3,668	5.84	0.46	0.02	0.02
Costa Rica (CRI)[b]	2005	2,872	5.83	0.81	NA	NA
Russia (RUS)[c]	2014	15,163	5.67	0.46	NA	NA
South Africa (ZAF)[d]	2015	4,141	4.59	0.33	0.89	0.15
Mexico (MEX)	2012	14,645	3.98	0.32	0.19	0.08
Israel (ISR)	2015	2,014	3.67	1.12	0.00	0.00
Japan (JPN)[e]	2011	4,515	3.42	0.41	NA	NA
Czech Republic (CZE)	2015	4,804	3.30	0.66	0.13	0.07
Portugal (PRT)	2015	1,666	3.09	0.73	0.00	0.00
Malaysia (MYS)	1988	1,357	2.39	0.57	1.00	0.39
India (IND)[f]	2010	1,088	2.31	0.52	0.63	0.31
Indonesia (IDN)[g]	2014	5,798	2.00	0.20	0.25	0.07
China (CHN)	2013	15,040	1.79	0.29	0.18	0.04
Republic of Korea (KOR)[h]	2010	8,465	1.41	0.23	0.24	0.06

Notes: Sorted in descending order of kinless 1 estimates. ISO alpha 3 abbreviations drawn from https://unstats.un.org/unsd/tradekb/knowledgebase/country-code. [a]Children includes all children. [b]Weighted to represent the population ages 60 and above. [c]Children include adopted children. [d]Not nationally representative; married includes those currently married or living with a partner. [e]Weighted to represent the population ages 50–80; married includes those currently married or living with a partner. [f]Not nationally representative. [g]Siblings include biological and non-biological siblings. [h]Married includes those currently married or living with a partner; common law is considered marriage.

living kin because the demographic forces propelling the rise of kinlessness, particularly patterns associated with the second demographic transition, mean that the kinless population in many contexts may be younger than those with living kin.

Finally, we compute a rough estimate of the numbers of kinless individuals around the world in the countries we examine by multiplying the prevalence of kinlessness in each country by the size of that country's older adult population in 2015 according the United Nations Population Division (2015). Though far from an exact figure because not all the surveys that we examine were conducted in

2015, not all of the surveys are nationally representative, and we do not have surveys in all countries, this "back of the envelope" calculation will provide a useful benchmark estimate, one that future research can refine, of the size of the global population of kinless older adults.

Results

Table 2 presents the unweighted sample sizes and percentages of older adults that are kinless by two different definitions for each country and year; it is sorted in descending order of kinless1 prevalence (those with neither
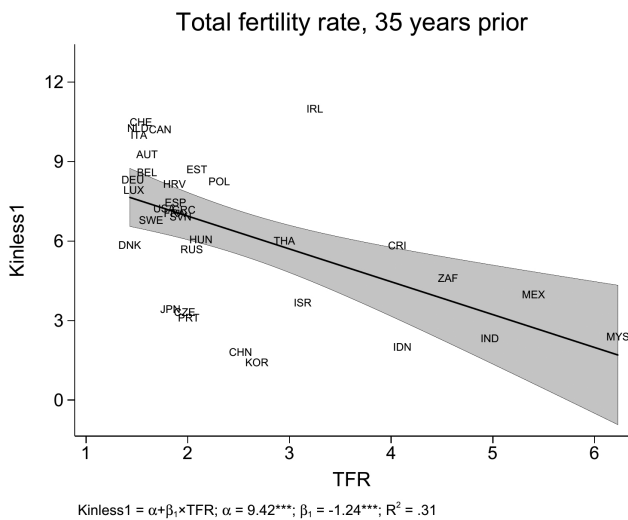
Total fertility rate, 35 years prior

