PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

Kinship resources for the elderly

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SUMMARY

As population ageing strains social insurance systems, cohorts whose own fertility was low will be reaching elderly status, leaving close biological kin in short supply. However, there is a countervailing trend, inasmuch as burgeoning divorce, remarriage and family blending have expanded the numbers and varieties of step-kin and other non-standard kinship ties. Methods of computer microsimulation in conjunction with richer sample surveys can help us to foresee the contours of kin numbers and kinship relations in the future. Prime areas include the likely frequency of kin-deprived elderly, the overlap with economic deprivation and the interaction between kin frequency and intensity of contact. Step-ties may be weaker but nonetheless critical in raising the probability of at least one compatible member with whom one can choose to maintain contact and rely on. Kinship networks extended through half- and step-links, by stretching across racial and economic lines, may promote social cohesion.

1. INTRODUCTION

As population ageing strains the social insurance systems of Britain, America, and other nations, increasing reliance on family and kin is one possible adaptive response. The period of greatest anticipated fiscal strain around 2030 is also the period when cohorts whose own fertility was low will be reaching elderly status. By historical standards, close biological kin will be in short supply. However, divorce, remarriage and family blending are expanding the numbers and types of step-kin, endowing the elderly of the future with kinship networks at once problematic, rich and varied.

Students of ageing are only beginning to gain scientific knowledge that will help to predict the evolving contours of kinship. A strong methodological base exists for future research, including methods of computer microsimulation and family-status lifetables for projections of numbers and types of kin, along with cross-sectional and longitudinal sample survey designs for eliciting and tracing kinship roles.

This paper presents a sampling of numerical predictions for US seniors chosen to illustrate the power of demographic simulation to shed light on different aspects of ageing and kinship. The predictions derive from computer modelling carried out using the SOCSIM demographic microsimulation program at the University of California, Berkeley, with support from the US National Institute on Aging. The second section presents and discusses the predictions. The third section outlines the technical methods and assumptions, and the scope for refinements and extensions. The fourth section takes up broader issues of ageing and kinship on which future research should be able to shed light.

The research to be described has its roots in joint work with the ESRC Cambridge Group for the History of Population and Social Structure going back to 1970. Peter Laslett at Cambridge and Eugene Hammel at Berkeley have been central contributors. Laura Hill is a collaborator in current work. The present paper is restricted to the United States, but parallel estimates for British populations are being developed by Michael Murphy of the London School of Economics in collaboration with the ESRC Cambridge Group, and continental European and Japanese comparative research efforts are in the planning stage.

Computer simulation, working from historical series of vital rates or from statistically linked multiple files, is required for contemporary estimates of kinship numbers as well as for predictions into the future, because national surveys must put limits on the number of questions devoted to numbers and ages of the large variety of kin that there may be. In this case, the demographic history of the US white population has been reconstructed from 1900 up to the 1990s and then predicted onwards to 2030. Outcomes up to the 1990s have been tested against such restricted survey estimates as are available.

2. KIN OF THE ELDERLY TO 2030

Since this paper aims to provide a sampling of different types of results and estimates, detail and disaggregation are necessarily limited. Five topics have been chosen to indicate the wide-ranging potential of microsimulation methods to contribute to studies of ageing. The simulations are the same in structure as those documented in greater detail in Wachter (1995), but the results drawn from them offered in this paper are new.

To conserve space, men and women have been combined in all graphs. Under the chosen assumptions, roughly 60% of the 70 to 85-year-old age group are women throughout the period. The results in figures 1 to 3 are averages over 40 independent stochastic realizations, and standard errors of estimation are in all cases less than 1% of the plotted values. Figures 4 and 5 are taken from a single realization, with standard errors of estimation of a few percentage points. The chief uncertainties are not due to random errors of estimation but to our uncertainties about the future course of demographic rates and especially of mortality rates at extreme ages, as discussed in Wachter (1995). The graphs given here are those pertaining to white and other-race Americans, other than African-Americans (abbreviated as 'white' in captions). Parallel estimates for African-Americans have been prepared by Hill & Wachter (1996).

