Kinship, Demography, and Inequality: Review and Key Areas for Future Development

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Abstract

Kinship relations play a crucial role in structuring populations and shaping individual outcomes. Differences in kinship among individuals, cohorts, and subpopulations are one important aspect of these structures. Demography and related disciplines have proposed sophisticated approaches to study kinship in recent years. We argue that the development of a demography of kinship that centers on these processes will help advance the field of demography as a whole. Here, we review four key substantive areas of kinship research in demography: (1) kin supply and intergenerational transfers; (2) demographic change; (3) kin loss; and (4) social stratification. For each area, we identify important gaps in the literature and avenues for future research. We then review available methods and data sources to advance each of these areas, and conclude with an agenda to foster the study of the demography of kinship in general and kinship inequalities specifically.

Keywords: kinship, family, inequality, bereavement, social structure

Introduction

The family is the setting in which the drama of the human life course unfolds. The actual plot, characters, and genre of this drama vary over time and place, but kinship dynamics remain one of the most fundamental principles of social structure. Families represent a universal of demography: all humans are embedded in kinship structures in the same way that all humans are born and die (Caswell 2019). The sociological tradition has tended to equate families with co-resident kin, often members of the nuclear family. This focus on 'who lives together,' rather than 'who is a family member,' derives from the assumption that relatives beyond the household are largely irrelevant (see Daw, Verdery, and Margolis 2016; Madhavan et al. 2017; Furstenberg et al. 2020). Many scholars, including several presidents of the Population Association of America (Entwisle 2007; Mare 2011; Seltzer 2019), have called for demographers to move beyond the household and recognize more comprehensive definitions of family and kinship. Yet, despite a growing awareness of the key role of kinship in demography, the centrality of these family systems is still not fully recognized (Furstenberg 2020).

In this review, *kinship* refers to the social relationships that bind individuals together through culturally shared definitions of relatedness on biological, legal, or normative grounds, ultimately constituting family systems (Cox and Paley 2003; Hareven 2015). Conversely, *family* refers to the more narrow group of kin given special privilege which, among other things, organize the provision of support, socialization, and social placement of its members (Furstenberg 2020). Families comprise ties that individuals recognize as kin, irrespective of whether a biological or legal connection exists (Schneider 1984; Furstenberg et al. 2020). Whereas kinship configurations share some general traits, no particular configuration is universal or stable over time (Lévi-Strauss 1969; Reczek 2020).[1]

Studies in the demography of kinship are often interested in documenting the prevalence and consequences of *kinship inequalities*. We use this term to refer to the differences in kin presence, availability, and resources that create distinct environments for individuals to develop, support each other, and obtain a sense of shared identity (Chung 2019; Furstenberg 2020). The differences may be expressed between age groups, sexes, cohorts, social classes, or populations. Kinship inequalities can be seen both as expressions of underlying

[1] The kinship terminology we use in this article comes from a Western tradition (Parsons 1943; Burling 1970), but other kinship taxonomies exist (e.g., Chao 1956; Chen 2019).

demographic trends and the social inequities that they produce. Scholars of family demography (Margolis and Verdery 2019), historical demography (Murphy 2011), social stratification (Song 2021), and population health (Smith-Greenaway and Trinitapoli 2020), to name a few, have routinely studied kinship inequalities (for a visual overview, see Figure 1).

The concept of kinship inequalities draws heavily on life course studies in sociology, which assert that an individual's life course is contingent on institutional and historical forces acting at different points in life (Alwin 2012; Elder 1994). Life course trajectories are determined contextually, often through demographic forces, so that particular life course patterns become normative within time periods and places. Of particular interest is the notion that family members are entangled in a mesh of 'linked lives' that influence them through bonds of kinship (Elder 1998; Bengtson, Elder, and Putney 2012). For instance, Black and White individuals in the US face differing exposure to deaths in the family as a result of disparate social conditions over the last century (Umberson 2017). Early-life exposure to kin death, in turn, may affect educational attainment in later life (Patterson, Verdery, and Daw 2020), contributing to the reproduction of the social stratification that created the differential exposure in the first place. This is just one example of how kinship inequalities reverberate in matrices of interconnected family members.

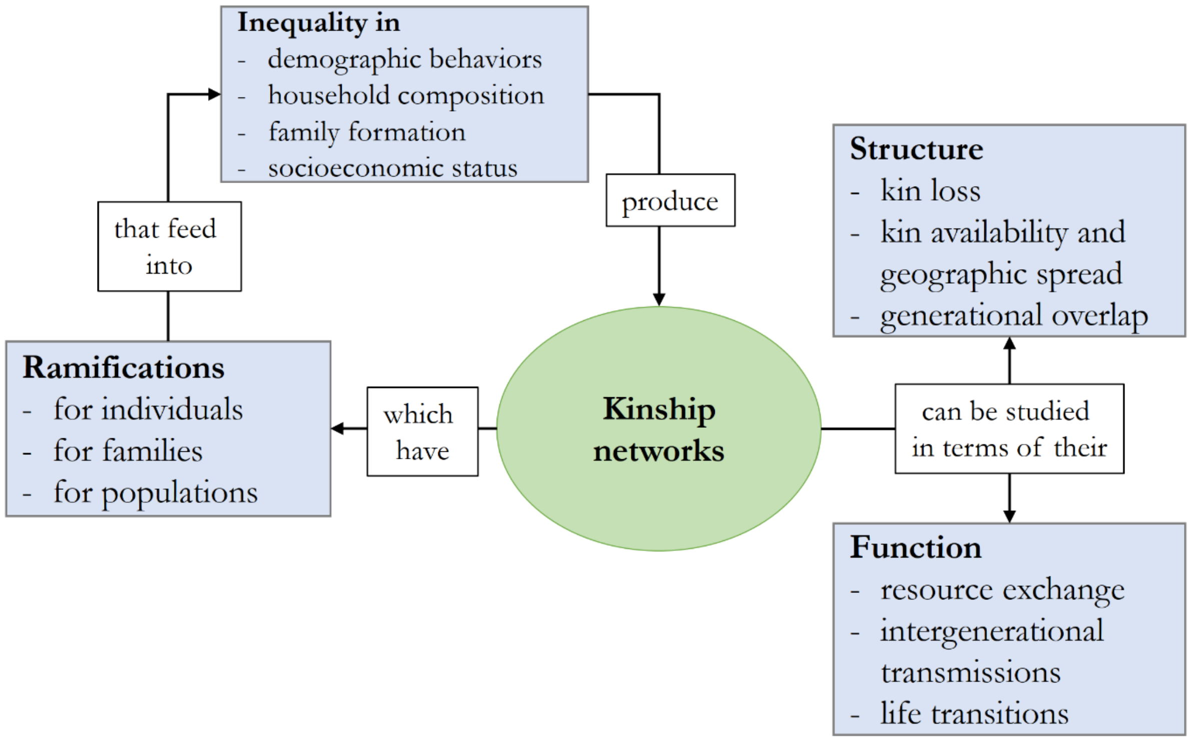

Figure 1. Summary of the relationship between kinship dynamics and structures and broader societal processes, as conceptualized in this article.