Kinless1 = $\alpha + \beta_1 \times$TFR; α = 9.42***; β_1 = -1.24***; R^2 = .31

Figure 1. Scatterplot and linear relationship between national prevalence of population without a spouse or child (kinless1) and total fertility rates measured 35 years prior to survey.
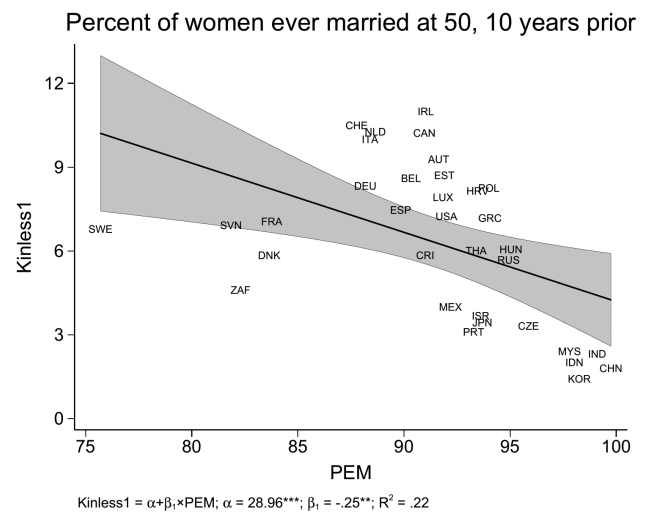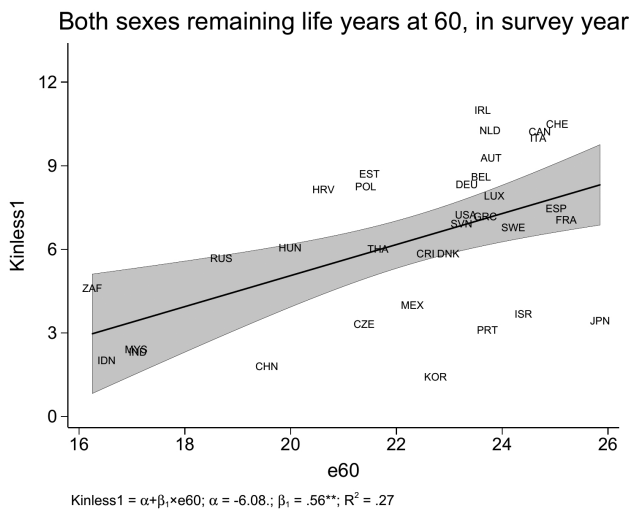
Both sexes remaining life years at 60, in survey year

Kinless1 = $\alpha + \beta_1 \times$e60; α = -6.08.; β_1 = .56**; R^2 = .27

Figure 2. Scatterplot and linear relationship between national prevalence of population without a spouse or child (kinless1) and remaining life years remaining for both sexes at age 60 measured at time of survey.

Percent of women ever married at 50, 10 years prior

Kinless1 = $\alpha + \beta_1 \times$PEM; α = 28.96***; β_1 = -.25**; R^2 = .22

Figure 3. Scatterplot and linear relationship between national prevalence of population without a spouse or child (kinless1) and percent of women ever married at age 50 measured 10 years prior to survey.

Crude divorce rate, 25 years prior

Kinless1 = $\alpha + \beta_1 \times$CDR; α = 5.26***; β_1 = .69.; R^2 = .08

Legitimacy ratio, 35 years prior

Kinless1 = $\alpha + \beta_1 \times$LGT; α = 8.49.; β_1 = -.02.; R^2 = .01

Figure 4. Scatterplots and linear relationships between national prevalence of population without a spouse or child (kinless1) and (A) crude divorce rates measured 25 years prior to survey and (B) legitimacy ratios measured 35 years prior to survey.

a spouse nor a biological child). There is a substantial variation across countries. The percentage of older adults without a spouse or biological child (kinless1) is highest in Canada, Ireland, the Netherlands, and Switzerland, at 10%–11%. Next, there is a group of countries where 6%–10% of older adults are kinless1: Austria, Belgium, Croatia, Estonia, France, Germany, Greece, Hungary, Italy, Luxembourg, Poland, Slovenia, Spain, Sweden, Thailand, and the United States. The third group has rates of kinlessness of about 3%–6%, and these countries are: Costa Rica, Czech Republic, Denmark, Israel, Japan, Mexico, Portugal, Russia, and South Africa. Last, there is a group of countries with very low levels of kinless1 prevalence, about 2% or lower, and these countries are all in Asia: China, India,
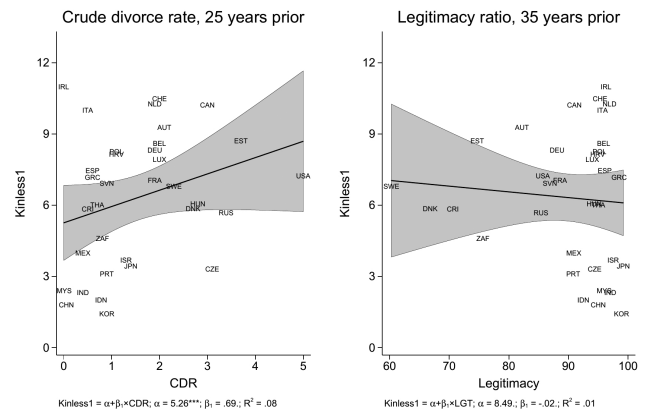
Indonesia, Malaysia, and the Republic of Korea. There are not clear breaks in the national-level distribution of kinlessness; rather, it is a continuum.

