Cooperation beyond consanguinity: Post-marital residence, delineations of kin, and social support among South Indian Tamils

Eleanor A. Power[1] & Elspeth Ready[2]

[1]Department of Methodology, London School of Economics and Political Science, Houghton Street, London, WC2A 2AE, UK

[2]Department of Human Behavior, Ecology and Culture, Max Planck Institute for Evolutionary Anthropology, Leipzig, 04103, Germany

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Abstract

Evolutionary ecologists have shown that relatives are important providers of support across many species. Among humans, cultural reckonings of kinship are more than just relatedness, as they interact with systems of descent, inheritance, marriage, and residence. These cultural aspects of kinship may be particularly important when a person is determining which kin, if any, to call upon for help. Here, we explore the relationship between kinship and cooperation by drawing upon social support network data from two villages in South India. While these Tamil villages have a nominally male-biased kinship system (being patrilocal and patrilineal), matrilateral kin play essential social roles and many women reside in their natal villages, letting us tease apart the relative importance of genetic relatedness, kinship, and residence in accessing social support. We find that people often name both their consanguineal and affinal kin as providing them with support, and we see some weakening of support with lesser relatedness. Matrilateral and patrilateral relatives are roughly equally likely to be named, and the greatest distinction instead is in their availability, which is highly contingent on post-marital residence patterns. People residing in their natal village have many more consanguineal relatives present than those who have relocated. Still, relocation has only a small effect on an individual's network size, as non-natal residents are more reliant on the few kin that they have present, most of whom are affines. In sum, marriage patterns have an important impact on kin availability, but the flexibility offered by the broadening of the concept of kin helps people develop the cooperative relationships that they rely upon, even in the absence of genetic relatives.

1 Introduction

Evolutionary ecology has a longstanding interest in the relationship between relatedness and cooperation [1]. Inclusive fitness theory suggests that the shared genetic material among

kin may facilitate altruism, because by helping a relative, an organism can increase its own fitness (i.e., the replication of its own genes) [2, 3]. Considerable research has found that consanguineal relatives, and especially close consanguineal relatives, are more likely to have cooperative ties with each other than with non-relatives [4–6]. In particular, the presence of female relatives has been shown to have a positive impact on female reproductive performance in numerous mammalian species, including non-human primates, providing diverse benefits such as coalitionary support, reduced stress, and improved offspring nutrition and survival [7].

While the benefits of support from relatives is straightforward, the actual availability of relatives is far more complicated. Sex-biased dispersal (where one sex leaves their natal territory) mitigates inbreeding and resource competition among relatives, but also shapes relatedness within local groupings. Female philopatry is the norm in mammals, possibly because foraging efficiency has a stronger impact on female reproductive success [8]. In primates, cooperative relationships are sometimes stronger in the non-dispersing sex, for example, among male chimpanzees [9, 10] and among females in matrilineal cercopithecines [11, 12]. Social bonds in the dispersing sex have been considered to be less developed, although they are not absent [13,14]. The consequences of dispersal in primates makes clear the importance of social systems for shaping individuals' prospects, strategies, and behaviour, especially in terms of cooperative alliances with kin.

In our own species, many societies have exogamous marriage practices that lead to one gender more consistently dispersing than the other. Such practices have the consequence that those who leave have few (or at least fewer) relatives present, while those who stay in place will be primarily surrounded by relatives from either the maternal or paternal side. Our unique life history pattern—especially our extended period of childhood dependency—means that women can particularly benefit from help during their reproductive years [15,16], and, across numerous cultural contexts, maternal relatives have been found to be particularly important for assisting women and their children [17]. Yet, cross-cultural data suggest that, in contrast to other mammals, in human societies it is most often women who leave their natal communities [18].