This paper offers an overview of the state of kinship studies in demography as seen through the lens of kinship inequalities. We have two main objectives. The first is to distill recent advances in the literature on kinship inequalities by emphasizing progress in four areas of demographic inquiry: kin structure and transfers; demographic change and kinship; kin loss; and kin-based social stratification. In recent years, scholars have developed new areas of substantive interest. Yet, these developments arise from different fields and have been published in journals with different readerships. This review brings them together to facilitate the development of breakthroughs that consolidate different strands of existing work in new and creative ways. The second objective is to identify outstanding research questions that can help guide scholars to fill persistent gaps in the literature. The demographic study of kinship would benefit from leveraging recent theoretical, methodological, and substantive developments. For instance, increased computing power has facilitated the implementation of kinship models based on matrix theory and large-scale simulations. An increasing number of data sources, from longitudinal household surveys to large online genealogies, also include information on extended kinship structure. We conclude this article with a discussion of the role of kinship inequalities in contemporary societies and how we may study them better.

Key Areas for the Study of Kinship Inequalities

Kin Structure and Intergenerational Transfers

Kinship dynamics shape and constrain the forms and levels of intergenerational transfers that can occur. As populations go through the demographic transition, kinship networks change in both size and structure (Murphy 2011). For example, mortality decline at young ages increases child survival and the number of children that parents have (net of fertility level); lower mortality rates in midlife affect the availability of parents to children, and adult children to parents; old age survival affects adult children's and grandchildren's access to older relatives. The onset of fertility decline has the inverse effect on kin supply: lower fertility decreases the numbers of children and siblings and other myriad kin available to subsequent cohorts (Lam and Marteleto 2008; Verdery 2015). The supply of these types of close kin, as well as more distant kin like aunts/uncles and cousins, often indicates the number of relatives who could be called upon when needed, since kinship ties act as latent ones that are often among the first to be activated for financial or functional support (Daw, Verdery, and Margolis 2016). Moreover, the length of overlap between kin represents the duration of intergenerational relationships—the period in which members of different generations are alive and during which intergenerational transfers can occur (Margolis 2016; Margolis and Verdery 2019; Margolis and Wright 2017; Song and Mare 2019). These dynamics of kin supply and generational overlap constitute an important expression of kinship inequality.

Demographers have examined changes in kinship networks for several decades. Foundational work focused on demonstrating the stylized facts outlined above: the effect of mortality change on the size and shape of families (Uhlenberg 1974, 1980), the extent of generational overlap, and the features of kin networks in the United States (Watkins, Menken, and Bongaarts 1987; Wachter 1997, 1998), Britain (Murphy 2011), and China (Jiang 1995; Verdery 2019). More recently, research on kinship has focused on four main areas: (1) the rising complexity of kin relationships (Curran, McLanahan, and Knab 2003; Fomby, Goode, and Mollborn 2016; Pilkauskas and Cross 2018; Seltzer 2004; Yahirun, Park, and Seltzer 2018); (2) generational overlap with grandparents and great grandparents (Alburez-Gutierrez, Mason, and Zagheni 2021; Yahirun, Park, and Seltzer 2018; Margolis and Verdery 2019; Margolis and Wright 2017); (3) the kin available to older adults (Jiang 1995; Verdery 2019; Margolis and Verdery 2019; Curran, McLanahan, and Knab 2003); and (4) the spatial distribution of kin, including extra-household kin and transnational kin networks

(Clark, Madhavan, and Kabiru 2018; Daw, Verdery, and Margolis 2016; Verdery et al. 2012; Madhavan et al. 2017; Bryceson 2019).

Together, this literature has shown that even as there is some universality to how demographic change affects the size and shape of kin networks and kin overlap, distinct population features can moderate the ways in which families function and provide support. Moreover, as inter-population variation emerges in mortality, fertility and nuptiality at the end of the first demographic transition, analysis of kinship across societies has highlighted the importance of local demographic context on social lives.

There are many important topics related to kin supply and intergenerational relationships that can and should be addressed in the coming years. We highlight three areas for new research. The first is understanding how increasing family complexity is shifting the supply of kin and generational overlap in new and important ways. For example, as patterns of partnership, marriage, separation/divorce, and remarriage shift, families become more complex and so does the task of identifying available kin. Step-parenthood, step- and half-siblinghood, and step-grandparenthood will become more prevalent, as will children living across multiple households. The types of extended kin that will be available in more complex families will differ, such as cousins, aunts, uncles, second cousins from non-biological parents. Demographic research taking a kinship perspective can show what the future of complex families may look like.

Second, future research is needed to better clarify differences, at all levels, in the supply of kin and to what effect generational overlap is changing. Grandparents and great grandparents are important kin, with benefits accruing to grandchildren, adult children, and to grandparents themselves. The supply of these kin and the length of overlap depend on mortality, fertility and marriage patterns which change over time, making questions about the supply of grandparents and degree of overlap difficult to answer. Efforts to quantify such trends will require incorporating these factors into a formal demography of kinship (see Section 'Advancements in Data and Methods'). Future research should address how grandparenthood and great grandparenthood are shifting over time and across contexts.

Third, new research should address the intersection of changing kin networks and the need for caregiving in aging populations. With lower rates of partnership at older ages, and fewer adult children and nieces and nephews, older adults in many contexts will have fewer descendants to help them in older age than in the past. This coincides with changes in the gender composition of children and with growing cadres of older adults who have either only sons or only daughters (Zhou, Verdery, and Margolis 2019; Pandian and Allendorf 2022). How these processes will play out in different contexts is an important area for future research. In addition, the worsening health of the older population, with increasing chronic conditions, limited mobility, and poorer cognitive health will affect some kinship networks and families more than others. Some research has begun to address the implications of Alzheimer's and dementia for family and care networks (Friedman et al. 2015; Rutter et al. 2021), and as population health and kinship networks shift in ways that make them more vulnerable to strains associated with caregiving, these topics will grow in importance. Research that answers these questions will extend our understanding of kin supply and intergenerational transfers.

The Effect of Demographic Change on Kinship Structures

Kinship regimes, the product of long-running demographic processes, build slowly but may change quickly (Billari 2022; Caswell and Song 2021). Demographic discontinuities, i.e., changes in population-level demographic trajectories, can provide both rapid and lasting influences on kinship structures, depending on the nature of the discontinuity and the kin ties considered (Hammel 2005). The effect of demographic change on kinship structure can be more dramatic, and longer-lasting, than the effects of demographic change on age structure (Hammel et al. 1991; Murphy 2011).