Our second measure (kinless2) captures whether respondents have no living kin of the following types: spouse, biological child, or sibling. Since this definition is much more restrictive, rates are much lower. The highest levels are around 1% and are found in Hungary, the United States, and South Africa. There are some countries with very low levels, such as Denmark, France, Israel, Portugal, and Sweden (in Israel and Portugal, no respondents met the conditions of being kinless2). However, most countries are in the middle. Intriguingly, there is almost no macro-level correlation between national prevalence of kinless1 and kinless2 among those countries with available data (ρ = .008, p = .968), which highlights the complexity of kinship networks and the fact that different demographic

forces, operating at different timescales, affect both measures in complex ways (see Verdery & Margolis, 2017). Because levels of kinless2 prevalence are so low in most of the surveys and not available in others, we do not examine its macro- or micro-level correlates.

Figures 1–4 examine five macro-level factors that we expect may be related to the level of kinless1 prevalence across countries. Each figure also shows the line of best fit and its associated uncertainty from an ordinary least squares regression, along with the bivariate regression coefficients, an indicator of their statistical significance (*p < .05; **p < .01; ***p < .001), and the relationship's coefficient of determination (R^2) at the bottom of the figure. To aid interpretation, we use country abbreviations instead of markers (Table 2 lists each country's abbreviation).

The first figure captures a key indicator of demographic change—the lagged level of fertility, measured as each country's total fertility rate 35 years prior to the survey when respondents were in their prime childbearing years. There is a clear, strong, and statistically significant negative relationship between fertility and kinlessness. In general, the predicted values from this simple bivariate regression fit the data well, explaining 31% of the variance. At the top left corner, we see almost all European countries, along with the United States and Canada, with high levels of kinlessness and low or very low lagged fertility. On the right side of this chart, we see countries with higher lagged fertility generally have lower levels of kinlessness (Costa Rica, India, Indonesia, Malaysia, Mexico, and South Africa). Some countries (Czech Republic, Japan, Republic of Korea, China, and Portugal) all have substantially lower kinlessness than would be expected on the basis of their low historical fertility rates. In contrast, Ireland has much higher kinlessness than would be expected.

Next, in Figure 2, we see that the level of mortality, measured by the contemporaneous expected years of life remaining at age 60, explains 27% of the variance in kinlessness. Surprisingly however, this variable has a strong and statistically significant *positive* relationship with kinlessness; countries with lower old age mortality have higher kinlessness. The reason for this counterintuitive finding is that mortality decline generally precedes fertility decline, so countries with lower older adult mortality rates will tend to be ones with lower fertility as well. These results conform to an interpretation of higher kinlessness being driven by the unfolding of the first demographic transition and not, per se, by high levels of mortality.

We now turn to indicators of marriage and divorce. Figure 3 shows that the lagged percentage of women who had ever married by age 50, which is measured 10 years prior to the year of the survey, explains 22% of the variance in kinlessness. There is a strong, statistically significant, and negative linear relationship between lagged marriage and kinlessness in older age. In five countries where cohabitation has long been or has recently become an institution similar to marriage (Denmark, France, Slovenia, South Africa, and Sweden), we see lower rates of kinlessness than would be expected (note: in this set, only in South Africa are non-marital partners included in the kinless1 definition; see Supplementary Appendix B). The Asian countries on the right, where marriage remains almost universal, have the lowest rates of kinlessness.

Figure 4A plots kinlessness against the lagged crude divorce rate, measured 25 years prior to the year of the survey. Unlike the earlier figures, we do not see a strong relationship between lagged divorce rates and kinlessness; the bivariate coefficient of the linear relationship is small and non-significant, and only 8% of the variance is explained (we also tested the relationship between kinlessness and a contemporaneous measure of crude divorce rates and found it had even less explanatory power than the lagged model; not shown). Remarriage may be one reason we see little relationship between divorce rates and kinlessness. Figure 4B focuses on the relationship between kinlessness and the lagged legitimacy rate, measured 35 years prior to the survey year to capture childbearing contexts during respondents' prime childbearing years. As with divorce, however, there is no meaningful relationship and little variance is explained.