A middle-of-the-road demographic scenario for the future is adopted for the forecasts presented here, in the spirit of Preston (1993). Continuing gradual improvements in mortality at older ages are assumed to lie ahead. Fertility is assumed to persist at current moderately low levels, with no abatement in the high levels of extra-marital fertility. The rates of divorce and remarriage which have levelled out over the last 15 years are assumed to remain stable into the next century. Immigrants up to 1990 are included, with immigrant and non-immigrant kin, but immigrants after 1990 are not included, due to the indeterminacy of future migration streams. More details about the demographic assumptions are given in section 3.

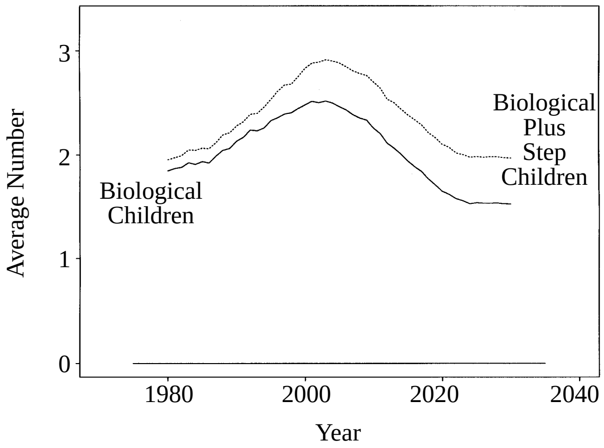

Figure 1. Living biological children and stepchildren, US whites aged 70–85. Outputs of Berkeley SOCSIM simulations, average of 40 replications.

(*a*) *Living children*

The most conspicuous trend in kinship for US elderly is shown in figure 1. The lines on the graph track predicted average numbers of children for 70 to 85-year-old US white men and women over time from 1980 to 2030. The solid line refers only to biological children, the dotted line to biological plus stepchildren. For these tabulations, a person is defined to be a child's step-parent if the person is the current or last spouse of a child's biological parent.

The first lesson from figure 1 is the sharpness of the anticipated rise and fall in average numbers of biological children. The age-group of younger-old, 70–85, is increasingly rich in biological children as time passes over the next few years, but after about 2005 we can expect it to have fewer and fewer biological children, with levels dropping well below those of the 1980s by 2030. This drop reflects the low fertility of members of the 'Baby Boom' generation, who themselves produced the 'Baby Lull' during their childbearing years, and who will be entering senior status at the end of the period.

The second lesson from figure 1 is the increasing numerical prominence of stepchildren, seen in the increasing separation between the upper solid and dotted lines. By 2030, the growth in numbers of stepchildren wholly compensates the net decline in average biological children after 1980.

Forecasts of the proportion of the elderly population without children, not shown in the figures here, suggest a muted increase after 2000. Stepchildren appear likely to have less impact in mitigating older-age childlessness than their average numbers might lead one to expect. The values calculated from the simulations for the early 1990s have been checked against estimates from the US National Survey of Families and Households (NSFH) in a validation study reported in Wachter *et al.* (1997) and they are in good agreement. Nonetheless, it may well be that the simulations overstate eventual childlessness by insufficiently allowing for the recent and continuing increases in childbearing at later ages and in later marriages now much discussed in the United States. As further fertility data become available, revisions will be considered. Even allowing for some modifications, it seems clear that by 2030 there will be a substantial fraction of the elderly population with neither living biological children nor living stepchildren. This phenomenon is a cause of concern, as citizens look forward toward a time when public sector transfers to the elderly are likely to diminish. In the face of incipient limitations on activities of daily living at older ages, aid and contact from children may be a main line of defence against dependency and institutionalization. A substantial portion of the population may be expected to lack recourse to children of their own. On the other hand, recent estimates by Manton *et al.* (1997) confirm a trend toward reduced limitations on activities of daily living at older ages, which may soften this component of need.

(*b*) *Living grandchildren*

Figure 2 shows the predicted patterns in average numbers of grandchildren for the same population and age group as figure 1. The solid line represents biological children of a person's biological children. The dotted line also includes stepchildren of a person's biological children, biological children of a person's