Four key factors determine the influence of demographic change on kinship structures. First, there is the question of whether the event is kin-accreting or kin-depleting. The postwar 'Baby Boom' seen in some countries after World War II is an accretive example: a kin regime-changing event that came after the demographic transition and owed to a different mechanism (fertility increase) (Reher 2019), whereas wars, famines, and the ravages of the HIV/AIDS epidemic in highly-affected regions are examples of kin-depleting discontinuities (e.g., Zagheni 2011). The second factor relates to the scale of the change; e.g., did the mortality crisis bring about high levels of excess mortality; was the fertility increase rapid or gradual? The third and fourth items relate to the temporal duration of the discontinuity and its geographic scope. Taken alone, shorter discontinuities, even catastrophic ones like the Great Chinese Famine of 1958-1961 (Jiang 1995), exert a surprisingly limited influence on population level kinship regimes, though their indirect effects on fertility and fecundity can be large (e.g., how the Chinese famine slowed that country's fertility decline for approximately a decade; Zhao and Chen 2008; Song 2013) and they can leave substantial cohorts of individuals bereaved (Verdery et al. 2020; Alburez-Gutierrez 2022). The same can be said for discontinuities that are geographically concentrated versus dispersed. Of course, the types of kin that are considered, and the timescale at which we are interested in observing the potential impacts, and, for whom, are also critical in determining how a demographic event influences kinship structures.

The existing literature also suggests that some demographic processes linger more than others: fertility disruptions tend to create vastly larger changes in kinship regimes than do mortality disruptions. Hammel (2005) shows that a demographic disruption in fertility rates in a growing population can triple the number of kin available to working age people, whereas a comparably large disruption in mortality rates only doubles the amount of kin available. We know less about migration or marital disruptions. What few studies have focused on migration disruptions show that their influence on kinship structures are often small, though they can play an outsize role in localized contexts (Entwisle et al. 2007; Verdery et al. 2012). Marital disruptions, though also typically smaller in effect than fertility or mortality disruptions, present a more complex case through their well-documented ancillary influence on fertility (Verdery 2019; Attané 2006).

The Chinese case highlights the myriad ways kinship regimes can change in response to demographic discontinuities. China's family planning policies from 1972 to 2015 (especially the 'Later, Longer, Fewer' campaign in the early 1970s and the 'one child policy' in effect from 1979 to 2015) drastically altered its kinship regime in ways that will persist throughout this century (Chen and Fang 2021; Verdery 2019; Eberstadt and Verdery 2021). The restrictions reduced the numbers of available children and siblings, which will soon create social challenges in that country as a very large cohort ages into and through older adulthood (Tuljapurkar, Li, and Feldman 1995; Zhou, Verdery, and Margolis 2019). Fewer girls than boys were born in China over this period, primarily owing to sex-selective abortion. Because men tend to marry women younger than themselves, China is entering into a period of substantial marriage squeeze, as a result of which at least 15% of recent cohorts of Chinese men may never marry (Guilmoto 2012). These unmarried men will almost certainly not bear children unless the strict social proscriptions against unmarried childbearing change dramatically (Verdery 2019) and may be at increased risk of suicide or otherwise untimely deaths (Zhou, Yan, and Therese 2013).

We identify three main areas for future development. First, we need a clearer understanding of the implications of changing kinship configurations for societies. Demographers have linked demographic change to female empowerment, human capital gains (Lutz et al. 2019), and even democratic change (Dyson 2013). We know less about the societal ramifications of kinship transitions. For instance, is kin availability associated with societal levels of trust and economic practices (Eberstadt and Verdery 2021)? How will kinship configurations change around the world and what new challenges and opportunities will this bring for societies? Can policy makers anticipate these to the same extent that population projections allow them to adjust systems of state-based social support such as pensions, and others?

Second, more work is needed to characterize migration from the perspective of kin (Kandel and Massey 2002). Migration is a unique discontinuity, changing kinship networks locally as well as forming extra-local links. Kinship is central in the migration process and the migrant experience, forming a key component of theories of 'the auspices of migration' (Brown and

Tilly 1967), immigrant incorporation (Hagan 1998), and transnational network ties (Bilecen, Gamper, and Lubbers 2018). Few studies are well set up to examine migration and kinship dynamics. This is true for surveys, which rarely collect information on the geographic dispersion of relatives, and for microsimulation or formal modeling, where it is difficult to parameterize rates appropriately. New approaches to collecting data on transnational social ties (e.g., Lubbers, Verdery, and Molina 2020) and incorporating such data into kinship models (e.g., Entwisle, Verdery, and Williams 2020) are a rapidly growing area for future scholarship.

Third, it is critical that researchers begin to formalize the relationship between demographic discontinuities and kinship structures using tools from mathematical demography. This could improve our understanding of the consequences of fast and slow demographic change (Billari 2022). It may also help us understand whether and how kin networks act as 'repositories of memory' (Denton and Spencer 2021; Alburez-Gutierrez 2022).

The Lived Experience of Kin Loss

Despite demography's principal interest in mortality, the field's fixation with risk has yielded a body of mortality research steeped in an individualistic framework. That is, it focuses on the probabilities of death of an individual and the factors determining it. But demographic measures and models rarely acknowledge that our deaths bear meaning for others, especially those in our kin network. When demographers have conceptualized the possible relevance of kin death for individuals' lives, they have done so in narrow terms, focused heavily on its possible consequences for fertility (Preston 1978; Palloni and Rafalimanana 1999).

The neglect of this topic may seem reasonable given the restructuring of kin networks that corresponds with concomitant declines in mortality and fertility. Across the globe, experiences of kin loss are becoming more orderly. In low fertility and mortality populations, parents can reasonably expect that their offspring will out-survive them (Alburez-Gutierrez, Kolk, and Zagheni 2021), and that their first major loss will likely be the death of their elderly grandparent. Even so, growing scholarship recognizes that even with low annual rates of mortality, these experiences accrue in a way that often leads to higher lifetime exposure to off-timed deaths than may be expected. In the U.S., for example, upwards of 1-in-10 young people have endured a sibling death (Fletcher, Vidal-Fernandez, and Wolfe 2018) and 1-in-20 mothers (ages 45-49) have lost a child (Smith-Greenaway et al. 2021). The differential exposure to kin loss constitutes an understudied form of kinship inequality with potentially far-reaching consequences for surviving relatives (Umberson et al. 2017; Patterson, Verdery, and Daw 2020). Calculations of the degree of kin loss implied by age schedules of mortality and fertility have shown that changes in mortality over relatively few decades can imply huge changes in the experience of kin death (Caswell 2019).