Last, we test for sociodemographic and health differences between kinless older adults and their counterparts with kin. Figure 5 charts age-adjusted logit coefficients for each country's associations between kinlessness and being male, in fair or poor self-rated health, having contextually low education, and living alone. To show the range of relationships across contexts, countries are sorted by rank in each panel and statistically significant (p < .05) results are indicated with darkened markers. The age-adjusted gender composition of kinless older adults varies widely between countries. For example, in China, the kinless population is predominantly male. Many other countries, including Ireland, Denmark, Slovenia, Germany, and Poland, also have more men than women among kinless older adults, controlling for age. Yet others, such as Indonesia, Portugal, Thailand, Greece, Canada, and Russia have more women than men, controlling for age. Still others are in the middle, with no age-adjusted tendency for the kinless to be men or women. Next, we examine whether the kinless are more likely to report fair or poor health, net of age differences. In most countries, they are. This tendency is particularly evident in Israel, the Netherlands, Malaysia, Denmark, Korea, and China. Only in Mexico are the kinless in better age-adjusted health than those with kin. The third panel examines whether the kinless are more likely to have contextually low education, net of age differences. The degree of educational disadvantage among the kinless is strongest in Germany and the Netherlands; we see the opposite relationship in Greece and Italy. As shown in the fourth panel, kinless older adults are much more likely to live alone than older adults with kin across all the countries in our study. This result is expected, but there is substantial variability in its extent.
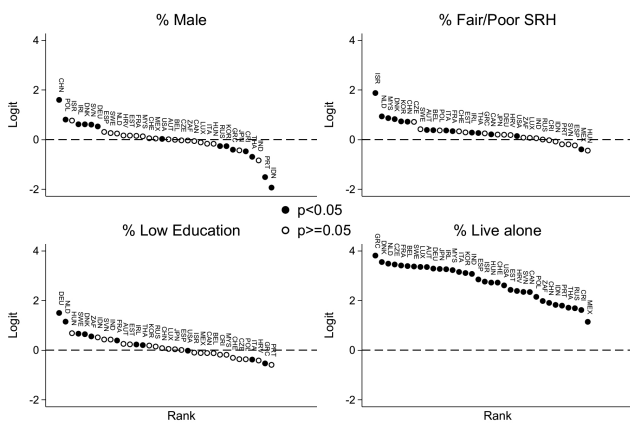
Figure 5. Countries ranked by age-adjusted logit coefficients for being without a spouse or child (kinless1) compared to not kinless1 individuals; coefficients and *p*-values calculated accounting for survey design.

Discussion

Sociologists and social gerontologists have paid increasing attention to the important roles kin play in the lives of older adults and how demographic changes are affecting the pool of kin available to older adults over time. It is broadly recognized that kin are critical to the social and economic well-being of older adults, as well as to their health (Berkman, 1984; Berkman, Glass, Brissette, & Seeman, 2000; House, Landis, & Umberson, 1988; Redfoot, Feinberg, & Houser, 2013). For instance, a growing body of research documents the health benefits that parents may gain from their children and other kin (De Neve & Kawachi, 2017; Friedman & Mare, 2014), whose absence may reduce healthy aging. In this article, we highlight the extensive cross-national variation in levels of kinlessness among older adults. One in 10 adults over the age of 50 does not have a spouse or living children in four European countries and Canada. Between 6% and 9% of older adults lack these two important types of kin in most European countries and the United States. Kinlessness is less common in countries that went through the first demographic transition more recently like South Africa, Mexico, Indonesia, Malaysia, and India. Perhaps surprisingly, it is also less common in some places that completed the first demographic transition well in the past (Japan, Denmark, Portugal, Poland, Israel). China and Korea have the lowest rates of kinlessness, with less than 1 in 50 older adults lacking a spouse and living children.

We can make a back of the envelope calculation of a lower bound on the size of the global population that is kinless using the population sizes of each country in Table 1 and the kinlessness prevalence estimates in Table 2. Our rough estimate indicates that as many as 43.6 million older adults around the world (in the countries we examined) lack a spouse and biological children, and as many as 4.4 million are without a spouse, biological children, and siblings. These figures represent 3.8% and 0.4%, respectively, of the population over age 50 in 2015 in all the countries we examine. If we compute these percentages as a fraction

of the over 50 population globally—that is, if there are no other kinless individuals outside of the countries we examined, which is highly unlikely—they represent 2.6% and 0.3% of the world's older adults, respectively. The scale of the kinless population is substantial.