As dispersing individuals often join groups with fewer relatives, they may be at a disadvantage in terms of their ability to build cooperative relationships. However, cultural kinship systems, as an extension of relatedness, have the potential to ameliorate this disadvantage in several ways. First, one of the main features of human kinship systems is the extension of kinship to affinal kin, meaning in-laws [19–21]. Many affines share a real genetic stake in descendent generations, and so their fitness is in this sense interdependent [22–27]. Another common feature of human kinship systems is prescriptions for preferred marriage partners. Such preferences often have the effect of bringing more distant relatives back into the family fold (e.g., cross-cousin marriage), and mean that dispersing individuals may nevertheless find themselves in the presence of consanguines. In these ways, human kinship systems may facilitate the development of cooperative ties both within and beyond consanguineal relatives, ties that should perhaps be particularly important for the dispersing sex. However, kinship systems also divide, creating distinctions between categories of kin (e.g., matrilateral versus

patrilateral) and establishing normative obligations for particular types of kin relations. We expect that these cultural aspects of kinship that modify how people interact with all types of kin should have consequences for people's cooperative relationships, and ultimately for their reproductive success.

To explore how these various aspects of cultural kinship systems may differentially influence cooperation, we focus on the case of Tamil kinship. Dravidian kinship has long been seen as a particularly distinctive and complex form of kinship [28, 29], and one that has been argued to have important ramifications for regional demographic patterns. Tamils traditionally favoured close kin marriages, with preferential marriages commonly being between cross-cousins or between a maternal uncle and his niece [30]. Such marriages result in a tangling of kinship relations [31], and mean that many women continue to reside near their natal family after marriage. Consequently, many have argued that matrilateral relatives are often present and prominent providers of support for South Indian women, giving them greater autonomy and better health outcomes than women in other regions of India that have distinct marriage patterns [30, 32–38]. Tamils, then, nominally have patrilocal residence, but many women actually continue to reside in their natal place, and have patrilineal inheritance, but place a simultaneous emphasis on matrilateral relatives. Here, we attempt to use this variability to investigate how these aspects of kinship that extend beyond simple relatedness are associated with the support that people are able to call upon.

1.1 Hypotheses

Both the primate literature on sex-biased dispersal and the demographic work on marriage practices and village exogamy of India consistently emphasise that leaving the natal place entails leaving one's consanguineal relatives. This leads us to hypothesise that: (**Hypothesis 1**) People residing in their natal village after marriage should (a) have more consanguineal relatives present and (b) name more people as providing them with support, than those who are not in their natal village after marriage.

The hypothesised supportive advantage for natal residents rests on the grounds that consanguineal relatives should be more likely to offer support to one another than to non-relatives, because of inclusive fitness. This leads us to hypothesise that: (**Hypothesis 2**) Greater genetic relatedness should be associated with an increased likelihood of a supportive relationship.

Kinship systems further incorporate ties to unrelated individuals connected through bonds of marriage that lead to shared social, economic, and reproductive interests. Consequently: (**Hypothesis 3**) (a) Greater affinal relatedness should be associated with an increased likelihood of a supportive relationship. This should be especially so for non-natal residents if they have fewer consanguineal relatives (see Hypothesis 1a), in which case, (b) compared with natal residents, non-natal residents should name more of their spouse's consanguineal relatives as providing them with support.

We next consider whether people differentiate between their consanguineal relatives based on laterality. Despite being patrilineal, Tamils see relations with matrilateral relatives as being particularly affectionate and those with patrilateral relatives as being potentially con-

