Between kith and kin: Network centered measures of kinship

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Abstract

Objective

This paper uses a novel, population-scale network approach to investigate whether "non-kin" caregivers are truly unrelated, or instead embedded within extended kinship networks.

Background

The distinction between kin and non-kin lies at the heart of sociological theories of family, reciprocity, and social obligation. Survey instruments rely on self-reports that may mask the existence of extended family ties. A population-scale family network can help better understand this measurement challenge.

Methods

A population scale family network is linked to records of every government-compensated informal care relation involving recipients over age 65. This sociocentric kinship network allows for measuring family network distance and classifying caregivers as direct kin, extended kin, or true non-kin, and measure family network distance for all ties. Logistic regression models compare caregiver characteristics between extended kin and true non-kin to validate the criterion validity.

Results

Around one-third of presumed non-kin caregivers are extended kin rather than non-kin—separated by two degrees in the family network. These extended kin are more distant than direct kin (e.g., cousins) but far closer than the general population. They also display caregiving patterns more akin to family, including heavier care loads and greater co-residence. True non-kin caregivers face distinct constraints, like greater geographical distance and age-related

barriers. All caregivers are both disproportionately female, of lower socio-economic status, and more likely to have a migration background.

Conclusion

By empirically disentangling kin from non-kin within population-scale networks, this study demonstrates a methodological pathway for addressing a core problem in family sociology: the operationalization of kinship boundaries.

Key words: Extended kin; Population network; Caregiving relationships; Social support networks; Elder care

Introduction

The distinction between kin and non-kin lies at the heart of sociological theories of family, reciprocity, and social obligation (Allan, 1986; Connidis, 2020; Pahl & Spencer, 2004). Kinship defines a set of enduring, normatively laden ties that structure resource exchange, caregiving responsibilities, and expectations of mutual support. Non-kin relationships, by contrast, are often understood as voluntary, less institutionalized, and more contingent—yet empirical boundaries between these categories are often blurred. Friends can become "like family," extended relatives may be socially distant, and formal definitions of kin frequently fail to capture the complexity of lived relationships (Jerrome, 1981; Pahl & Pevalin, 2005).

This ambiguity is not just a matter of definition: it reflects a core challenge in empirical sociology. While kinship systems have long been theorized as central to the organization of social life, researchers often lack tools to systematically map relational ties across entire populations. Survey instruments, which dominate empirical research, typically rely on egocentric networks and predefined kin categories, making it difficult to observe the "grey zone" of extended kin or kin-like non-kin (Furstenberg, 2020). As a result, much remains

unknown about how these relational categories are constituted in practice, and whether presumed non-kin ties are truly socially and genealogically distinct from kin ties.

Caregiving offers a particularly revealing empirical lens through which to investigate this question. In later life, support networks are mobilized in ways that reflect both normative obligations and personal affinities, making the distinction between kin and non-kin especially consequential. Non-kin caregivers—friends, neighbours, and acquaintances—are often portrayed as a separate avenue of support, but qualitative evidence suggests many of these ties may in fact be embedded in broader kinship networks. Understanding where and how the boundary between kin and non-kin is drawn in such relationships can illuminate fundamental processes of social connection, obligation, and support.

In this study, we use Dutch population register data to link every informal care tie in the population that receives government financial support to a complete, population-scale family network. This sociocentric approach enables us to measure the exact kinship distance between care recipients and providers, including ties beyond those typically enumerated in surveys. We compare the family-network distances between caregiver and care recipients to those in the general population, and the extent to which caregiving dynamics change across those distances. By leveraging administrative network data, we overcome the size and measurement limitations of previous survey-based studies, providing a rare population-level view of the empirical boundary between kin and non-kin.

Background

The question of who counts as kin — and who does not — lies at the heart of sociological theories of family, reciprocity, and social obligation. This boundary is analytically important because it structures expectations of support, obligations of care, and patterns of resource exchange. Yet in practice, it is neither fixed nor easily observed. Extended relatives may be socially distant, while some friends or neighbors become “like family.” For decades,

sociologists have developed theoretical frameworks to understand this relationship spectrum, each with distinct emphases but shared recognition of the significance of the kin/non-kin distinction.

Structural–functionalist perspectives position the family as a core social institution fulfilling essential functions for societal stability — reproduction, socialization, and the provision of care (Parsons & Bales, 1956; Litwak, 1985). Within this view, kinship is a categorical status imbued with enduring obligations, and non-kin ties are supplementary sources of support. The "hierarchical compensatory model" (Cantor, 1979; Litwak, 1985) encapsulates this logic: individuals preferentially draw help from spouses, then adult children, followed by other relatives, friends, neighbors, and, finally, formal services.

From this vantage point, the kin/non-kin divide is stable and sharply drawn. Normative obligations are presumed to be strongest within the nuclear and extended family, while non-kin support is discretionary and substitutive. Although this framework provides a clear baseline for distinguishing kin and non-kin, it underplays the diversity of family forms, overlooks fictive kin, and assumes a universality to obligations that may not hold in contemporary, more fluid relational contexts (Allan, 2008).

Exchange theories shift the focus from institutional roles to the mechanics of give-and-take. Influenced by Mauss's foundational work on The Gift (1925) and Gouldner's (1960) formulation of the "norm of reciprocity," these perspectives see social ties as sustained through ongoing exchanges of goods, services, and emotional support. Kin ties are distinctive because they are embedded in norms of generalized reciprocity, where giving occurs without immediate expectation of return and imbalances can persist over time. Non-kin ties, by contrast, are more often governed by balanced reciprocity, with exchanges monitored for equivalence. This distinction offers a behavioral basis for differentiating kin and non-kin but also highlights potential overlaps: long-standing friendships can exhibit generalized reciprocity, and some kin

exchanges may be highly transactional. The framework draws attention to the motivational underpinnings of relationships but requires careful empirical operationalization, as reciprocity norms vary culturally and across the life course (Komter & Vollebergh, 2002).

Network and relational approaches move beyond categorical definitions to see kin and non-kin as positions in a web of social ties. Rather than relying solely on role labels, these perspectives examine the structure, content, and multiplexity of relationships (Wellman & Wortley, 1990; Emirbayer, 1997; Widmer et al., 2010). Relational distance — the number of steps separating two individuals in a genealogical or social network — becomes a measurable proxy for closeness and potential support. From this perspective, the kin/non-kin boundary is not binary but gradational: close relatives are one step away, extended kin are two steps away, and most non-kin are more distant or unconnected in the network. This opens up empirical space to test whether "non-kin" in surveys are truly outside kinship structures or are simply further removed in the network. Relational sociology also accommodates multiplex ties — relationships that are simultaneously kin and non-kin in different role dimensions — which traditional categorical approaches often misclassify.