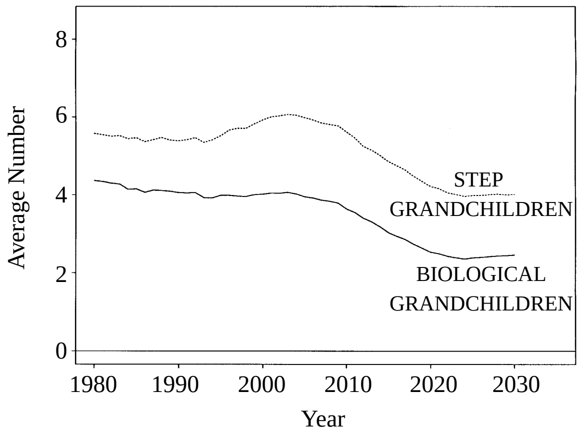

Figure 2. Living grandchildren, US whites aged 70–85. Outputs of Berkeley SOCSIM simulations, average of 40 replications.

stepchildren and stepchildren of a person's stepchildren. There is a kind of multiplier effect from the proliferation of stepchildren over two generations, and by 2030 grandchildren reckoned through some step-link represent more than one-third on average of all grandchildren. Broader definitions of step-hood are possible, which would increase the share of step-grandchildren even further. For example, children of previous spouses might well maintain some contact with grandparents even after successive remarriages of parents.

Step-grandchildren, as these estimates show, may be expected to make a strong contribution to the overall pool of younger relatives for the elderly of the future. Fifteen years ago, Riley (1983) called attention to possible positive side-effects of the traumas of widespread divorce, family break-up and remarriage, as they increase the pool of extended kin. It is not that there are more younger people per older person in the population, but that each person is connected to more members of the other generation, so that each person's pool from which to find compatible kin is enhanced. Whether contact is maintained across step-links may be expected to depend on many factors, including the investments that parents and grandparents make in their younger step-kin. Contemporary evidence on the strength of ties with step-kin and possible future trends are discussed in Wachter (1995). The subject is one aspect of the 'changing contract across generations'; Bengtson (1993) provides an overview and sets out a variety of negative and positive dimensions of the grandchild–grandparent link. The connectedness to a world of promise that grandchildren may bring to grandparents is plausibly to be seen as an important contributor to mental health and well-being. If one believes that step-kin will gradually step into more of the roles of biological kin as they become a larger part of the social landscape, then the numbers shown in figure 2 suggest an optimistic view.

(*c*) *Proportions without kin*

Kin of different kinds can substitute for each other. The presence or absence of one particular category of kin, like children or spouses, is never the whole story. The power of demographic microsimulation is most keenly to be appreciated in its ability to estimate the joint distribution of kin of several types. One illustration of the results that can be obtained is found in figure 3, which may be called a 'staircase plot'. The figure pertains to the age group of 70 to 85-year-olds in 2030. The top step on the left of the 'staircase' shows the proportion of people without a living spouse, around 60%. Those without either a living spouse or living biological children represent the next step, at around 30%. Adding stepchildren into the reckoning, in the next step, reduces the proportion of kin-deprived slightly. Adding siblings reduces it dramatically. Adding half-siblings reduces it slightly further, leaving only 4% without any one of these types of kin.

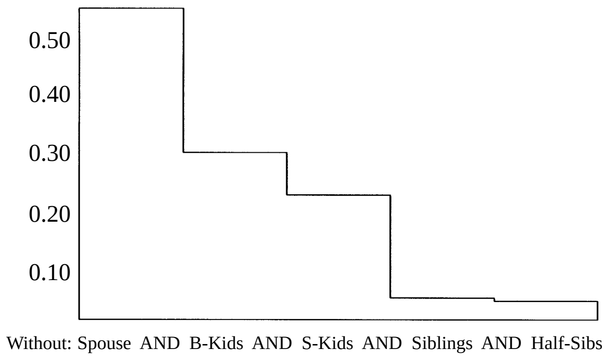

Figure 3. Joint proportions without kin, US whites in 2030 aged 70–85. Outputs of Berkeley SOCSIM simulations, average of 40 replications.

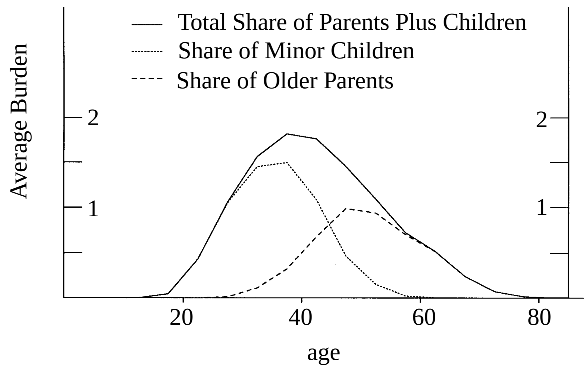

Figure 4. Simultaneous responsibility by age, US whites in 2030. Outputs of Berkeley SOCSIM simulations.