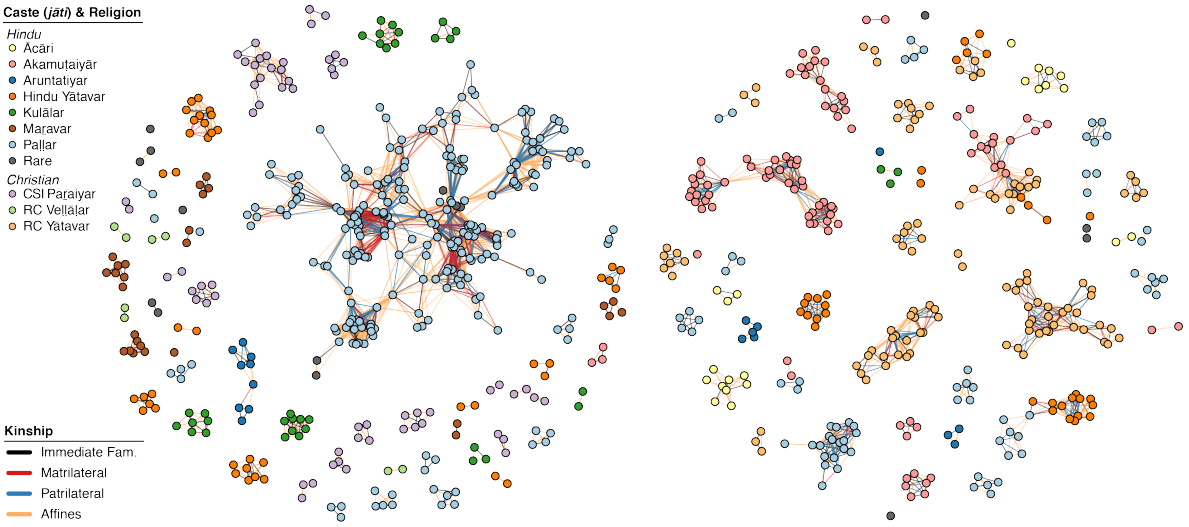

Figure 1: The kinship networks of Aḻakāpuram (left, N = 440) and Teṉpaṭṭi (right, N = 344). Nodes (individuals) are coloured by caste. Edges are coloured by the nature of the kinship relationship.

tentious, thanks in part to disputes over inheritance [39, 40]. Both these local conceptions of kinship and evolutionary research on kin support lead to the hypothesis that: (**Hypothesis 4**) Matrilateral relatives should be more likely to have supportive relationships with each other than patrilateral relatives.

Within the broad class of matrilateral relatives, the role of the mother's brother (the *tāymāmaṉ*) is particularly culturally salient. He has specific responsibilities at life cycle rituals and is understood to be someone whom one can ask things of freely [40, 41]. Tamil men are seen as having a duty to ensure the well-being of their sisters and their sisters' children [42]. Because of the strong sentiment within Tamil culture (and because of parallels to research showing the importance of the mother's brother in matrilineal [43] and in some other descent systems [Starkweather & Ahsan 2019, this volume]), we hypothesise that: (**Hypothesis 5**) Men should be especially likely to provide support to their sisters and their sisters' immediate family.

2 Materials and methods

To answer these questions, we draw on data gathered by the first author as part of ethnographic fieldwork conducted in two neighbouring villages in the Indian state of Tamil Nadu, "Aḻakāpuram" and "Teṉpaṭṭi" (both pseudonyms). Each village has roughly 400 adult residents, representing a mix of different caste and religious denominations (see Supplementary Section S1 for more details). Most engage in a mix of agricultural and wage labour, with a growing number seeking more skilled work, whether in a factory, shop, or office. Residents assist each other in many ways: working together in the fields, sharing news and employment