In contrast to structural-functionalist approaches, the personal communities literature foregrounds individual agency in defining significant relationships. Pahl and Spencer (2004) describe personal communities as the blend of kin and non-kin in people's close social worlds. The "family of choice" framework, particularly influential in LGBTQ+ studies (Weston, 1998), highlights how non-kin can fulfil the same emotional, practical, and symbolic functions as kin. Here, the boundary between kin and non-kin is understood as socially and biographically constructed. "Fictive kin" — godparents, long-term friends, neighbors — may be integrated into family-like roles. This approach captures the fluidity of intimate networks and the agency individuals exercise in shaping them. However, it is less concerned with how these personal definitions map onto structural kinship networks or broader patterns in the population.

Finally, life course theory emphasizes the temporal and dynamic nature of relationships. The principle of linked lives (Elder, 1994) holds that individuals' life trajectories are interdependent, and relationships — both kin and non-kin — evolve as people transition through roles and life stages. Non-kin can become kin through marriage, co-residence, or adoption, and kin ties can weaken through geographic mobility, divorce, or conflict. In this framework, the kin/non-kin boundary is permeable over time. Obligations and support flows are contingent on current roles and life stage, meaning that any empirical classification must be time sensitive. While this perspective enriches our understanding of relational change, it requires longitudinal data to capture transitions and is less equipped to define static boundaries for cross-sectional analysis.

Across these frameworks, several points of agreement emerge. Kinship is typically a privileged relational category associated with stronger and more enduring obligations. Non-kin relationships can, in some contexts, approximate kin in function and meaning but the precise boundary between the two is often context dependent. Each framework points to reasons why kin and non-kin may differ in caregiving roles — and why the boundary is often blurred. Structural–functional and exchange theories emphasize normative and motivational differences; network and relational perspectives show that many "non-kin" are structurally close in kinship networks; personal communities highlight agency in constructing family-like roles; and life course approaches remind us that these categories shift over time.

Yet a shared empirical limitation remains: the absence of population-scale relational data that can clearly map formal kinship distance. Most large-scale studies rely on self-reported categories and egocentric name generators, which cannot reliably and formally separate extended kin from genuine non-kin. Even frameworks that assert the fuzzy boundary between these two, such as exchange based theories, require a formal measurement of kinship to empirically illustrate such fuzziness. This study addresses that gap by applying a sociocentric,

register-based family network to identify and measure the actual genealogical distance between caregivers and care recipients, enabling a direct empirical test of the kin/non-kin boundary. This is not a comprehensive and definitive assessment of these conceptualizations of kin and non-kin relationships, but instead an illustration of how population scale networks can be used to help us better understand the value and validity of kin and non-kin distinctions in caregiving.

Is non-kin truly non-kin?

Quantitative studies of kin and non-kin care relationships typically rely on surveys with "name generators" to map respondents' social networks (Dykstra et al., 2016). The Longitudinal Aging Study Amsterdam (LASA), for instance, starts with the role-relation method and asks for the names of the respondents' partners, children, friends, neighbors, colleagues and so on. Subsequently, the survey asks with whom the respondent exchanges support, like informal care (the exchange method). Surveys may also first ask whether the respondent receives or provides informal care, and then who the respective providers or recipients are. The Health and Retirement Study (HRS) and the Survey of Health, Ageing and Retirement in Europe (SHARE) use both orders, first mapping family structures, then possible care exchange, after which it is possible to mention helpers other than primary kin. These generated ego-networks cover fewer relationships, as extended kin and non-kin are only visible if they are reported to exchange support of some kind.

While this type of research has garnered valuable insights into the patterns of exchange and reciprocity, significant reporting biases may occur from these self-reports. First, respondents might underestimate how much care they receive and from whom exactly (Dykstra et al., 2016; Furstenberg, 2020). Second, even if the survey allows for impressively large egocentric network generation (e.g., up to 80 ties can be reported with LASA), this will be a tedious task on the end of the interviewee, who might not be motivated to share their entire network (Furstenberg, 2020). Another problem of the use of a survey and a representative

sample, is the relative rareness of care relationships among non-kin or distant relatives (Höllinger & Haller, 1990). The survey might not have a sufficiently precise category for these types of relationships, or researchers may merge the different types of uncommon care relations to facilitate analysis, thereby obscuring the distinction between extended kin and non-kin. Additionally, a care relationship can qualify as friendship and kinship simultaneously (Pahl & Spencer, 2004; Wall et al., 2018), which most surveys don't account for. Empirical findings that people are more likely to foster (deeper) friendships with relatives later in the life course (Jerrome, 1981; Pahl & Pevalin, 2005) lends credence to this possibility. These considerations raise questions about the extent to which non-kin caregivers are truly distinct from a category like extended kin.

In this paper we seek to address these shortcomings by using a population scale network approach to conceptualize formal kinship. Population scale networks use administrative registers to represent the relations between individuals at population scale. Administrative registers capture parent-child relationships in a structured and systematic way, and these are commonly used to recreate the 'list of relations' that are observed in survey research such that for any individual it is possible to identify all individuals that fit these categories. Furthermore, because it is at population scale, it is possible to identify kin-of-kin in iterative steps until the entire population is covered. In network terms, this allows us to not only consider those who are kin and non-kin, but also kin proximity (i.e. how many hops through the family network are needed to arrive at this individual). Using this network, we conceptualize formal kinship ties in three categories. Kin are those who are identified as direct kin of an individual using the same list of relations as is widely used in surveys. True non-kin are those who are as far from the individual in the kinship network as any other person in the population chosen at random (on average about 7.5 hops). Finally, we identify 'extended kin' as those individuals who are

not in the formal list of kin used by surveys but that are at path-length that is much shorter than one would statistically expect had the person been drawn from the population at random.

Non-kin Caregiving in the Netherlands

To examine the validity of our distinctions between kin and non-kin empirically, we focus on the specific context of elder care and the degree to which kin, extended kin, and true non-kin caregivers differ. Non-kin are an important element in support networks (Conkova et al., 2018; Rosow, 1970; Stewart-Williams, 2007; Suanet et al., 2019). For older people with growing care needs, non-kin may facilitate and prolong independent living by extending help with tasks like grocery shopping, housekeeping or emotional support. In the context of care shortages, local communities and non-kin relationships may help mitigate the pressures on formal care systems (Jacobs et al., 2018). Yet it can't be assumed that non-kin are willing and able to take on more responsibilities, as this might clash with the character of the previously established relationship and competing responsibilities (Allan, 1986, 2008; Litwak, 1985; Suanet et al., 2019).