(*d*) *Simultaneous responsibility*

The graphs so far have displayed the kinship universe from the point of view of the older generation. From the point of view of the younger generation, there are generally a number of parents, step-parents, grandparents and others, among whom each younger person's attention is necessarily divided. The relationship between members of the older and younger generation is not one-to-one but many-to-many.

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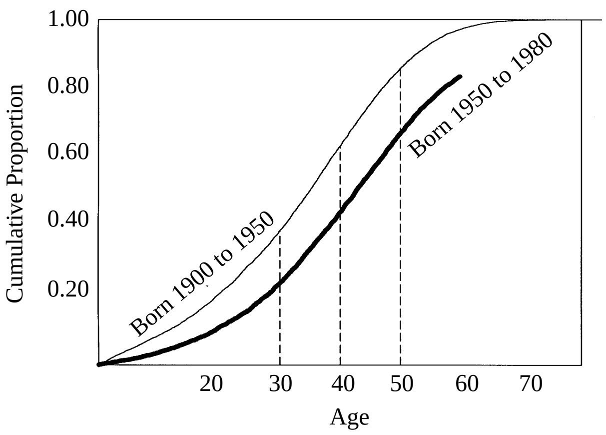

Figure 5. Age at first parent's death, US whites born 1900–1980. US whites up to 2030. Outputs of Berkeley SOCSIM simulations.

Figure 4 gives one of many possible ways to measure effects of this multiplicity. It pertains only to biological kin, but corresponding plots for step-kin are easily constructed. For figure 4, the responsibility for each living person over the age of 70 has been divided in equal shares among all that person's living children. The responsibility for each child under the age of 18 has been divided among the child's living parents. For each person, the credited shares of responsibility have been added up and the totals tallied as a function of age. In this reckoning, a couple would have the total responsibility obtained by adding the wife's and the husband's share on this plot.

The solid line in figure 4 shows the total index of responsibility by age in 2030. The dotted line shows the contribution from children and the dashed line the contribution from parents. The plot shows that the prominence of overlapping responsibility for young and old described by Hammel *et al.* (1981) for the year 2000 is still prominent in 2030. However, the decreasing levels of disability at older ages forecast by Manton *et al.* (1997), as already mentioned, may be expected to reduce the salience of the responsibilities measured in this graph. Refinements with weightings for disabilities and dependencies are feasible with future research and will be an improvement on this figure. One interesting feature that emerges even with this crude index is the prolonged responsibility for an older generation into old age, an outcome of the enhanced survival at older ages and the expansion of the population of the oldest-old.

(*e*) *Ages at parental death*

For our final example of the kinds of information yielded by kinship simulation, we turn to a life-course perspective. One effect of improving mortality at older ages is a shift in the timing of the experience of family loss. Figure 5 shows cumulative distributions of age at first parental death. The thin line pertains to individuals born between 1900 and 1950. The heavy line pertains to individuals born between 1950 and 1980. The horizontal axis represents age. To interpret the figure, note that by age 40, about 43% of the later birth cohorts had lost at least one parent (the height of the heavy curve over age 40) whereas 63% of the earlier birth cohorts had experienced the loss of a parent by this age. The heavy line ends before reaching the top because these cohorts go out of observation in 2030. It is remarkable to see that 35% of the younger birth cohorts are arriving at the age of 50 before living through parental death.

(*f*) *Summation*

The five graphs presented here illustrate the variety of perspectives that demographic microsimulation supplies on the kinship universe of the present and future. A range of other results may be found in Wachter (1995) and Hill *et al.* (1996). It is valuable to be able to view patterns both over time and in cross-section, to switch back and forth between the perspectives of older and younger generations, to identify subgroups deprived of multiple kinds of kin, and to track life-course experience for cohorts of individuals. No single sample survey can provide estimates from such a variety of perspectives. However, surveys are an essential concomitant of the simulation enterprise. They provide empirical data against which simulation estimates for current years can be validated, and they provide data on attitudes and current behaviours in the light of which the numerical results from simulations must be interpreted.