Moreover, most of the world's population still resides in countries where higher fertility and mortality rates combine to keep premature kin losses tragically common. In several low-income countries, upwards of one-third of young people have had a sibling die (Smith-Greenaway and Weitzman 2020) and upwards of one-half of mothers have lost a child (Smith-Greenaway and Trinitapoli 2020; Smith-Greenaway et al. 2021). Even in these settings, however, much of the bereavement that the surviving population has experienced is the result of the higher mortality conditions in recent years.

Efforts to measure and study kin loss may inform theory on the long lags between mortality change and responses to it (Smith-Greenaway and Trinitapoli 2020; Denton and Spencer 2021). Even with the ushering in of low annualized mortality rates, if a large percentage of the population has personally experienced higher mortality conditions, this raises questions of the implications of this for future demographic trends and population wellbeing. These potentials have led to questions of what shifts in kin loss mean for societal consequences: does the memory of losing relatives work to keep fertility high (Smith-Greenaway and Lungu 2021)? Do the high levels of parental bereavement explain poor mental health outcomes in highly burdened populations (Smith-Greenaway et al. 2021)? Greater efforts to systematically capture the 'bereavement burden' (Verdery et al. 2020) in a population will be a fruitful area of inquiry for scholars to better theorize the relevance of kin loss to other population processes.

Another area ripe for investigation is cross-national studies of the consequences of kin loss for those who have endured it. A growing literature has used survey and registry data to demonstrate the implications of kin loss; however, a meta-inequality is apparent in this work: most evidence comes from studies of populations in the world's lowest-mortality enclaves (see discussion in Smith-Greenaway et al. 2021). The degree to which a surviving population has endured a type of kin loss could color the implications of such a loss for the individuals who endure it (Scheper-Hughes 2009). That is, there has long been suspicion that the extent to which the death of kin is 'normative' (i.e. it follows a regular schedule) could inform bereaved individuals' reactions to loss. It is also possible that the sheer absence of kin loss leaves many in low-mortality enclaves especially ill-prepared to navigate them when they invariably occur (Umberson 2009). What is the risk of outsurviving younger kin and how does it vary over time and place? How is the lifetime risk of widowhood, and average time spent widowed, changing? Efforts to export insights from kinship studies to study bereavement will offer new insights into an understudied source of social inequality. It has recently become possible to incorporate the deaths of kin, and their distributions over the age of a focal individual and the ages of the kin, into formal kinship models (Caswell 2019). Linking these projections to empirical studies of bereavement will provide an important link to the factors determining this process.

The still-rising number of individuals bereaved by COVID-19 (Verdery et al. 2020; Kidman et al. 2021; Snyder et al. 2022) also raises questions of the particular consequences of enduring kin deaths in the midst of a crisis. Given the disruption to daily life, inability to memorialize the deceased, and confluence of social stressors, there is reason to suspect that the loss of kin ties during periods of crisis could have particularly adverse effects for affected individuals. More research analyzing the unique consequences of disaster-induced kin loss is needed.

Mortality shocks aside, reductions in mortality and fertility will invariably lead to convergence toward lower levels of kin loss and a concentration of normative losses. Just as there has been convergence in the key demographic drivers of kin loss, the experience of kin loss itself will become more orderly (Alburez-Gutierrez, Kolk, and Zagheni 2021), with more tightly scripted chronological losses becoming the global norm. Even so, within demographic regimes, social disparities are likely to pattern the concentration of these experiences—demonstrating another axis of kinship inequality. A growing scholarship has outlined the disparate likelihood of experiencing mortality among racial groups in the United States (Umberson 2017; Umberson et al. 2017). More research is needed to characterize inequalities in the exposure to kin death in an international perspective.

The Role of Kinship in Social Stratification

The transmission of social inequality across generations is the central topic of social stratification (Blau and Duncan 1967; Featherman and Hauser 1978). Trends and patterns in intergenerational status associations shed light on the degrees of equality, opportunity, and mobility in a society (Erikson and Goldthorpe 1992; Hout and DiPrete 2006). Traditional studies on social stratification rely on a two-generation, top-down approach, focusing on the influence of parents on offspring's socioeconomic attainment and demographic outcomes (reviewed in, e.g., Ganzeboom, Treiman, and Ultee (1991; Treiman and Ganzeboom 2000; Van Leeuwen and Maas 2010)). If social mobility is *Markovian* (or a first-order autoregressive process), an investigation of the two-generation mobility would suffice to explain mobility over multiple generations (Bartholomew 1967; Boudon 1973; Duncan 1966; Hodge 1966). Markovian in this context, indicates a simplified theoretical model in which each generation only directly influences the immediately following generation, without skipped-generation influences or indirect influences via collateral kin. This assumption dictates that all multigenerational relationships, including those with grandparents, great-grandparents, remote ancestors, and a broader network of kin, amount to a sum of relationships between each pair of adjacent generations.

In his presidential address to the Population Association of America, Mare (2011) urged demographers to go beyond the two-generation paradigm and incorporate multigenerational kinship relations into the study of social stratification. The processes described above, increasing longevity, declining fertility, and the growing complexity of family structures, imply that individuals now spend more years of shared lives with their kin and rely on grandparents and other kin to take on parent-like roles (Bengtson 2001; Cherlin and Furstenberg Jr 1986; Seltzer 2019; Uhlenberg 1996, 2009; Watkins, Menken, and Bongaarts 1987). These demographic changes may have important implications for kin availability and inequality, leading to a greater disparity in family resources between children with and without long-lived, closely related, and mutually supporting kin.

Studies on social stratification have begun to ask whether family members other than parents may supplement or replace the influences of parents and reinforce the persistence of socioeconomic status across generations. Second- or higher-order Markov chain processes like these are typically referred to as *non-Markovian* in the social mobility literature. Existing empirical evidence that has predominantly focused on grandparent effects, however, is far from conclusive. A large body of literature has documented sizable influences of grandparents on grandchildren's education, income, occupational status, and wealth net of parents' effects, drawing on large-scale surveys or linked administrative data from the US (Long and Ferrie 2018; Pfeffer and Killewald 2018; Song 2016; Wightman and Danziger 2014), the UK (Chan and Boliver 2013), Sweden (Adermon, Lindahl, and Waldenström 2018; Hällsten and Pfeffer 2017; Hällsten and Kolk 2020), Germany (Braun and Stuhler 2018; Hertel and Groh-Samberg 2014), Netherlands (Knigge 2016), China (Zeng and Xie 2014), Taiwan (Chiang and Park 2015), and South Korea (Park and Kim 2019). Some studies have also shown null findings of grandparent effects in Finland (Erola and Moisio 2007), the Netherlands (Bol and Kalmijn 2016), and the United States (Cherlin and Furstenberg Jr 1986; Fiel 2019; Jæger 2012; Warren and Hauser 1997) or spurious effects due to measurement errors (Ferrie, Massey, and Rothbaum 2021) and omitted variable bias from unobserved characteristics of parents (Engzell, Mood, and Jonsson 2020; Solon 2018). Anderson et al. (2018) provided a systematic review of grandparents' effects on educational attainment. Their meta-analysis suggests that the Markovian theory of social mobility may be temporally- and context-specific. Grandparents influences appear to be stronger in East Asian populations than in Europe or the United States, especially before the societal transition from agricultural to industrial economy and the expansion of mass education in the 20th century (Campbell and Lee 2011; Dong and Lee 2014; Mare and Song 2014; Song, Campbell, and Lee 2015). These multigenerational influences are particularly significant when grandparents co-reside with their grandchildren, are highly involved in raising their grandchildren, and are compensating for poor parental resources (Kreidl and Hubatkova (2014; Zeng and Xie 2014); but also see Daw, Gaddis, and Morse (2020)).