We may witness increasing rates of kinlessness in the future. Our results examining associations between national kinlessness prevalence and demographic forces are helpful here. For instance, total fertility rates have continued to fall in nearly all of the countries we examined since the time period at which we measured them, 35 years prior to the survey date. This trajectory and the nearly linear relationship between lagged fertility rates and kinlessness suggest substantial increases in the prevalence of kinlessness may occur in many countries in the near future, driven by cohort replacement as cohorts who had fewer children on average, and more childlessness, age into older adulthood. Likewise, the strength of the association between kinlessness and non-marriage also points to increasing kinlessness in many contexts, as non-marriage is rapidly increasing in many world regions. Last, population aging and population growth will likely lead to an even greater number of kinless older adults, net of percentage increases. These demographic forces are not geographically isolated; they have been documented around the world. Their continuance may result in large increases in both percentages and numbers of kinless older adults in the coming decades.

The kinless are not uniformly disadvantaged across all contexts in our analysis. In most countries, the kinless are more likely than their peers who have kin to have low levels of education and fair or poor self-rated health, after controlling for age, but in some notable cases we observe the opposite tendencies. In Mexico, we see the opposite relationship for health, and in Greece and Italy we see it for education. The gender composition of the kinless older population also differs widely across contexts, being predominantly male in China and some European countries (Ireland, Denmark, Slovenia, Germany, and Poland), and predominantly female in other contexts (Indonesia, Portugal, Thailand, Greece, Canada, and Russia). The demographic forces shaping the sex composition of the kinless likely vary across countries, as do the associations between kinlessness and well-being for men compared to women. The gendered experience of being kinless in older age should be a topic for future research. In all countries, those without immediate kin are more likely to live alone than their peers with such kin. This is an important finding because living arrangements are a strong predictor of social connectedness, support, and loneliness. Although we cannot examine associations with social connectedness, support, and loneliness in the current study, increasing kinlessness could be an important link between these phenomena and population health (Cohen & Janicki-Deverts, 2009; Holt-Lunstad, Smith, & Layton, 2010; Pinquart & Duberstein, 2010). Studies repeatedly implicate a lack of close relationships with family members as one of the largest contributors to older adult loneliness and social

isolation (Nicolaisen & Thorsen, 2014; Ong, Uchino, & Wethington, 2016; Pinquart & Sörensen, 2003). This relationship is unsurprising, because kin comprise the majority of adults' confidant networks in many contexts (Litwin & Stoeckel, 2014; McPherson et al., 2006). Future work should address the broader social networks in which kinless older adults are situated, as well as examining those who are functionally kinless because they lack contact with available kin.

There are several limitations and directions for future research to note. First, although we sought to locate surveys that would provide coverage of all world regions, we could access few data sets from Latin America and the Caribbean (except Costa Rica and Mexico), and we have scant coverage of Africa (only South Africa). Future research should examine how kin availability varies in these contexts and how it is likely to change in the near future, especially with recent changes in marriage and fertility in these regions. Second, we were limited to finding approximately comparable measures for education, health, and living arrangements in comparing the kinless subpopulations across countries. Other research could consider other factors such as poverty. Third, this analysis did not address what explains the variation in gender composition, health, education, or the living arrangements of the kinless across contexts in a multivariate framework. We computed age-adjusted coefficients, but other factors are surely also important. Future research should seek to explain why kinlessness is associated with ill-health and low education in some contexts, but not others, as well as why the kinless are more or less likely to be male and live alone. Perhaps the most important limitation is data availability, which impedes our capacity to look at different types of kin including step-children, adopted children, and others. Step-kin ties are expected to increase (Hammel, Wachter, & McDaniel, 1981; Hill & Wachter, 1996; Wachter, 1995, 1997), for instance, which may offset the effects of fewer biological relations if norms of closeness among step-family members increase (Becker, Salzburger, Lois, & Nauck, 2013). To keep things analytically tractable, we focused on spouses, biological children, and siblings, but future work could examine other types of contextually important ties. Despite these limitations, the scope of older adults lacking immediate kin around the world merits future research.

We expect that the kinless population will continue to grow around the world in the coming decades. Of course, not all countries will experience the same growth in kinlessness; in some, kinlessness will increase much more rapidly than in others. By tying the contemporary prevalence of kinlessness to lagged indicators of the underlying demographic forces that produce it, this article offers a theoretical framework that can be used to predict such changes. This article also demonstrates that, in general, kinless older adults tend to be in poorer health and have worse well-being compared to older adults with living family. However, these relationships are far from uniform across nations. Indeed, in some places, the kinless are better off.

As such, the policy challenges associated with kinlessness are likely to vary, both because of cross-national variation in the scale of kinlessness and because of variation in its associations with health and well-being. Nonetheless, we can anticipate that many places around the world will face substantial challenges from kinlessness. Some of these places are foreseeable, such as countries in Europe, while others are more surprising, such as Thailand, which has high kinlessness and strong negative associations between kinlessness and health and well-being. In the face of such challenges, a cross-national perspective on kinlessness, such as we take here, has much to offer scholars and policymakers, who can leverage what is known about kinlessness in different contexts, including the policies that mitigate or exacerbate its negative effects, and apply them locally.