3. THE METHOD OF DEMOGRAPHIC MICROSIMULATION

The forecasts put forward here employ the method of demographic computer microsimulation as implemented in the SOCSIM simulation program. SOCSIM was originally developed for studies of demographic constraints on complex household formation in pre-industrial England reported in Wachter *et al.* (1978). Hammel *et al.* (1981) put it to use for the first forecasts of future kin counts to take historically changing vital rates into account. The program has been progressively refined, and it has been applied with US data by Reeves (1987) and with Chinese data by Hammel *et al.* (1991) and Lin (1994). Other approaches to kinship forecasting include stable population theory calculations initiated by Goodman *et al.* (1974), Family Status Life Tables developed and applied by Willikens *et al.* (1982), Bongaarts (1987) and Yi (1988), and multisurvey statistical matching developed by Goldstein (1996). Related recent treatments include Menken (1985), Smith (1987), Zhao (1994), Wolfson (1989), Bartlema (1989) and Wolf (1988). Overviews are found in Bongaarts *et al.* (1987) and Wolf (1994).

The basic idea behind microsimulation is to construct and update a simulacrum of a population register inside the computer. The imaginary individuals in the register are linked by ties of kinship and are assigned events of births, deaths, marriages, divorces and migrations at times determined by computer-generated random numbers compared with specified tables of demographic rates. In SOCSIM, individuals choose their marriage partners from among existing members of the computer population, making SOCSIM a 'closed model' and enabling kinship to be traced out to any desired degree through both husbands and wives. Records for individuals are created at their births and are retained after death, so that kinship relations at any point during the simulation can be computed after the end of the simulation.

The method and assumptions behind the simulations presented here are spelled out in Wachter (1995) and readers should consult that work for details. The computer population is designed so that each individual in the computer stands for 20 000 individuals in the US population as it evolves from 1900 through to 2030. African-Americans are treated in a separate simulation study; the computer population here is meant to represent the white and other-race US population. The native-born population is supplemented with immigrants up to 1990, and immigrants retain links to their foreign-born kin. Forty independent simulations forward from 1990 have been conducted, with different random numbers but the same demographic rates. In total more than half-a-million individual life-histories have been simulated to produce the estimates shown in the graphs.

Naturally, all predictions of the future are uncertain, and the uncertainties in future demographic rates introduce uncertainties into forecasts of kin. The problem of quantifying these uncertainties is beyond the scope of this paper, but parallel research is underway. In this research, uncertainties in the future course of mortality are incorporated directly into the randomness of the simulations, implementing and extending the stochastic mortality forecasts of Lee *et al.* (1992) developed further in Lee & Tuljapurkar (1997). The mortality forecasts are optimistic, contemplating continued improvements in mortality at older ages at unabating rates.

In the simulations, marital and non-marital fertility are separately parity-specific at each age, adjusted for gestation intervals, heterogeneous across individuals and correlated across generations, as advocated by Ruggles (1993), at levels based on data in Pullum & Wolf (1991). The algorithm for marriage choice is a mixed-dominant model based on target age differences. For remarriages, the choice of partners is not yet dependent on numbers of prior children, which is a limitation on the realism of the present estimates that should be remedied in future work.

The simulations, as we have said, run forward from 1900, not from 1997. They recreate an estimate of the kin-connected population of the present day, as well as forecasting it into the future. To do so required a painstaking process of collection and tuning of historical demographic rates from separate and generally uncertain and inconsistent sources, as discussed in Hammel *et al.* (1981) and Wachter (1995). The reason for this labour is fundamental to the method of kinship microsimulation. Modern national surveys do not include sufficiently extensive rosters of kin with ages to supply a contemporary kin-linked starting population directly. The methods adopted here offer a way out of this difficulty. Another way would be the use of statistical matching techniques to combine information on different segments of kin networks from multiple surveys, along lines recently pioneered by Goldstein (1996).

Although surveys like the US National Survey of Families and Households (NSFH) do not provide rich enough kinship information to obviate the need for historical reconstruction of networks, they do provide a number of estimates for the early 1990s against which estimates from simulations forward from 1900 can be compared. Wachter *et al.* (1997) conducted a validation study of simulation outcomes, comparing both earlier and current simulation-based predictions to several kin count averages and distributions estimated from the NSFH. This study indicates that the current simulations are able to recover information like the distribution of numbers of grandchildren to within the precision achieved by the NSFH itself.