Less attention has been given to the influences of siblings, cousins, uncles, aunts, great-grandparents, and remote ancestors (Erola et al. 2018; Hällsten 2014; Hällsten and Kolk 2020; Jæger 2012; Knigge 2016; Mare and Song 2014; Prix and Pfeffer 2017) or influences of stepparents, parents-in-law, stepchildren, and step-relatives on individuals' socioeconomic attainment and demographic behaviors (Park, Wiemers, and Seltzer 2019; Seltzer, Yahirun, and Bianchi 2013). In addition, the multigenerational influences of kin may not be as simplistic as suggested by models that emphasize top-down influences on adjacent generations. The influences may be mutual, reciprocal, and long-lasting. For example, parents' investments influence their offspring's education, which would yield significant returns for themselves in later life, such as lower mortality risks (Yahirun, Sheehan, and Hayward 2016). However, due to the lack of data that go beyond nuclear families, our understanding of social inequality through the linked lives of extended family members remains limited.

From a demographic perspective, families are linked across generations not only by their social status but also by their demographic outcomes. Socioeconomic characteristics of grandparents may impact their own and their children's decisions surrounding marriage and childbearing, potentially affecting opportunities for upward social mobility (Breen 2018; Lawrence and Breen 2016; Maralani 2013; Mare and Maralani 2006; Song and Mare 2015). In other words, mobility analyses should not focus exclusively on the association between parents and their offspring, conditional on the existence of the offspring, but should also consider the process of how the offspring come into existence as part of parents' effect on their children. More broadly speaking, inequality between families exists not only in the multigenerational transmission of social status but also in their differentials in timing and levels of reproduction, namely, inequality among families who have (many) offspring or kin and those who have none or few kin.

This demographic view of mobility, albeit deeply rooted in the literature (Matras 1961, 1967), has been largely overlooked by major studies on social mobility (see exceptions in Lam 1986; Mare 1997; Preston and Campbell 1993) but has proliferated in recent years

(Breen and Ermisch 2017; Lawrence and Breen 2016; Maralani 2013; Mare and Maralani 2006). Song (2021) illustrates different methods that incorporate families' demographic behaviors into the study of multigenerational social mobility and proposes a joint model of mobility and demography that shows the long-term dynamics of kin and population processes. Breen (2018) addresses the problem of causal inference in estimating the demographic effects of grandparents and other kin types in social mobility. This demographic approach shows the extent to which population processes may amplify or reduce the effects of socioeconomic positions because of the interaction between social differentials in mobility and demographic behaviors among kin.

Advancements in Data and Methods

Our growing understanding of kinship, demography, and inequality has been fueled by an explosion in data and methods. Studies in the demography of kinship have long been limited by their reliance on household surveys (Madhavan et al. 2017). Commonly used surveys like the Demographic and Health Surveys, the Gender and Generations Survey, the International Social Survey Programme, the Panel Study of Income Dynamics, and the China Family Panel Study have recorded some household-level ego-centric kinship data (e.g., siblings and children). The lack of individual-level kinship data extending beyond the household[2] has motivated the development of formal demographic methods to characterize kinship structure based on aggregate demographic rates. Goodman, Keyfitz, and Pullum (1974), for example, showed how to compute average kin frequencies for any population for which demographic rates are known, an approach recently extended by Caswell (2019). In the 1980s, the development of microsimulation techniques facilitated the exploration of kin networks as a function of various demographic inputs (Hammel et al. 1976). These model-based approaches have been useful for conceptualizing kinship dynamics in the absence of extended kinship microdata. However, contemporary researchers have access to a far wider array of data sources and methodological approaches to studying kinship, many of which originated outside the field of demography. We now summarize these in detail.

Population-Level Administrative Data

Administrative data, stemming from contemporary and historical sources, have become increasingly available to social scientists over the last two decades. Registry data, long available in many northwestern European countries, are now accessible in countries like the U.S., UK, and Germany (Connelly et al. 2016; United Nations 2007; Song and Coleman 2021).

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[2] With notable exceptions like the 2013 wave of the Panel Study of Income Dynamics, which includes information on members of the respondents' (co-resident and non-co-resident) extended family (Schoeni et al. 2015).

High-quality registry data on pre-industrial populations (e.g., Song, Campbell, and Lee 2015) have also been digitized and released for several East Asian countries, including Japan, Taiwan, and Korea (see Dong et al. 2015). Japanese colonial administration records in both Korea and Taiwan in the first half of the 20th century constitute perhaps the highest quality data on kinship and household structure anywhere in the world for that time period (Dong et al. 2015; Li et al. 2020). These sources constitute an important resource to study household dynamics and kinship inequalities outside Europe and North America.

The increasing availability of registry data has been accompanied by a concerted effort to bridge the gap between data on contemporary and historical (i.e., that before the mid-20th century) populations. Linking these data sources can substantially expand the temporal and generational coverage of the data (Kolk 2014). Longer and uninterrupted time-frames make it possible to identify more distant kin, like grandparents and cousins (Kolk et al. 2021). For example, researchers have created high-quality linkages between (historical) parish registers and contemporary registry data for Sweden (Westberg, Engberg, and Edvinsson 2016), Norway (Thorvaldsen and Østrem 2018), Utah (Smith and Mineau 2021), the Netherlands (Mandemakers and Kok 2020), and Finland (Nenko et al. 2021) in recent years. These developments may help better integrate the subfield of historical demography into mainstream demography (Ruggles 2012). They will shed light on the implications of long-term trends in kinship inequalities for life outcomes in contemporary populations (e.g., Hällsten and Kolk 2020).