Though the number of studies comparing a representative sample of kin and non-kin caregivers is limited, previous work has established some similarities and differences between the two. Some consensus has been reached about the different and complementary care tasks typically carried out by kin and non-kin in western countries (Broese van Groenou & De Boer, 2016). In line with Litwak's task-specific model (Litwak, 1985; Messeri et al., 1993), neighbors tend to take on work that requires geographic proximity, such as grocery shopping, odd jobs around the house, keeping an eye on the dependent or incidental help during emergencies (Litwak & Szelenyi, 1969; Pleschberger & Wosko, 2017). As friendships are typically characterized by intimacy, reciprocity and equality, friends are more likely to provide emotional support or advice (Allan, 1986; Jerrome, 1990), though they may also be involved in practical tasks like handling bills, transportation, or sometimes personal care (Lapierre & Keating, 2013; Wosko et al., 2024). Family, especially partners followed by children, are more likely to

commit to the most demanding and time-consuming jobs, like long-term housework or personal care (Bamford et al., 1998; Finch & Groves, 1980). Consistent with Cantor's (1979) hierarchical-compensatory model, prior studies have shown that non-kin is more likely to step in when kin is not available (Bamford et al., 1998; Conkova & King, 2019). Since proximity is a strong prerequisite for family care exchange (Dykstra & Fokkema, 2011), some have contended that proximity is more important than the specific role of a friend, neighbor or relative, expecting that the care dependent person will turn to whomever they see often (Nocon & Pearson, 2000).

Like the content of the tasks, the motivation of kin and non-kin caregivers also diverges to an extent. Studies on non-kin caregivers found that they are generally motivated by feelings of compassion or friendship (Barker, 2002; Pleschberger & Wosko, 2017), whereas a sense of duty and family obligations tend to be a main driver for kin caregivers (Nocon & Pearson, 2000). While kin caregivers experience feelings of moral obligation toward the care recipient, their decision to enter the care relationship is less tied to social norms and more voluntary (Barker, 2002; Pleschberger & Wosko, 2017). The idea that non-kin caregivers could directly substitute kin caregivers seems to underestimate the importance of the sense of family obligation in people's decision to care. Empirical evidence supports this, as studies show that barriers to provide care, such as employment, are more important for non-kin than for kinships ties (Klerk et al., 2021; Suanet et al., 2019).

In the Netherlands, care relationships can be supported financially through personal budgets issued by the state. The recipient of informal care pays the caregiver via a budget linked to either the Long-term Care Act (Dutch: Wet langdurige zorg; WLZ) or the Social Support Act (Dutch: Wet maatschappelijke ondersteuning; WMO; Maarse & Jeurissen, 2016). The personal budget allocations leave an administrative record which we use to establish which persons in the Dutch population have a care relationship. We can discern between higher and lower care

intensity as the record indicates whether the budget is tied to long-term care (i.e., 24-hour care (*WLZ*)) or lighter social care that facilitates "aging in place" (e.g., transportation or housekeeping services (*WMO*)). To receive compensation from either act, the caregiver must provide help on a structural basis and the recipient must be eligible for state-funded long-term care or social care, implying that the care provision is demanding in either case. These care arrangements do not therefore represent all caregiving arrangements but only for those which are structural and long-term in nature, something that most theories of kinship suggest would be dominated by kin rather than non-kin relationships. These care arrangements do however provide an administrative record of intensive caregiving relationships that are financially compensated and which are linkable to both caregiver and care recipient.

Hypotheses

Our first expectation is that most non-kin caregivers are at shorter kinship distance than the general population. Our expectation is that the distribution of caregiving ties for those who are not direct kin (i.e. at a distance of 1) is normally distributed like the ties between random people in the population, but the mean distance is substantially shorter than the population overall. In network terms, the distance (i.e., shortest path via the family network) between a non-kin caregiver and recipient will be smaller than between two randomly selected people in a population scale family tree (*h1*) Our expectation is grounded in findings from existing research. Given the salience of family norms in overcoming barriers to intensive care work (Klerk et al., 2021), extended kin are more willing to step in than 'true' non-kin. If caregivers are sampled from all available ties, it should be expected that those at a shorter distance will be selected. We should therefore expect that caregivers, even when direct kin ship ties are not available, are selected based on kinship proximity to some degree. In many countries but particularly a country such as the Netherlands that is small and has relatively stable populations, you are more likely to have a shorter kinship path to your neighbors and your local community

generally than you are someone in the general population. Geospatial availability and cultural proximity can therefore manifest themselves in kinship path lengths that are substantially shorter than the population overall. The result of comparing the path length of non-kin care givers with the general population of ties will be a delineation between 'Extended kin' (those who have kinship path length that is statistically less than that expected from the population of ties) and 'True non-kin' (whose path length one would statistically have been likely to expect to be drawn from the general population of ties).

We then use the estimand of marginal effects in the probability that a given tie is an 'Extended kin tie' as opposed to a 'True non-kin tie' to test hypotheses drawn from prevailing theories of kin and non-kin support. Specifically, since norms of care obligation are central to the emergence of kin care ties (Finch & Mason, 1990; Nocon & Pearson, 2000), characteristics associated with such responsibilities should be more prevalent among extended kin than true non-kin. Prior research has indicated that such responsibilities weigh more heavily on women, persons with lower socio-economic status and those with a migration background (Bredewold et al., 2020; Dykstra & Fokkema, 2012; Haberkern et al., 2015). Existing research shows that women and lower socio-economic strata are overrepresented among kin caregivers compared to non-kin caregivers (Broese van Groenou & Tilburg, 2003; Klerk et al., 2021). To our knowledge, prior studies have not made such direct comparisons for kin and non-kin carers with a migration background, but we expect the mechanism to be the same. We therefore hypothesize that caregivers who are female (*h2a*), have a migrant background (*h2b*) or a lower socio-economic status (*h2c*) will be more likely to be 'Extended kin' than 'True non-kin' caregivers.

Finally, we expect that Extended kin caregivers will also have a similar tolerance for barriers to care as has been observed in kin caregivers. Barriers, such as geospatial distance, care intensity, and age of the caregiver are presumed to be more tolerable for kin (Broese van

Groenou & De Boer, 2016; Klerk et al., 2021) and may therefore matter more for non-kin caregivers with a longer path via the family network. As such, we hypothesize that caregivers who are older, live further away from the care recipient or provide more intensive care are more likely to be 'Extended kin' than 'True non-kin caregivers' who are younger (*h3a*), live closer by (*h3b*), or provide less intensive care (*h3c*), respectively.