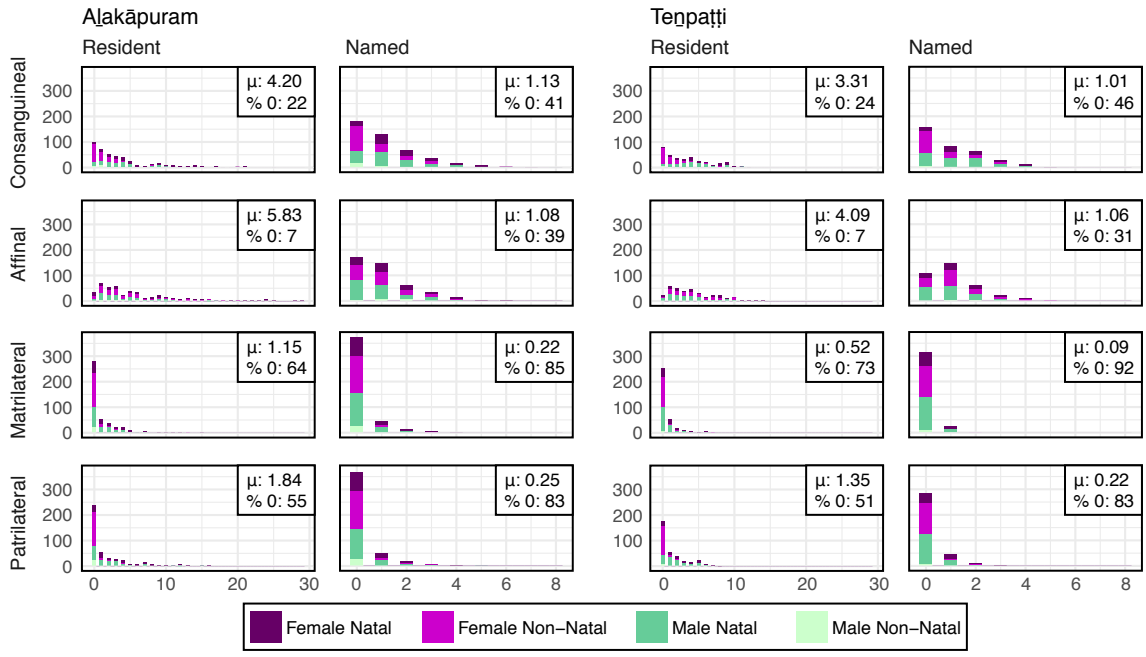

Figure 2: Distributions of the number of resident kin and of the number of kin named as providing support, for four groups of kin (consanguineal, affinal, matrilateral, and patrilateral) broken out by gender and natal/non-natal residency, for all survey respondents in Alakāpuram and Teṉpaṭṭi. Numbers in the upper right of the plots give the mean and percent of zeroes for the overall distribution in each plot.

opportunities, watching each others' children, sharing meals, etc. Whether kin, caste-mates, or simply neighbours, their assistance is crucial to each others' livelihoods [44].

2.1 Kinship Relations

Networks representing kinship relations between the residents of the villages are constructed based on data from a household census first conducted in 2011 and updated in 2017 (Figure 1, see Supplementary Section S2 for more details). While the resulting kinship network for Alakāpuram is dominated by one large component linking many of the Paḷḷar caste together, the distributions of kin are similar across the two villages. For example, the average coefficient of relatedness among survey respondents is quite comparable (0.0031 in Alakāpuram versus 0.0034 in Teṉpaṭṭi).

For Hypothesis 1, we use records of each person's marital status and *conta ūr*, their "natal place," to create a variable denoting whether people are living in their natal village or not. Across the two villages, almost all unmarried people (95%) are living in their natal village, and among those who have ever been married, 30% of women and 87% of men are living in their natal village. Histograms showing the number of kin of varying types that residents

(a) have residing in the same village, and (b) named as a source of support are provided in Figure 2.

For Hypothesis 2, we use records of people's parentage from our kinship data to calculate the estimated genetic relatedness between residents, dividing them into three groups: those with an approximate relatedness of 0.5 (or greater), 0.25 (to less than 0.5), and 0.125 (to less than 0.25). Because of potential issues of completeness, we only consider relatedness up to the 0.125 level.

For Hypothesis 3, we examine relationships with affines, both the relatives of spouses and the spouses of relatives, using a "affinal relatedness" coefficient, based on the estimated relatedness of the consanguineal relatives involved [23], divided into four groups: spouses (assigned an affinal relatedness of 1.0), followed by affines with an affinal relatedness of 0.5 (e.g., a brother- or daughter-in-law), 0.25 (e.g., a spouse's aunt or uncle), and 0.125 (e.g., a full cousin's spouse). Table S2 provides a full description of the individuals included in each category.

For Hypothesis 4, we disaggregate the genetic relatedness matrices into five groups: one consisting of immediate family (parents, children, full siblings), and four composed of matrilateral and patrilateral relatives, with estimated relatedness of 0.25 and 0.125.

For Hypothesis 5, we include additional terms for the support provided by people to their siblings and their siblings' immediate family. This includes not only a term for men's support of their sister and sister's immediate family, but for all combinations of sibling relationships.