Advances in census and vital record linkage provide unprecedented opportunities for researchers to expand the geographic scope of kinship demography. The digitization of historical records and the development of matching algorithms have increased the availability of linked census data from around the world (Abramitzky, Mill, and Pérez 2020; Abramitzky et al. 2021; Ruggles, Fitch, and Roberts 2018). While cross-sectional census data can provide a wealth of demographic data on kinship within the household (Ruggles and Brower 2003), linked censuses provide a unique opportunity to study longitudinal (and multigenerational) life course family dynamics (Ruggles, Fitch, and Roberts 2018; Helgertz et al. 2022; Song et al. 2020). Data sources that include high-quality linkages for women, ethnic minorities, and migrants, who have been historically excluded from these sources, are particularly valuable (Collins and Wanamaker 2014; Maloney 2001; Bailey et al. 2022). New sources of linked administrative data are likely to expand the number of countries in which kinship inequalities can be studied. These new data resources will facilitate ground-breaking research on family and kinship.

Large-Scale Non-Administrative Data

A complementary and promising data source are online user-generated genealogies. These large-scale genealogical databases have grown out of the digitization of historical data and the development of 'direct-to-consumer' genetic testing. Crowdsourced genealogies—such as Ancestry, FamilySearch, FindMyPast, MyHeritage, Geni, and Wikitree—are produced by a decentralized network of genealogists and constitute large-scale repositories of demographic and kinship information (Lussier and Keinan 2018; Price et al. 2021). Genealogical linkage has allowed researchers to construct longitudinal and multigenerational samples (Helgertz et al. 2022) and to increase the number of variables and generations available in linked census data (Lleras-Muney, Price, and Yue 2020; Price et al. 2021).

FamiLinx is a good example of this. This database, extracted from Geni.com and curated by a team of geneticists and computer scientists, is one of the largest internet-based crowdsourced genealogical databases (Kaplanis et al. 2018). The FamiLinx database contains demographic and kinship information, often geolocated, for 43 million individuals from a range of countries, although mainly in Europe and North America. This emerging data source offers plenty of challenges and opportunities (Embley et al. 2017).

Genealogy websites provide users with multiple resources to increase the number and accuracy of the family ties they can identify. Users can improve the accuracy of the genealogical records by including information on direct-to-consumer DNA test results and digitized historical records (e.g., census records, birth, death, and marriage certificates, and military service records). Genealogy companies have teamed up with demographic data providers like IPUMS to transcribe, digitize, and process historical records (Fitch et al. 2018). Nevertheless, crowdsourced genealogies, like other types of digital data, are not representative samples of larger populations and should be analyzed with caution (Stelter and Alburez-Gutierrez 2022). There have been few efforts to develop methodologies to assess and address this bias, even though demographers are uniquely positioned to correct the assumption that genealogical data can be taken at face-value (Chong et al. 2022).

Despite their limitations, genealogies can provide unprecedented insights into the evolution of demographic traits and kinship inequalities across time. The transnational nature of the data, with kin ties extending over multiple countries, opens up the opportunity to study the evolution of kin networks across national borders and over multiple generations. Genealogies can produced valuable insights into processes of intergenerational transmission, migration, and longevity (Lleras-Muney, Price, and Yue 2020). Furthermore, genetic-informed kinship data can improve our understanding of the role of genetics in shaping behavioral traits and the complex mechanisms that underlie the processes of human heritability.

Matrix Kinship Models

Matrix kinship models are a promising new area of mathematical demography. These models reflect the fact that the kinship network surrounding a focal individual (we will refer to her as Focal) reflects the mortality, fertility, and stage transition rates within the population. Goodman, Keyfitz, and Pullum (1974) showed how to calculate the numbers of each type of kin by integrating over all the pathways by which an individual could accumulate kin. The recursive Goodman, Keyfitz, and Pullum (1974) approach has recently been superseded by a matrix approach that provides a more easily programmed calculation that produces more comprehensive results. The key to the approach is to treat each type of kin of Focal as a population, and to project this population from one age of Focal to the next using matrix algebra (Caswell 2019). Matrix formulations of population projection have a venerable history in demography, starting with Keyfitz (1964). Turning their power to the analysis of kinship opens a wide range of hitherto inaccessible questions to investigation. This new approach is easily implemented, flexible in its data requirements, and requires no simulations.

To give an idea of the approach, define $\mathbf{k}(x)$ as a vector containing the age structure of some type of kin at age x of Focal. How does this age structure evolve as Focal ages? Individuals survive and age, and new kin arrive (possibly) from somewhere. Let $\mathbf{U}$ be a matrix with age-specific survival probabilities on the subdiagonal, and $\mathbf{F}$ a matrix with age-specific fertilities on the first row and zeros elsewhere. Then the dynamics of $\mathbf{k}(x)$are given by

$$\mathbf{k}(x+1) = \mathbf{U}\,\mathbf{k}(x) + \begin{cases} \mathbf{0} \\ \mathbf{F}\,\mathbf{k}^{*}(x) \end{cases} \tag{1}$$

The first term in the model accounts for the aging and survival of the kin over one year. The second term accounts for the arrival of new individuals. For some types of kin, no new individuals are possible and the second term is zero (e.g., Focal does not accumulate any new mothers). For other types of kin, new individuals are produced by the fertility of other types of kin (e.g., new granddaughters are produced by the fertility of daughters). An initial condition is added to specify the kin that Focal has at her birth (e.g., Focal has no daughters at birth, but may have older sisters, etc.).

Caswell (2019) introduced the model and showed how to calculate other aspects of the kin network, including the experience of the death of any kind of kin at any age and the age-specific prevalence of disease. A comparison of the rates in Japan in 1947 and 2014 shows striking differences in the expected experience of bereavement and of disease (Alzheimer's was used as an example of a strongly age-dependant condition).

Age is not the only variable determining the dynamics of kin. Caswell (2020) generalized the model to include factors other than age (e.g., parity) as additional dimensions. Perhaps surprisingly, the expressions for kin dynamics retain the same form, with the vectors and matrices now including blocks representing age-by-stage combinations. An analysis of parity dynamics documented dramatic differences in the expected parity and sibship size structure of the kinship network of Slovakia over a period of about fifty years.

As has been the case from the earliest formal kinship models (e.g., Goodman, Keyfitz, and Pullum 1974), and indeed from the use of period mortality rates as describing synthetic cohorts, these analyses facilitate exploration of hypothetical dynamics under scenarios of constant demographic rates. Caswell and Song (2021) extended the model to incorporate time-varying patterns in the demographic rates, obtaining kinship versions of cohort, period, and age-specific results. Once again, the model retains its mathematical form, except that the survival and fertility matrices **U** and **F** vary over time. See Song and Caswell (2022) for an application to exposure to unemployment. All of these analyses are restricted to female kin of a female Focal through matrilineal descent. Caswell (2022) has developed the two-sex version of the model, projecting the full kinship network including both sexes and all possible lines of descent. The model retains its basic mathematical form, with block-structured vectors and matrices accounting for age and sex.