Through this we hope to not only delineate between kin, extended kin, and true non-kin caregivers but also to validate whether these represent differing care dynamics as described by the existing sociological literature on kinship ties.

Data & Methods

Administrative data: informal care ties, family ties, demographics and proximity

We used Dutch administrative data from 2019, which are held by Statistics Netherlands and available for scientific research under certain conditions. Informal care ties were identified with a dataset of all persons in the Netherlands who receive a personal budget at the expense of the Long-term Care Act or Social Support Act (Statistics Netherlands, 2015) (PGBWLZWMOJWTAB: doi: 10.57934/0b01e410803afb68). These care ties include a pseudonymized version of the national security number for both the care recipient and the care giver. We excluded care ties of recipients younger than 65 to focus the analysis of care needs on elder care. In addition to the identification of the care recipients and their caregivers, these data record the annual payment to the caregiver and the type of care delivered (social (WMO) vs. long-term (WLZ)).

We linked the persons with care ties to the family network dataset (Laan et al., 2023; Statistics Netherlands, 2009a; FAMILIENETWERKTAB: doi:10.57934/0b01e41080760802), which identifies the family members of each (registered) person in the Netherlands. The dataset is an edge list that provides an extensive set of potential relationship types: partners, parent - child, co-parents, grandparent - grandchild, siblings, halfsiblings, stepsiblings, stepparent -

stepchild, cousins, uncle/aunt-niece/nephew, parent-in-law – child-in-law, siblings-in-law, cousins by marriage, or uncle/aunt by marriage - niece/nephew by marriage. We classified care ties that overlapped with any of these family relationship types as *kin care ties* (i.e., path length 1, see Figure 1a), while *non-kin care ties* were care ties falling outside of this set of family relationships. We then measured kinship path length between the caregiver and care recipient using igraph shortest paths function in R. If no path existed between individuals, then the path length was recorded as infinite.

Finally, for both caregivers and care recipients we linked individual-level demographic information (Statistics Netherlands, 2021, GBAPERSOONTAB: doi:10.57934/0b01e4108071ba40), indicators on socio-economic status (Statistics Netherlands, 2011; INPATAB: doi:10.57934/0b01e41080371196) as well as dyad-level information on their geographic proximity. For the latter we used a neighbor network dataset (Statistics Netherlands, 2009b, BURENNETWERKTAB: doi:10.57934/0b01e410807607b7), a co-resident network dataset (Statistics Netherlands, 2009c; HUISGENOTENNETWERKTAB: doi:10.57934/0b01e4108076077c), and a dataset that links each person to a residence (Statistics Netherlands, 2023a: GBAADRESOBJECTBUS: doi:10.57934/0b01e410807bdb13) and that residence to a municipality (Statistics Netherlands, 2023b: VSLGWBTAB: doi:10.57934/0b01e410807c42fc). The code to reproduce the results is indexed in the ODISSEI Code Library: https://odissei-data.github.io/ODISSEI-code-library/.

Figure 1 – Kinship Path lengths for Caregivers

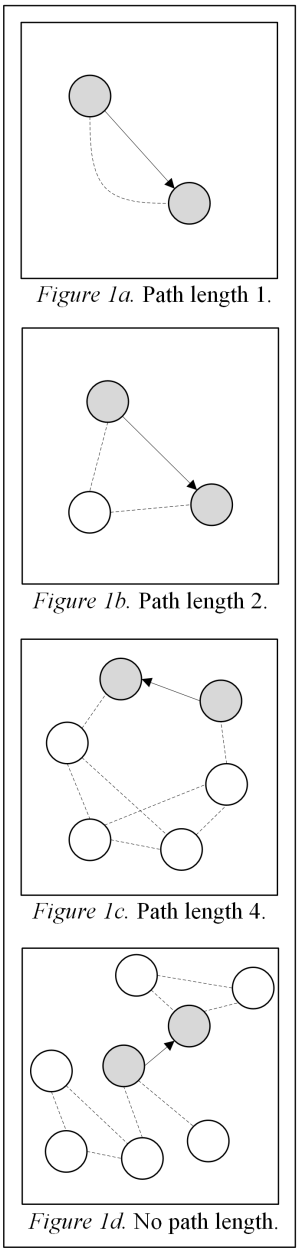


Figure 1a. Path length 1.

Figure 1b. Path length 2.

Figure 1c. Path length 4.

Figure 1d. No path length.

Note: Ties with arrows represent caregiving relationships, and dashed lines represent kinship ties

Dependent variable: Path length calculation

After combining the family network and care, we calculated the shortest path for all non-kin care dyads via the family network using the 'distance' function of the R igraph package. Around 91% of the population registered in the family network were part of a single component of connected nodes. If both caregiver and recipient of a given dyad were part of that big cluster

(or shared another smaller cluster), we calculated the shortest path. Figure 1b and 1c show examples of such potential path lengths. Since there is no path between a caregiver and recipient in different clusters, an 'infinite' value would be generated for these dyads (see Figure 1d). To compare the path length of non-kin care dyads to random dyads, we drew 3 random samples of 2,000 persons in the family network and calculated the shortest path for all 3,998,000 dyads. The average distance of these 3 samples gave a reference to gauge which non-kin caregivers were closer or further away from their recipients.

Other dyad-level variables

Geographic proximity was estimated by means of three dichotomous variables. These indicated whether the caregiver and care recipient were *co-residents, neighbors*, or *lived in the same municipality* in 2019. For all three variables, "yes" was coded as one, and "no" was the reference category.

Individual-level variables

On the individual level, we counted the *number of family ties* and the *number of co-residents* of both care recipients and caregivers. We also counted the *number of care dyads*, since sometimes multiple people get compensated to care for the same person, or vice versa, one person gets compensated to care for multiple people. As a proxy for care intensity, we calculated the *average monthly compensation* on the individual level. For a caregiver with multiple recipients, the monthly average was based on the sum of all incomes in 2019. Likewise, for a care recipient with multiple caregivers, the average was based on the total of all budgets linked to this recipient. The dichotomous variable *compensation above minimum wage* indicates whether the amount was equal to or higher than €1,635 for caregivers.

For lack of reliable registry data on the educational history of people over 50, we used *standardized disposable household income in percentiles* income as an indicator of socio-economic status for both caregiver and care recipient.

Finally, we established the *age, gender* and *migration background* of caregivers and care recipients. The respective reference categories of the latter two variables were "men" and "no migration background". A person with a migration background had at least one parent who was born abroad.