2.2 Social Support Networks

The social support network is drawn from a survey conducted with the adult residents of the villages (N = 440, 97% in Alakāpuram and 344, 94% in Tenpaṭṭi) in September 2017 (see Supplementary Section S3 for more details). All interviewees provided oral consent. The survey consisted of several questions asking who they would turn to for different kinds of help, including getting a loan, borrowing household items, getting help with physical tasks, having convivial conversations, discussing important matters, and getting help finding work. While interviewees could name anyone, here we limit our focus to include only ties among survey respondents within each village, which constitute 65% of all nominations. For the questions studied here, interviewees named an average of seven other residents as providing them with support of some kind. These nominations are combined to create a network representing the flows of support between survey respondents (Figure 3), which comprise 3266 ties in Alakāpuram and 2474 ties in Tenpaṭṭi. We find that while kin are more likely to provide certain types of support, there are limited differences in which kin provide support of different types, so the aggregation of different support types should have a limited impact on our results (see Supplementary Table S5).

2.3 Data Analysis Methods

We construct a series of exponential random graph models, or ERGMs [45, 46], which allow us to model the probability of a support tie between two people, based on individual, dyadic,

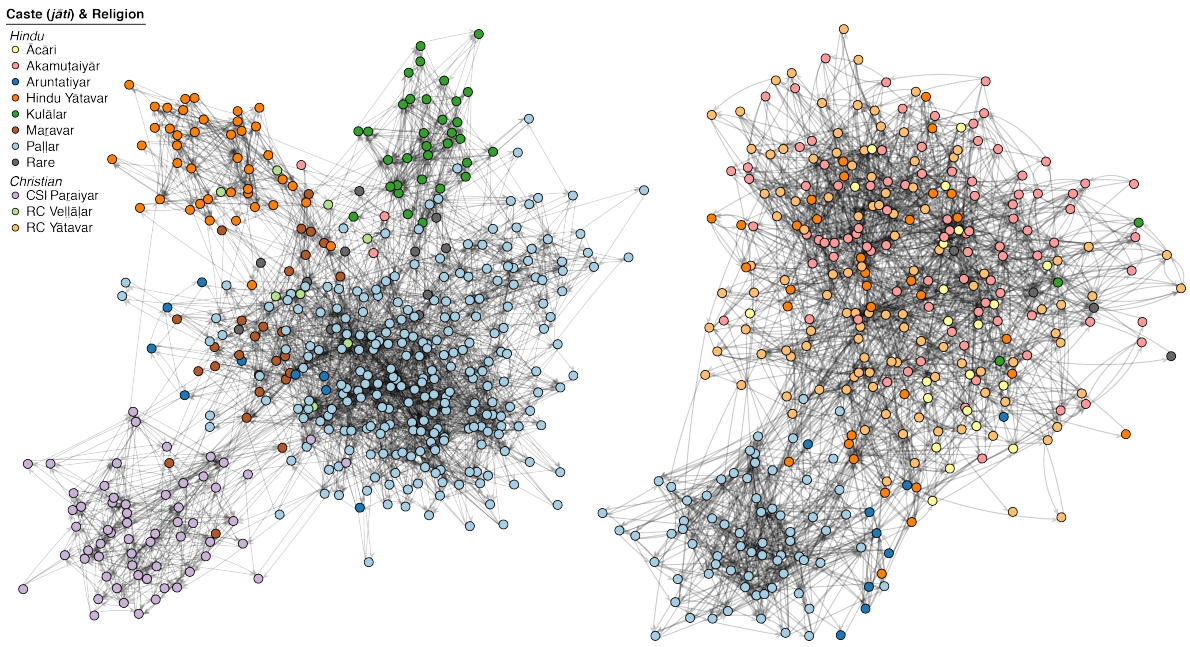

Figure 3: The social support networks of Aḷakāpuram (left, N = 440) and Teṉpaṭṭi (right, N = 344). Nodes (individuals) are coloured by caste. Edges are directed, with arrows pointing to the individual asked for support. Node position is determined by the Fruchterman-Reingold algorithm.

and structural terms, among which are terms representing the kinship relations between individuals (see Supplementary Section S4 for more details). To assess how residing in one's natal village (or not) shapes the assortment of kin present and overall access to support, we conduct a series of simple Poisson regressions which model the number of kin present. To assess how residence patterns shape the propensity to call upon those kin, we conduct a series of simple binomial regressions which model the proportion of available kin named as a source of help (see Supplementary Section S5 for more details). For these regressions, we include only people who have ever married, as we are interested in *post*-marital residence.