The growing diversity of data sources and methods will make formal demography increasingly essential for the study of kinship. As in all other areas of demography, formal models provide the structure within which empirical studies make sense. They can also provide new questions not accessible before. Future studies can use the toolbox of formal demography to study same-sex couples, families of gender minorities, adopted and step kin, polygamy, and other common but understudied family configurations (Furstenberg et al. 2020).

Kinship Microsimulation

Reflecting on his life's work, the pioneering mathematical demographer Nathan Keyfitz (2004, p. 114) wrote that "there were plenty of formulas in my assembly, but abstract formulas is what they could well have remained [...] what saved my hard work from this fate was the advent of the computer.'' The exponential increase in computational power over the last several decades has enabled a seamless translation of mathematical concepts for the study of kinship dynamics into detailed calculations, reconstructions, and projections (Zagheni 2015). This has provided fertile ground for the development of microsimulation models, also known as individual-based simulations, that complement formal methods for the study of kinship, enhancing their predictive power. In demographic simulations, members of an initial population are exposed to a series of transition rates (e.g., mortality, fertility, and marriage rates). These rates determine the probability that a given individual in the simulation will experience death, childbirth, marriage, or any other event, over a defined period of time. The simulation produces a synthetic population that resembles the population from which the input rates originated and which has a realistic genealogical structure, making it possible to evaluate inter-generational and other kin-dependent processes (Wachter 1997, 1998).

The study of kinship structure is one of the most successful applications of microsimulation models in demographic research. Microsimulations are especially useful when individual histories or interaction between individuals are relevant or when processes that are complex at the macro level are easily understood at the micro level. Consider the case of marriage markets in the context of complex patterns of union formation and dissolution. Simulation-based work has shown that relatively simple mate-search rules that adjust on the basis of sequential encounters with potential partners are sufficient to replicate observed regularities in the distribution of the age at first marriage (Todd, Billari, and Simão 2005; Billari et al. 2007).

Microsimulations are also useful for analyzing heterogeneity or in cases where the number of variables and the number of attributes that these variables can take is very large (Van Imhoff and Post 1998; Spielauer 2011). The heterogeneity of kinship networks can be easily observed from simulated population microdata. In contrast, analytical kinship studies account for heterogeneity by including it as age- and stage-dependent parameters in more complex multistate models (e.g., Caswell 2020). Similarly, individual-level models allow researchers to simulate individual interactions between kin and family members. These interactions are clearly important for the demography of kinship, but they are difficult to model formally, because interaction among individuals violates one of the requirements of formal population theory (Metz and Diekmann 1986; Caswell and John 1992; Caswell 2001).

While microsimulation is a powerful tool to gain insights into kinship dynamics, the accuracy of simulation-based models depends on the availability of high-quality and detailed input data. In addition, the high-dimensional space of inputs and outputs, including the statistical relationships within sets of inputs and outputs, makes calibration computationally intensive. In some cases, the model complexity makes it difficult to interpret the results, limiting the model's usefulness for answering substantive questions. These limitations have constrained a broader adoption of microsimulation models in the past, and have reduced the ability of scientists to fully model relationships between demographic events (Ruggles 1993).

We anticipate that the three trends outlined in this section will significantly accelerate the use and impact of microsimulation for understanding the demography of kinship, increasing the availability of micro-level synthetic populations. First, large-scale data from surveys, administrative, and digitized sources are increasingly available to researchers. These can be used to parameterize increasingly complex microsimulations. Second, methodological advances are paving the way for simulation-based estimates with lower uncertainty. The new approaches described in Section 'Matrix Kinship Models', for example, provide a benchmark for assessing the validity of simulation models that do not include complex interactions or that rely on simple rules regarding marriage markets and the heterogeneity of behaviors and choices. Similarly, advances in calibration methods (Ševčíková, Raftery, and Waddell 2007) will allow demographers to place simulations within solid statistical frameworks. Third, the increasing availability of inexpensive computational power has enabled the deployment of large-scale simulation models and made possible complex calibration processes in high-dimensional spaces. Rapid developments in general-purpose software environments, such as R and Python, have facilitated the construction of microsimulations and subsequent statistical analyses. Computers may, once again 'save the hard work' of mathematical and statistical demographers, projecting the study of kinship toward a bright future.

Discussion

We have argued that demographers are uniquely qualified to study kinship structure (the availability of kinship resources) and kinship inequalities (the degree to which differential kinship structures affect individuals and societies). We outlined key developments related to the study of kin supply, kin loss, and kin-based social stratification in the context of slow and fast demographic and social change. The studies we reviewed ask new questions, but they are also firmly grounded in a sociological tradition studying families and the developmental contexts that they produce for individuals (Alwin 2012; Elder 1998, 1994). We also summarized some of the methodological advances and novel data sources that can support the interest in kinship inequalities.

We now outline an agenda to further the study of kinship dynamics and kinship inequalities in demography. For this, we distinguish four areas of inquiry: *description*, *explanation*, *explication*, and *ramification*. We consider each of these in more detail (see also Figure 2).

Future studies focusing on *description* can build on existing work to document changes in the availability of kin by age and socio-economic groups. The demography of grandparents and great grandparents is an especially promising avenue of research in this respect, but siblings and aunts or uncles also deserve more attention. Similarly, we need more work to describe how migration affects kin connections both locally and transnationally. The COVID-19 pandemic has underlined the need to generate summary measures that explicitly quantify mortality conditions from the perspective of bereaved kin. More work is needed to characterize the lived experience of kin death from a demographic perspective. Lastly, the growing availability of longitudinal data sources will allow researchers to determine the degree to which demographic behaviors—including patterns of fertility, mortality, assortative mating, and living arrangements—are correlated across generations and modify the multigenerational transmission of social status.

We use *explanation* to refer to studies of how demography and individual behavior jointly shape kinship structures, kinship change, and kinship inequalities. Scholars interested in explanation could study the implications of increasing family complexity for the availability of kin and generational overlap. Why are families becoming more complex? How do behavioral and demographic changes affect kinship dynamics and what will kinship structures look like in the future? Have families become more geographically sparse as a result of migration but better connected thanks to the increasing digitalization of life? What is the role of kinship for the perpetuation of social stratification over generations and within families? In order to answer these questions, kinship demography must go beyond a narrow focus on biological relatedness to encompass the many ways in which individuals experience kinship (Schneider 1984). This includes devoting more attention to lesser studied kinship configurations, such as families of gender minorities (Kolk and Andersson 2020; Reczek 2020), complex families and step-relationships (Furstenberg et al. 2020; Smith-Greenaway and Trinitapoli 2014; Yahirun, Park, and Seltzer 2018), multi-partner fertility (Thomson et al. 2014; Andersson 2021), and transnational migrant families (Bryceson 2019).