Analysis

Our analysis consists of three parts. First, we provide a description of the care recipient and care giving population across the variables set out above. We then examine and describe the network position of caregivers relative to care recipients through a statistical comparison of care tie path lengths with the path lengths of random dyads extracted from the population in order to test our first hypothesis (h1). Finally, we compare the kin and extended kin ties with the non-kin ties using logistic regressions to test our other hypotheses. Missingness for these models was handled using listwise deletion as missing values were recorded for less than 1% of the population. Average marginal effects were then calculated to evaluate the differences between kin and non-kin relationship ties. As a sensitivity analysis we ran the models independently, excluding infinite path lengths for non-kin populations and comparing 'only extended kin' to 'true-non-kin'. These results are presented in the annex. The code for replicating in this analysis is available via github and indexed within the ODISSEI code library. Researchers wishing to directly reproduce the results can request access to project XXXX via Statistics Netherlands.

Results

Who are the caregivers and care recipients?

Table 1 shows that the care recipients and especially the caregivers in our sample tend to be women. People with a migration background are also vastly overrepresented as both caregiver and care recipient. For reference, around 24% of the Dutch population had a migration

background in 2019. The average caregiver is substantially younger than the average care recipient.

Table 1 indicates that the care provided tends to be intensive and partly shared across individuals, as having multiple care dyads is more prevalent among recipients than among caregivers. About a third of caregivers receive a compensation that reaches or exceeds minimum wage levels. The average compensation is higher for caregivers with more recipients. Care recipients' average household income seemingly increases with their number of care ties, but it remains consistently lower than caregivers' income. Finally, care recipients have fewer co-residents than caregivers on average.

Table 1. **Characteristics of all individual care recipients and caregivers of the compensated care dyads, by number of care ties.**

	1 care tie			2 care ties (including >2 ties for caregivers)			>2 care ties		
	Mean	SD	*N*	Mean	SD	*N*	Mean	SD	*N*
Care recipients [a]									
Woman	0.678	0.467	13,632	0.596	0.491	2,609	0.573	0.495	1,200
Migration background	0.396	0.489	13,632	0.490	0.500	2,609	0.488	0.500	1,200
Age	76.333	9.365	13,632	76.860	9.152	2,609	77.727	9.538	1,200
Number of family ties	18.271	15.496	13,632	18.381	15.272	2,609	21.560	16.135	1,200
Average monthly compensation	945.036	1205.423	13,632	2430.312	1685.984	2,609	3137.370	1762.195	1,200
Standardized disposable income (percentiles)	33.264	24.76	13,320	39.578	28.798	2,500	42.560	29.797	1,142
Number of co-residents	1.646	0.892	13,621	1.986	1.226	2,605	2.085	1.243	1,198
Caregivers [b]									
Woman	0.739	0.440	21,926	0.724	0.447	576			
Migration background	0.421	0.494	21,926	0.526	0.500	576			
Age	47.922	15.913	21,926	44.512	12.946	576			
Number of family ties	25.639	21.001	21,926	26.260	21.942	576			
Average monthly compensation	1066.917	1183.905	21,926	1540.867	1462.865	576			
Compensation above minimum wage	0.366	0.482	21,926	0.366	0.482	576			
Standardized disposable income (percentiles)	56.667	27.037	21,411	59.089	27.414	548			
Number of co-residents	2.949	1.428	21,624	3.298	1.542	563			

Note. [a] $N_{recipients}$ = 17,441. [b] $N_{caregivers}$ = 22,502. *Sources*: Statistics Netherlands, 2009a, 2009b, 2009c, 2011, 2015, 2021, 2023a, 2023b.

Table 2 shows that an overwhelming majority of the care dyads are a form of kinship. This is both true for the lighter social care (91.7%) and the heavier long-term care (89.3%). We find that only 4.1 and 5.1 percent of the respective care dyads are not direct kin. Children, followed by grandchildren and children-in-law are the most common providers of both types of care. Table 2 also shows that a large proportion of the caregivers and care recipients reside in the same municipality, whereas few of them are neighbors. For long-term care dyads, it is more common to share a household than for social care dyads.

Table 2. Relationship types of the compensated care dyads, by type of care.

	Social care tie [a]		Long-term care tie [b]	
	Frequency	Percentage	Frequency	Percentage
Kinship type (caregiver)				
Partner	538	5.07	2858	22.37
Child	6059	57.06	5279	41.32
Sibling	331	3.12	338	2.65
Grandchild	1452	13.67	1504	11.77
Co-parent	14	0.13	40	0.31
Child-in-law	1214	11.43	1105	8.65
In-laws (parent, sibling)	86	0.81	165	1.29
Stepchild	29	0.27	86	0.67
Other kin	17	0.16	40	0.31
Non-kin	432	4.07	648	5.07
Not in network data	446	4.20	714	5.59
Neighbors	322	3.03	386	3.02
Co-residents	867	8.17	4643	36.34
Live in same municipality [c]	7804	73.50	9934	77.75

Note. [a] N = 10,618. [b] N = 12,777. [c] 139 social caregivers and 182 long-term caregivers could not be linked to a municipality.
Sources: Statistics Netherlands, 2009a, 2009b, 2009c, 2023a, 2023b.

Kin and non-kin care dyads

Table 3 illustrates the similarities and differences between kin and non-kin care relationships. To examine whether ostensible differences were significant, we estimated logistic regression models for the likelihood of a relationship to be non-kin (see Table A1 of the supplementary material). Some similarities hold for both social and long-term care. Female caregivers are equally overrepresented in kin and non-kin relationships, and neighbors are equally

uncommon. A similar proportion of kin and non-kin caregivers' compensation reaches or exceeds minimum wage levels.

Some differences also hold for both social and long-term care. Non-kin carers less often live in the care recipients' household or municipality and have a lower household income. Caregivers with a migration background are also more common among non-kin than kin relationships, though this may have to do with the difficulty of identifying kin for individuals with family living abroad.

Other differences between kin and non-kin depend on the type of care provided. Long-term care recipients with a migration background are more prevalent among non-kin ties than among kin ties, but the prevalence is similar for social care. The average household income of long-term care recipients is higher among kin ties, while there is no such difference among social care recipients. For long-term care, kin and non-kin caregivers are similar in age, but non-kin caregivers providing social are somewhat older than kin caregivers. Conversely, social care recipients with non-kin care ties are somewhat younger than those with kin care ties, but we find no such difference among long-term care recipients.

These findings do not support the argument that kin caregivers are more likely than non-kin to overcome barriers to care, like care distance or age. Nor that they are more likely to be represented by people presumed to be more susceptible to family obligations. We add path-length to our analysis to see if extended kin miscategorized as non-kin could have suppressed the expected differences.

Table 3. Characteristics of the kin and non-kin care ties, by type of care.