Supplementary Material

Supplementary data are available at *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences* online.

Funding

Acknowledgments

Conflict of Interest

None.

References

Ajrouch, K. J., Blandon, A. Y., & Antonucci, T. C. (2005). Social networks among men and women: The effects of age and socioeconomic status. *The Journals of Gerontology, Series B:*

Psychological Sciences and Social Sciences, **60**, S311–S317. doi:10.1093/geronb/60.6.s311

Antonucci, T. C., & Akiyama, H. (1987). Social networks in adult life and a preliminary examination of the convoy model. *Journal of Gerontology*, **42**, 519–527. doi:10.1093/geronj/42.5.519

Becker, O. A., Salzburger, V., Lois, N., & Nauck, B. (2013). What narrows the stepgap? Closeness between parents and adult (step)children in Germany. *Journal of Marriage and Family*, **75**, 1130–1148. doi:10.1111/jomf.12052

Berkman, L. F. (1984). Assessing the physical health effects of social networks and social support. *Annual Review of Public Health*, **5**, 413–432. doi:10.1146/annurev.publhealth.5.1.413

Berkman, L. F., Glass, T., Brissette, I., & Seeman, T. E. (2000). From social integration to health: Durkheim in the new millennium. *Social Science & Medicine (1982)*, **51**, 843–857. doi:10.1016/s0277-9536(00)00065-4

Brown, S. L., Lee, G. R., & Bulanda, J. R. (2006). Cohabitation among older adults: A national portrait. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences*, **61**, S71–S79. doi:10.1093/geronb/61.2.S71

Carney, M. T., Fujiwara, J., Emmert, B. E. Jr, Liberman, T. A., & Paris, B. (2016). Elder orphans hiding in plain sight: A growing vulnerable population. *Current Gerontology and Geriatrics Research*, **2016**, 4723250. doi:10.1155/2016/4723250

Cherlin, A. J. (2014). First union patterns around the world: Introduction to the special issue. *Population Research and Policy Review*, **33**, 153–159. doi:10.1007/s11113-013-9320-7

Coale, A. J. (1972). *The growth and structure of human populations: A mathematical approach*. Princeton, NJ: University of Princeton Press.

Cohen, S., & Janicki-Deverts, D. (2009). Can we improve our physical health by altering our social networks? *Perspectives on Psychological Science: A Journal of the Association for Psychological Science*, **4**, 375–378. doi:10.1111/j.1745-6924.2009.01141.x

Cornwell, B., Laumann, E. O., & Schumm, L. P. (2008). The social connectedness of older adults: A national profile*. *American Sociological Review*, **73**, 185–203. doi:10.1177/000312240807300201

De Neve, J. W., & Kawachi, I. (2017). Spillovers between siblings and from offspring to parents are understudied: A review and future directions for research. *Social Science & Medicine (1982)*, **183**, 56–61. doi:10.1016/j.socscimed.2017.04.010

Fredrickson, B. L., & Carstensen, L. L. (1990). Choosing social partners: How old age and anticipated endings make people more selective. *Psychology and Aging*, **5**, 335–347. doi:10.1037//0882-7974.5.3.335

Frejka, T. (2017). Childlessness in the United States. In M. Kreyenfeld & D. Konietzka (Eds.), *Childlessness in Europe: contexts, causes, and consequences* (pp. 159–179). Cham, Switzerland: Springer. doi:10.1007/978-3-319-44667-7_8

Frejka, T., Jones, G. W., & Sardon, J. P. (2010). East Asian childbearing patterns and policy developments. *Population and Development Review*, **36**, 579–606. doi:10.1111/j.1728-4457.2010.00347.x

Friedman, E. M., & Mare, R. D. (2014). The schooling of offspring and the survival of parents. *Demography*, **51**, 1271–1293. doi:10.1007/s13524-014-0303-z

Glaser, K., Agree, E. M., Costenbader, E., Camargo, A., Trench, B., Natividad, J., & Chuang, Y. L. (2006). Fertility decline, family structure, and support for older persons in Latin America and Asia. *Journal of Aging and Health*, **18**, 259–291. doi:10.1177/0898264305285668

Gobbi, P. E. (2013). A model of voluntary childlessness. *Journal of Population Economics*, **26**, 963–982. doi:10.1007/s00148-012-0457-1

Guilmoto, C. Z. (2012). Skewed sex ratios at birth and future marriage squeeze in China and India, 2005–2100. *Demography*, **49**, 77–100. doi:10.1007/s13524-011-0083-7

Hammel, E. A., Wachter, K. W., & McDaniel, C. K. (1981). The kin of the aged in AD 2000: The chickens come home to roost. In S. Kiesler, J. Morgan, & V. Oppenheimer (Eds.), *Aging and Social Change* (pp. 10–39). New York: Academic Press.