The SOCSIM model includes many features and refinements aiming at relevant realism in the forecasting of kin. There remains, however, scope for important further developments. The computer programs accommodate demographic rates and marriage preferences disaggregated by socioeconomic categories such as education or income level. However, in order to exploit this capability, better ways must be found to estimate meaningful disaggregated demographic rates. The programs also allow transitions into and out of states of morbidity and disability, but again the estimation of required empirical rates remains a challenge for the future. Some of these developments should prove easier in national or regional settings other than the United States, and the creation of a range of comparative forecasts for British, Continental and Japanese populations promises to be the most immediate catalyst for better understanding.

4. ISSUES FOR THE FUTURE

The topic of kinship resources is much broader than ideas about caretaking and support. What is at stake are patterns of mutual contact, exchange, engagement and back-up, as well as care and support in times of challenge. Studies based on current surveys tend to show that patterns of contact across step-ties or ties involving broken families are much weaker than those across biological links. But today's patterns are being observed against the background of largely intact social insurance and community service systems in a period when the families of the majority of elderly have not been impacted by familial breakup. Today's patterns may therefore be a poor guide to the strength of incentives for maintaining and relying on kinship ties in the face of changing and more stringent circumstances.

Peter Laslett and others have traced the way that family, kin and collectivity have played off against each other in counterpoint over British history in terms of elderly support. Whatever adaptations do occur in the next several decades, they will not represent a return to some already familiar or mythical prior state, and some mix of personal and societal resources will continue to be involved.

Energetic research extending the pilot studies now available could give us much better knowledge about the likely frequency of kin-deprived people among the elderly of the future, and the coincidence of kinship deprivation with economic hardship. How does the availability of kin interact with the frequency and types of contact? Do those with more close kin—say, more grandparents and step-grandparents, or more grandchildren and step-grandchildren—tend to have more total contact and exchange, or do they tend to spread themselves thinner? Under what circumstances? How do these patterns differ by ethnicity and nationality within Britain? How do they compare across the European Union and beyond? It has been suggested that large numbers of structurally weak kinship ties are principally important in enhancing the probability that there is at least one compatible person whom one likes, values and can choose to have contact with. Future surveys could be tailored to scrutinize such patterns.

The prospect of the availability of census and other micro-data with suitable privacy protection on very large samples or whole populations holds out the prospect of studying the interaction between kinship contact and geographical mobility at meaningfully precise levels of geography. The role of new technologies in facilitating (or diluting) contact over physical and social distance will lend itself to study with appropriate survey instruments. Under what circumstances and with what preconditions is the computer enhancing intergenerational contact, rather than isolating generations further from each other? There is a wide field for creative survey research into newly emerging patterns of intergenerational relations.

The demographic changes in marriage, divorce, remarriage, cohabitation, shared custody and related processes have altered the chronological structuring of the life-course. They have created far greater heterogeneity in life experience. College gaudies now bring together members from the same year some of whom have children matriculating while others have newborns in their families. In terms of their life-course stages, friendship networks and psychological positions, siblings may find themselves belonging effectively to different generations. Computer simulation methods are well-adapted to tracing out the numerical prevalence of such combinations, and survey research is capable of probing their experiential dimensions. Such generational diversification may prove, serendipitously, to enhance the capacity of families to cope with crises of caretaking and disability as their oldest members reach old age.

The proliferation of step-ties and non-standard kinship networks also has implications, as yet largely unstudied, for the permeability of social barriers. As ties through ex-spouses, stepchildren, in-laws, half-siblings and others expand, the diversity of people with whom one has some formal kinship tie increases. Future research should be able to give us refined estimates of how many people now have or will come to have such extended families that stretch across racial lines or class barriers. Will these statistics be found to differ across groups or across countries in the European Union? Will they come to be an important component of social cohesion? What proportion of people will have had a victim of Alzheimer's or Parkinson's disease within their extended kinship universe? What proportion of young people will find themselves with opportunity within their family to know a person enjoying vigorous extreme age?

The tools of computer simulation and survey research put us in the position to delineate a richly varied social future before it is upon us. Kinship networks and resources are likely to be increasingly salient for tomorrow's elderly, as the resources of the state are strained. Although kin ties are problematic in many ways, having been shaped to a large extent by the social pathologies of broken and reformed families, they also hold out opportunities for adaptive transformations, which new research can characterize and enhance.

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