	Social care				Long-term care			
	Kin care ties [a]		Non-kin care ties [b]		Kin care ties [c]		Non-kin care ties [d]	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Female caregiver	0.823	0.382	0.815	0.389	0.676	0.468	0.677	0.468
Migration background caregiver	0.381	0.486	0.544	0.499	0.412	0.492	0.724	0.447
Age caregiver	45.848	14.112	47.250	16.080	49.959	16.734	43.789	16.440
Compensation above minimum wage [g]					0.457	0.498	0.377	0.484
Monthly compensation	348.230	506.230	337.345	497.610	1708.231	1254.948	1516.421	1372.333
Disposable income caregiver (percentiles) [e]	51.777	26.652	48.146	26.483	62.057	26.224	54.694	27.671
Co-residing [g]	0.088	0.283			0.390	0.488	0.091	0.288
Neighbors [g]	0.032	0.176			0.032	0.176	0.020	0.473
Living in same municipality	0.752	0.432	0.625	0.485	0.799	0.401	0.662	0.473
Female care recipient	0.745	0.436	0.741	0.439	0.540	0.498	0.650	0.477
Migration background care recipient	0.397	0.489	0.521	0.500	0.413	0.492	0.736	0.441
Age care recipient	76.741	9.492	75.852	9.102	76.733	9.311	78.488	8.922
Disposable income care recipient (percentiles) [f]	26.755	18.35	22.541	15.758	47.175	29.766	28.044	26.51

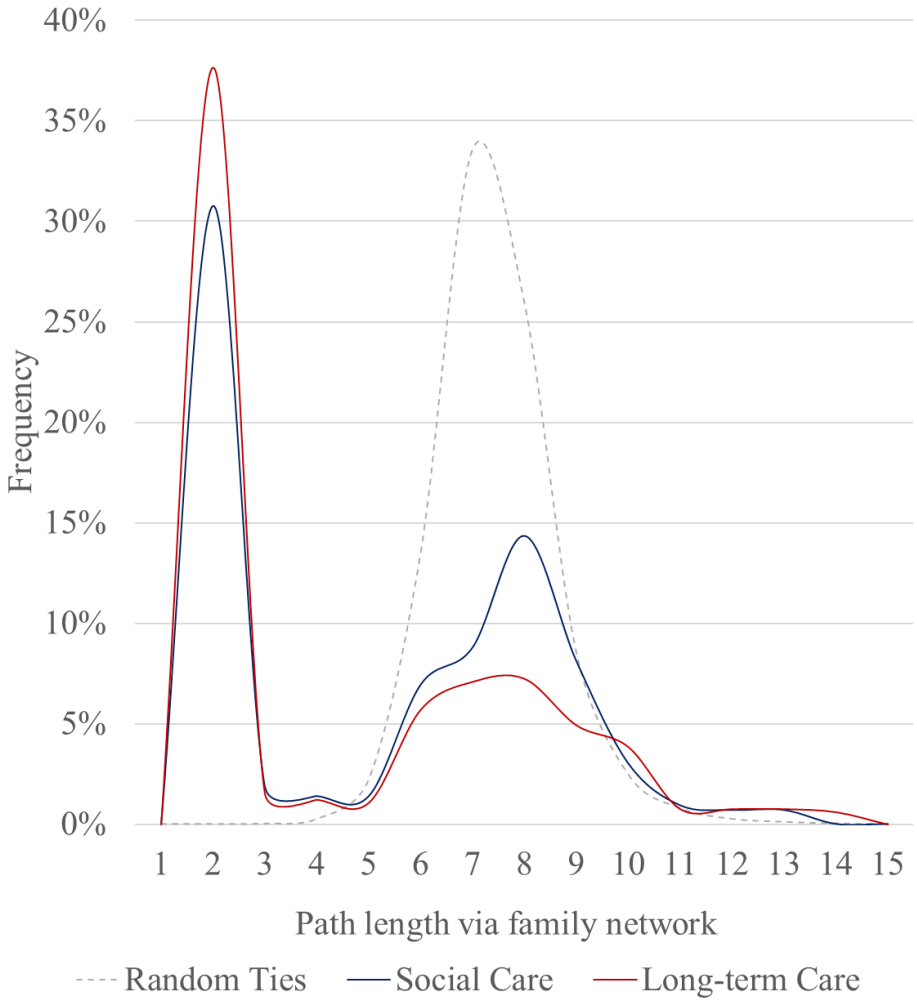
Note. [a] N= 9,740; [b] N=432; [c] N = 11,415; [d] N = 648. [e] Missing values for each column from left to right: 66, 6, 152 and 7. [f] Missing values for each column from left to right: 36, 5, 578 and 53. [g] The mean in combination with the N were so low that Statistics Netherlands could not release these exact data due to privacy considerations. *Sources*: Statistics Netherlands, 2009a, 2009b, 2009c, 2011, 2015, 2021, 2023a, 2023b.

Path length of non-kin care dyads

Figure 2 shows the distribution of the path length via the family network for all non-kin care dyads, as well as for one of the random samples of 2,000 nodes of the family network. Dyads with nodes belonging to different clusters (13-26%) are not shown in the figure, but they are used to calculate the percentages of the graph. We provide a complete overview of the distributions in the supplementary material (Tables A2, A3). The dotted line indicates the random ties are normally distributed. The average path length for this sample is 7.42 – very close to the other samples' averages (7.42 and 7.45). The blue and red line show that, by contrast, the distribution for social and long-term care ties is bimodal. 37.7 percent of long-term care ties and 30.8 of social care ties have a path length of 2. The remaining care ties, with a path length over 2 – 48.1 percent for social care, 35.6 percent for long-term care – follow a normal distribution like the random sample. These findings partly support *hypothesis 1.*

The sudden drop in frequency at path length 3 highlights the clear distinction between care ties of path length 2 and ties of the normal distribution. Potentially, path length 2 ties are more kin-like, while the remainder of the ties are comparable to the general population in terms of closeness, which would make them 'true' non-kin. Ties at path length 2 are linked by one individual who is related to both carer and recipient. We found that in many cases, these individuals are the grandchildren (47.7% for social care, 47.4% for long-term care) or children of the care recipient (21.1% for social care, 19.6% for long-term care; see Table A4 of the supplementary material). Specifically, that relations such as granddaughter-in-law or great-niece are also notable care dyads that fall outside traditional definitions of kin as captured by surveys.

Figure 2 – Observed kinship path length for caregivers



'Extended' kin and 'true' non-kin

Because we found distinct groups of 'extended' kin and 'true' non-kin, we ran logistic regression models to assess potential differences in terms of barriers and demographics. The reference category is a path-length over 2 (i.e., a 'true' non-kin care tie) or those without a path length. We provide additional models excluding the latter group in the supplementary material (Table A5), since we cannot completely rule out that these relationships are kin but missed by the registries.