Hartley, S. F. (1975). *Illegitimacy*. Berkeley, CA: University of California Press.

Hill, L. E., & Wachter, K. W. (1996). *African-American kin and stepkin: Forecasts for 2030*. Annual Meetings of the Population Association of America, New Orleans, LA.

Holt-Lunstad, J., Smith, T. B., & Layton, J. B. (2010). Social relationships and mortality risk: A meta-analytic review. *PLoS Medicine*, **7**, e1000316. doi:10.1371/journal.pmed.1000316

House, J. S., Landis, K. R., & Umberson, D. (1988). Social relationships and health. *Science (New York, N.Y.)*, **241**, 540–545. doi:10.1126/science.3399889

Jones, G. W. (2007). Delayed marriage and very low fertility in Pacific Asia. *Population and Development Review*, **33**, 453–478. doi:10.1111/j.1728-4457.2007.00180.x

Klinenberg, E. (2002). *Heat wave: A social autopsy of disaster in Chicago*. Chicago, IL: University of Chicago Press.

Klinenberg, E. (2012). *Going solo: The extraordinary rise and surprising appeal of living alone*. New York: Penguin.

Kreager, P., & Schröder-Butterfill, E. (2005). *Ageing without children: European and Asian perspectives* (Vol. **6**). Oxford: Berghahn Books.

Kreyenfeld, M., & Konietzka, D. (2017). *Childlessness in Europe: Contexts, causes, and consequences* (Vol. **10**). Cham, Switzerland: Springer International Publishing. doi:10.1007/978-3-319-44667-7

Lesthaeghe, R. (2010). The unfolding story of the second demographic transition. *Population and Development Review*, **36**, 211–251. doi:10.1111/j.1728-4457.2010.00328.x

Lesthaeghe, R., & Moors, G. (1995). Living arrangements, socio-economic position, and values among young adults: A pattern description for Belgium, France, the Netherlands, and West-Germany, 1990. In H. van den Brekel & F. Deven (Eds.), *Population and family in the low countries 1994* (pp. 1–56). Dordrecht, the Netherlands: Springer. doi:10.1007/978-94-011-0269-8_1

Lin, I.-F., Brown, S. L., Cupka, C. J., & Carr, D. (2017). A national portrait of stepfamilies in later life. *The Journals of Gerontology, Series B: Psychological and Social Sciences*, **73**, 1043–1054. doi:10.1093/geronb/gbx150

Litwin, H., & Stoeckel, K. J. (2014). Confidant network types and well-being among older Europeans. *The Gerontologist*, **54**, 762–772. doi:10.1093/geront/gnt056

Livingston, G. (2014). The demographics of remarriage. In Livingston, G. (Ed.), *Four-in-ten couples are saying 'I do,' again* (Chapter 2) (pp. 10–16). Washington, DC: Pew Research Center. Retrieved November 21, 2016, from http://www.pewsocialtrends.org/2014/11/14/chapter-2-the-demographics-of-remarriage/

Margolis, R., & Verdery, A. M. (2017). Older adults without close kin in the United States. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences*, **72**, 688–693. doi:10.1093/geronb/gbx068

Marsden, P. V. (1987). Core discussion networks of Americans. *American Sociological Review*, **52**, 122–131. doi:10.2307/2095397

McPherson, M., Smith-Lovin, L., & Brashears, M. E. (2006). Social isolation in America: Changes in core discussion networks over two decades. *American Sociological Review*, **71**, 353–375. doi:10.1177/000312240607100301

Nicolaisen, M., & Thorsen, K. (2014). Who are lonely? Loneliness in different age groups (18–81 years old), using two measures of loneliness. *International Journal of Aging & Human Development*, **78**, 229–257. doi:10.2190/AG.78.3.b

Ong, A. D., Uchino, B. N., & Wethington, E. (2016). Loneliness and health in older adults: A mini-review and synthesis. *Gerontology*, **62**, 443–449. doi:10.1159/000441651

Ortega, J. A. (2014). A characterization of world union patterns at the national and regional level. *Population Research and Policy Review*, **33**, 161–188. doi:10.1007/s11113-013-9301-x