Explication is a term borrowed from literary studies, where it describes the process of careful and deep examination of a text. Both the data and models used in kinship demography warrant such close examination. Demographic data are never given raw. Decisions are involved in every step, about the representativeness of samples, the accuracy of measurements, the wording of surveys, the comparability of data collection protocols across times and space, and more. The implications of all of these decisions warrant close inspection. Similarly, decisions are involved in the construction and analysis of models and theories of kinship. These decisions are sometimes referred to as assumptions, but they are not. Keyfitz (1972) distinguished the act of 'projection' from the act of 'prediction' in demography. The latter produces statements about what will happen. The former produces statements of what would happen if certain hypotheses were to hold. Essentially all of formal demography produces projections, in this sense, of the consequences of certain conditions. They do not assert that those conditions actually occur. Goodman, Keyfitz, and Pullum (1974) emphasized that there is no reason to expect that the results of a calculation of kin numbers implied by a set of rates will agree with a census of kin numbers in some population, because the actual population is potentially influenced by a host of factors not included in the formal model (see also Keyfitz and Caswell (2005)). Careful explication of data and models will be a critical future development, especially when scholars use models to characterize real-world kinship inequalities (e.g., Smith-Greenaway et al. 2021; Verdery et al. 2020; Song and Caswell 2022). We encourage researchers to use emerging kinship microdata to explore the implications of inferring and projecting kinship structures from demographic models.

There are plenty of opportunities for scholars interested in the *ramifications*, or effects, of kinship inequalities for individuals, families, and populations. The degree to which population aging and the associated changes in kinship structures will disrupt the intergenerational transfer of resources remains an open question. This is especially pressing in the context of strongly age-dependent health conditions, including the growing levels of dementia and loneliness among older people, the consequences of which are not yet fully understood. We also need more comparative work to understand how the legacy of past demographic rates affect contemporary populations. How does differential exposure to mortality affect bereaved individuals and how can resources be mobilized to support them? Changes in kinship structure also matter for societies at large. The partial end of China's 'one child policy,' for example, is likely to affect the composition of kin for current and future generations, significantly altering the landscape of intergenerational relationships. Efforts to quantify the economic burden it places on working-age individuals and those providing institutional support for older adults and young children are needed.

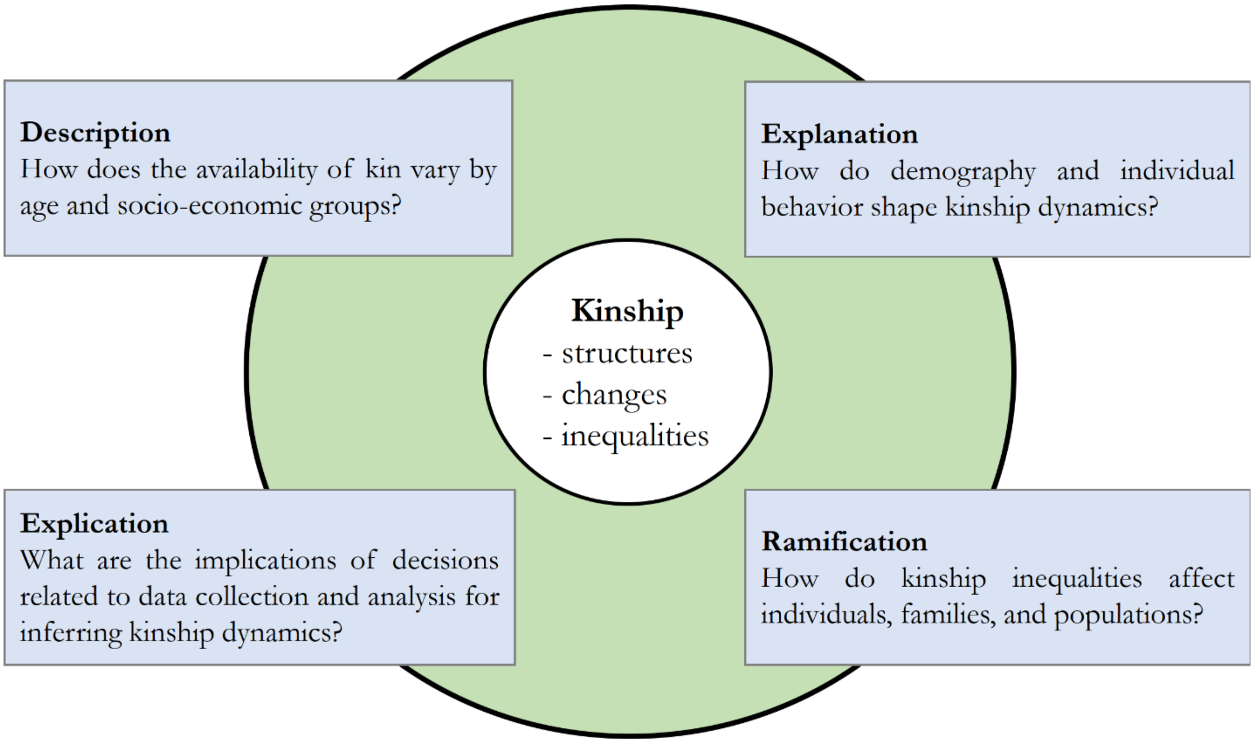

Figure 2. Graphical summary of the four areas of inquiry in the demography of kinship.

Kinship demography will continue to thrive on the increasing availability of microdata on kin ties beyond the household. We welcome ongoing efforts to digitize historical records with a kinship dimension, especially outside the well-known population registers of northern Europe. Digital data, either from crowdsourced genealogies or collected via bespoke online surveys, may yet revolutionize the demographic study of kinship. These emerging data sources are unlikely to replace the existing ones. Rather, their potential lies in the degree to which they can be articulated, and potentially linked, with established sources of demographic data. Sustained data collection efforts with a multigenerational component will continue to be essential for conceptualizing and understanding kinship inequalities.

Demographic changes—large and small, slow and fast—are projected to shift kinship configurations profoundly in years to come. These changes arise against the backdrop of increasing complexity in the structure and geographic distribution of family worldwide. A demography of kinship, including a strong focus on kinship dynamics, will be key for explaining and predicting these trends. We outlined the type of research needed to characterize these processes and to understand their implications for individuals, families, and societies. The list, far from exhaustive, is meant as a 'roadmap' to help consolidate recent developments and provide directions for future studies. With more data and analytical tools available than ever before, the stage is set for demographers to take the lead in the study of kinship structures, kinship changes, and kinship inequalities.

Author Contributions

D.A-G. and E.Z. conceptualized the study. All authors contributed to writing the text and provided feedback on all sections of the article, with particularly extensive comments from A.V., E.S.-G. and R.M., and key suggestions for framing the article from E.Z., A.V., and M.K. Lastly, D.A-G. consolidated the text, created the diagrams, and prepared the final version of the manuscript. The author list is alphabetical.

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