Table 4 shows that we find little evidence that groups presumed more susceptible to family norms are more likely to be 'extended' kin than 'true' non-kin cares. While female long-term carers are more likely to be extended kin than male long-term carers, no such difference

is found for social care. Moreover, the effect is not significant in the additional models, where the average marginal effect (AME) is substantially lower (0.04), indicating this was not just caused by the smaller sample size. We therefore do not find strong evidence for *hypothesis 2a*. Social carers with a migration background are less likely to be 'extended' kin, yet long-term carers with and without a migrant background are equally likely to be extended kin. The effect for social carers is not significant and somewhat smaller (AME=0.13) in the additional analyses. We find no support for *hypothesis 2b*, though this may be related to the difficulty of identifying 'true' non-kin carers with a migration background. We reject *hypothesis 2c*, as the income of social and long-term caregivers is not associated with the likelihood of being 'extended kin' or 'true non-kin'.

We also find limited support for our expectations regarding extended kin's higher tolerance for barriers. With age, social and long-term carers' likelihood of being 'extended' kin decreases rather than increases, which refutes *hypothesis 3a*. Social and long-term carers who live in the same municipality as the care recipient are more likely to be 'extended' kin rather than 'true' non-kin. Long-term care ties among neighbors or co-residents are also more likely to be 'extended' kin, though we see no such differences for social care ties. The effect of co-residence for long-term care relationships disappears in the additional analyses. These findings all contradict *hypothesis 3b*. We find some support for *hypothesis 3c*, since social caregivers whose compensation reaches minimum wage levels are more likely to be 'extended' kin. Long-term carers do not differ in this respect.

In sum, the barriers of distance and age seem to matter *less* for non-kin carers, while the barrier of care intensity matters *more*. The latter is also illustrated by the fact that the proportion of 'true non-kin' carers is smaller among non-kin long-term care ties (48.6%) than among non-kin social care ties (61.0%). Overall, extended kin seem more comparable to direct kin than non-kin with respect to co-residence and care intensity.

Table 4. Average marginal effects for non-kin care ties' likelihood of having a path-length of 2.

	Social care ties [a]			Long-term care ties [b]		
	AME		SE	AME		SE
Female caregiver	0.0225		0.0584	0.1075	**	0.0406
Migration background caregiver	-0.1659	*	0.0664	-0.1402		0.0725
Age caregiver	-0.0082	**	0.0013	-0.0068	***	0.0011
Compensation above minimum wage	0.2758	*	0.1279	-0.0209		0.0410
Disposable income caregiver	0.0003		0.0008	-0.0007		0.0007
Co-residing	-0.0704		0.1830	0.1624	*	0.0663
Neighbors	0.0249		0.1407	0.5454	*	0.2169
Living in same municipality	0.1516	**	0.0453	0.1201	**	0.0428
Female care recipient	0.1153	*	0.0519	-0.0199		0.0412
Migration background care recipient	-0.0053		0.0670	-0.0238		0.0756
Age care recipient	0.0015		0.0024	0.0049	*	0.0022

Note: AME = average marginal effect; [a] $N = 421$; [b] $N = 591$. *Sources*: Statistics Netherlands, 2009a, 2009b, 2009c, 2011, 2015, 2021, 2023a, 2023b.
Significance levels *$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Conclusion

While quantitative research has amassed valuable insights in the complementary roles of kin and non-kin caregivers, much remains unknown about the identity of non-kin committed to intensive informal caregiving. Prior research relying on surveys and representative samples may have underestimated the role of extended kin and obscured their distinction from non-kin (Furstenberg, 2020). To shed light on the role of and dividing line between kin and non-kin, we used population scale network data to assess the proximity of 'non-kin' caregivers and recipients in terms of their degree of separation via family ties.

Non-kin might be extended kin

Our analyses of structural closeness between non-kin caregivers and care recipients revealed that about a third of these relationships are better characterized as 'extended kin'. These extended kin caregivers had a distinct proximity of two degrees of separation via the family network, indicating they are further removed from the recipients than direct kin, yet closer than

the general population. Often, the recipients' grandchildren or children formed a link to the extended kin caregiver. Since specific definitions of these types of relationships are generally lacking and intensive caregiving is uncommon among extended kin, previous research may have overlooked them by categorizing them as 'other' or 'non-kin' caregivers. This implies that 'true' non-kin caregivers may be scarcer than previously assumed.

Extended kin and 'true' non-kin: similar motivations, dissimilar tolerance of care barriers

We expected that, compared to 'true' non-kin, extended kin would be more like direct kin in terms of their motivations and tolerance of care barriers. This seemed not the case for motivations, as female caregivers, caregivers with a migration background and caregivers with lower socio-economic status tended to be overrepresented to the same degree among extended kin as among 'true' non-kin relations. Potentially, these groups are more likely to adhere to care expectations in general, not just to family norms. This contrast with earlier findings (Broese van Groenou & Tilburg, 2003; Klerk et al., 2021) may be the result of our comparison between extended kin and 'true' non kin, rather than direct kin and the broader category of non-kin.

Contrary to our expectations, some barriers to care – distance and caregiver's age – were found to matter less for 'true' non-kin than for extended kin. Yet, in line with the task-specific model (Messeri et al., 1993), extended kin seemed to have a higher tolerance for the barrier of care intensity. Perhaps, 'true' non-kin caregivers who do commit to intensive caregiving share a bond so strong with the recipient, that they are more likely to overcome other barriers such as distance and age. Overall, compared to 'true' non-kin, extended kin were more family-like in terms of care intensity and tendency to co-reside with the care recipient but in many other respects they were comparable to 'true non-kin' caregivers. This supports the conclusion that extended kin are a distinct group of caregivers relative to both kin caregivers and true non-kin caregivers. Extended kin appear to be less subject to structural–functional and

exchange theories relating to normative and structural motivations, and adhere to relational theories of exchange.

Limitations

While our study's use of register data has generated novel insights, the data come with certain limitations. Register data contain formal definitions of kin, derived from official partnerships and child-parent relationships. This precludes certain ties that should arguably have been recognized as kinship (e.g., LAT partners without children and official registration) (Connidis, 2020). Likewise, the data is less suitable for identifying kin of persons with a migration background. For instance, we cannot establish sibship for siblings whose parents have never migrated to the Netherlands. We may have underestimated the proportion of people with a migration background among direct and extended kin relationships. Future research could also use linked survey data to better validate these support and exchange mechanisms beyond formal ties. However, for this approach to be as effective as possible, surveys that collect data on care and support should examine how care dyads described in surveys could be linked to both care providers and care recipients rather than solely via the survey respondent.