Park, H., & Raymo, J. M. (2013). Divorce in Korea: Trends and educational differentials. *Journal of Marriage and the Family*, **75**, 110–126. doi:10.1111/j.1741-3737.2012.01024.x

Pinquart, M., & Duberstein, P. R. (2010). Associations of social networks with cancer mortality: A meta-analysis. *Critical Reviews in Oncology/Hematology*, **75**, 122–137. doi:10.1016/j.critrevonc.2009.06.003

Pinquart, M., & Sörensen, S. (2003). Risk factors for loneliness in adulthood and old age—a meta-analysis. In S. P. Shohov (ed.), *Advances in psychology research* (Vol. **19**, pp. 111–143). Hauppauge, NY: Nova Science Publishers.

Raymo, J. M., Park, H., Xie, Y., & Yeung, W. J. (2015). Marriage and family in East Asia: Continuity and change. *Annual Review of Sociology*, **41**, 471–492. doi:10.1146/annurev-soc-073014-112428

Redfoot, D., Feinberg, L., & Houser, A. (2013). The aging of the baby boom and the growing care gap: A look at future declines in the availability of family caregivers. *Insight on the Issues*, 85. Washington, DC: AARP Press.

Reher, D. S. (2011). Economic and social implications of the demographic transition. *Population and Development Review*, **37**, 11–33. doi:10.1111/j.1728-4457.2011.00376.x

Rosero-Bixby, L., Martín, T. C., & Martín-García, T. (2009). Is Latin America starting to retreat from early and universal childbearing? *Demographic Research*, **20**, 169–194. doi:10.4054/demres.2009.20.9

Schröder-Butterfill, E., & Kreager, P. (2005). Actual and de facto childlessness in old age: Evidence and implications from East Java, Indonesia. *Population and Development Review*, **31**, 19–55. doi:10.1111/j.1728-4457.2005.00051.x

Shaw, B. A. (2005). Anticipated support from neighbors and physical functioning during later life. *Research on Aging*, **27**, 503–525. doi:10.1177/0164027505277884

Sobotka, T. (2017). Post-transitional fertility: The role of childbearing postponement in fuelling the shift to low and unstable fertility levels. *Journal of Biosocial Science*, **49**, S20–S45. doi:10.1017/S0021932017000323

Uhlenberg, P. (1980). Death and the family. *Journal of Family History*, **5**, 313–320. doi:10.1177/036319908000500304

Uhlenberg, P. (1996). Mortality decline in the twentieth century and supply of kin over the life course. *The Gerontologist*, **36**, 681–685. doi:10.1093/geront/36.5.681

United Nations Population Division. (2015). *World population prospects: The 2015 revision DVD edition*. New York: Department of Economic and Social Affairs. Retrieved from http://esa.un.org/unpd/wpp/

Van de Kaa, D. J. (2002). The idea of a second demographic transition in industrialized countries. *Birth*, **35**, 45. Retrieved from http://websv.ipss.go.jp/webj-ad/WebJournal.files/population/2003_4/Kaa.pdf

Verdery, A. M. (2015). Links between demographic and kinship transitions. *Population and Development Review*, **41**, 465–484. doi:10.1111/j.1728-4457.2015.00068.x

Verdery, A. M., & Margolis, R. (2017). Projections of white and black older adults without living kin in the United States, 2015 to 2060. *Proceedings of the National Academy of Sciences*. **114**, 11109–11114. doi:10.1073/pnas.1710341114

Wachter, K. W. (1995). *2030's seniors: Kin and step-kin.* Population Association of America. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.23.2011&rep=rep1&type=pdf

Wachter, K. W. (1997). Kinship resources for the elderly. *Philosophical Transactions of the Royal Society of London, Series B: Biological Sciences*, **352**, 1811–1817. doi:10.1098/rstb.1997.0166

Wang, Q., & Zhou, Q. (2010). China's divorce and remarriage rates: Trends and regional disparities. *Journal of Divorce & Remarriage*, **51**, 257–267. doi:10.1080/10502551003597949

Zaidi, B., & Morgan, S. P. (2017). The second demographic transition theory: A review and appraisal. *Annual Review of Sociology*, **43**, 473–492. doi:10.1146/annurev-soc-060116-053442

Zhou, Z., Verdery, A., & Margolis, R. (2018). No spouse, no son, no daughter, No kin in contemporary China: Differences in health, wealth, and economic support. *Journal of Gerontology, Series B: Psychological and Social Sciences*. doi:10.1093/geronb/gby051