We also acknowledge that our sample is quite specific. The interrelatedness of the Dutch population via kinship might not be found in more sizeable, geographically segregated countries. The role of extended caregivers may differ depending on context, such as reclusiveness (Furstenberg, 2020). Moreover, if a country's population is not part of a big population family tree, this study's method cannot be replicated. Additionally, our findings may not be readily generalizable as we studied care that is intensive *and* compensated. This excludes 'typical' incidental non-kin caregiving, as well as uncompensated intensive caregiving, common in relationships where caregiving is more normalized. This may explain the underrepresentation of partners and 'true' non-kin among our care relationships.

Future research

Building on the insight that the proportion of 'true' non-kin caregivers may be even smaller than assumed, future research could replicate this study and examine if this is related to competing family obligations of non-kin ties. A population family network with care dyads could be used to map these potential obligations and predict the formation of a non-kin care tie. Future studies could also link survey data like SHARE to these register data, to validate questions on the receipt of care and family networks, or vice versa. This work could be extended to other forms of care, support and exchange for which data is available and replicated in many of the other countries for which population scale networks are now available. The limitations of register data notwithstanding, our study shows that the use of population scale family networks linked with care networks generate novel insights and open exciting new avenues for research. Specifically, population scale networks offer an opportunity to understand support and exchange across society and the extent to which it is structured by kinship which is a long standing fundamental challenge within family sociology.

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Supplementary material

Table A1. Average marginal effects for individual and dyad level characteristics in relation to having a non-kin care tie.

	Social care (*N*=10,060)		Long-term care (*N*=11,373)	
	AME	SE	AME	SE
Female caregiver	0.0009	0.0053	0.0012	0.0044
Migration background caregiver	0.0360***	0.0076	0.0221**	0.0083
Age caregiver	0.0012***	0.0002	0.0003	0.0002
Compensation above minimum wage	-0.0101	0.0131	-0.0068	0.0044
Disposable income caregiver (percentiles)	-0.0002*	0.0001	-0.0001*	0.0001
Co-residing	-0.0812***	0.0174	-0.0630***	0.0081
Neighbors	-0.0131	0.0144	-0.0224	0.0149
Living in same municipality	-0.0215***	0.0043	-0.0234***	0.0047
Female care recipient	-0.0062	0.0046	0.0098*	0.0043
Migration background care recipient	-0.0050	0.0075	0.0340***	0.0083
Age care recipient	-0.0007**	0.0002	0.0001	0.0002
Disposable income care recipient (percentiles)	-0.0002	0.0001	-0.0004***	0.0001

Note: AME = average marginal effect. *Sources*: Statistics Netherlands, 2009a, 2009b, 2009c, 2011, 2015, 2021, 2023a, 2023b. Significance levels *$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table A2. Distribution of path length of potential dyads via the population-scale family network among three random samples of 2000 nodes.

	Sample 1 (%)	Sample 2 (%)	Sample 3 (%)
Path length			
1 [a]	x	x	x
2	0.002	0.002	0.002
3	0.024	0.023	0.022
4	0.261	0.249	0.242
5	2.357	2.223	2.207
6	14.066	13.539	13.293
7	33.297	33.599	32.648
8	25.989	25.922	25.445
9	9.074	8.514	8.841
10	2.795	2.457	2.776
11	0.826	0.782	0.859
12	0.194	0.251	0.318
13	0.034	0.104	0.149
14	0.004	0.028	0.045
15 or more	0.001	0.005	0.011
Infinite Path length [b]	11.078	12.300	13.141

Note. [a] These numbers were so low that Statistics Netherlands could not release the exact data due to privacy considerations. [b] This is the case for dyads belonging to different clusters. *Source:* Statistics Netherlands, 2009a.

Table A3. Distribution of path length of the non-kin care dyads via the population-scale family network.

	Social care ties (%)	Long-term care ties (%)
Path length		
2	30.787	37.654
3, 4 or 5	4.630	3.858
6	6.944	5.710
7	8.796	7.099
8	14.352	7.253
9	8.102	4.938
10	3.009	3.858
11 or more	2.315	2.932
Infinite Path length [a]	21.065	26.698

Note. [a] This is the case for dyads of which the nodes belong to different clusters. *Source:* Statistics Netherlands, 2009a.

Table A4. The role of the person linking care ties with path length 2 in relation to the care recipient.

	Social care ties		Long-term care ties	
	N	%	*N*	%
Co-parent or partner	25	2.465	63	3.380
Child	214	21.105	366	19.635
Grandchild	484	47.732	883	47.371
Stepchild	21	2.071	92	4.936
Sibling or cousin (or niece/nephew)	16	1.578	24	1.288
Parent-in-law or sibling-in-law	40	3.945	88	4.721
Child-in-law	70	6.903	109	5.848
Cousin (or niece/nephew) by marriage	10	0.986	14	0.751
Full cousin (or aunt/uncle) of partner	42	4.142	39	2.092
Cousin (or aunt/uncle) of partner	12	1.183	11	0.590
Nephew/niece of partner	80	7.890	175	9.388
Total [a]	1014	100.000	1864	100.000

Note: [a] The totals are higher than the number of ties with path length 2, since multiple relatives can form a link between the caregiver and care recipient. *Source:* Statistics Netherlands, 2009a, 2015.

Table A5. Average marginal effects for non-kin care ties' likelihood of having a path-length of 2, excluding care ties without a path length.

	Social care ties [a]		Long-term care ties [b]	
	AME [c]	SE	AME	SE
Female caregiver	0.0379	0.0663	0.0668	0.0492
Migration background caregiver	-0.1316	0.0727	-0.0674	0.0778
Age caregiver	-0.0095***	0.0014	-0.0090***	0.0012
Compensation above minimum wage	0.5016*	0.2371	0.0047	0.0491
Disposable income caregiver	-0.0007	0.0009	-0.0006	0.0008
Co-residing	0.0157	0.2135	0.1446	0.0790
Neighbors	0.0311	0.1573	0.5202*	0.2218
Living in same municipality	0.1924***	0.0492	0.1662***	0.0465
Female care recipient	0.1008	0.0593	-0.0454	0.0495
Migration background care recipient	0.1080	0.0731	-0.0013	0.0795
Age care recipient	0.0014	0.0027	0.0024	0.0024

Note: [a] $N = 330$; [b] $N = 437$; [c] AME = average marginal effect. *Sources*: Statistics Netherlands, 2009a, 2009b, 2009c, 2011, 2015, 2021, 2023a, 2023b.
Significance levels *$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.