3 Results

3.1 Do people who live in their natal village after marriage have more kin present and greater support?

We find that people residing in their natal village after marriage have substantially more consanguineal relatives present than those who moved into the village (Table S10), and that they also report having more support ties overall (Table S11). However, the difference between (ever-married) non-natal and natal residents in the number of support ties is slight compared to the difference in the number of co-resident relatives that they have (Figures 4a and 4b). In Teṉpaṭṭi, for example, despite having substantially fewer consanguineal relatives (four fewer,

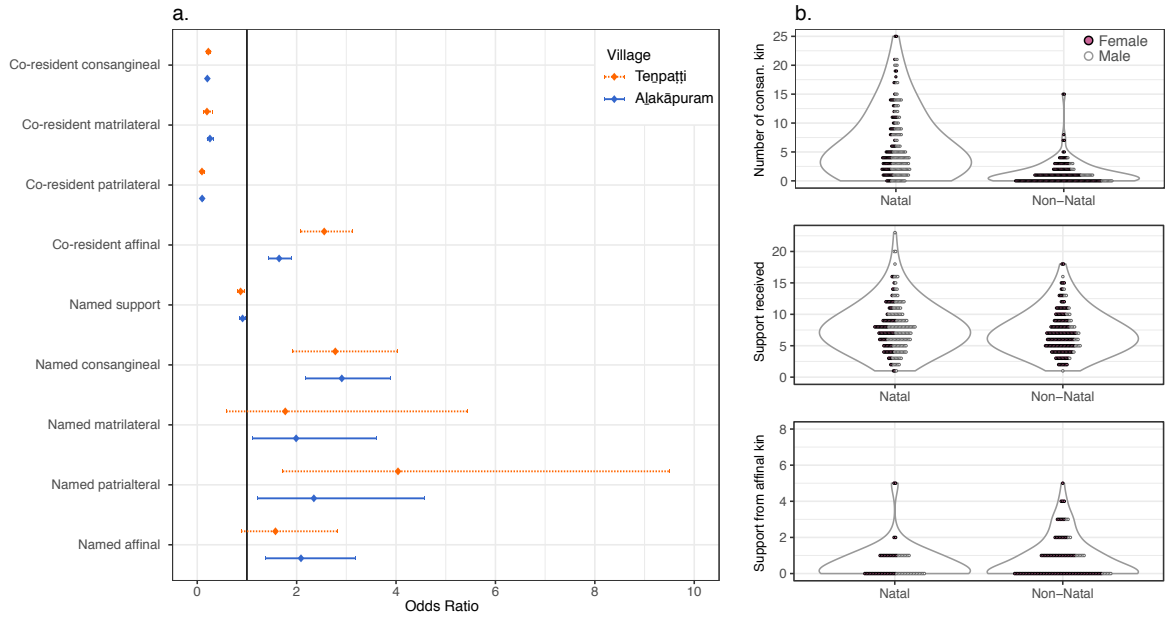

Figure 4: **a:** Odds ratios (with 95% confidence intervals) for natal versus non-natal ever-married residents of having relatives of various types residing in the same village ("co-resident" kin type), of having named others as support partners ("named support"), and of having named relatives of various types as support partners ("named" kin type), for each village, based on simple Poisson and binomial regressions (see Tables S10 and S11). **b:** Violin and dot plots showing the number of co-resident consanguineal relatives (top), named support partners (middle), and named affinal kin (bottom, specifically spouse's consanguineal relatives) for natal and non-natal ever-married residents of Aḷakāpuram.

on average), non-natal residents have only one less support tie in the village, on average.

In ERGMs that include terms for the likelihood of both incoming and outgoing support ties among natal and non-natal residents, we find a similar, small effect of being from elsewhere (Model 1 in Figure 5 and Tables S8 and S9). Overall, ever-married people (in their natal village or not) are more likely to be asked for help than unmarried people (who are almost exclusively living in their natal village). Predictions of the probability of a support tie between individuals based on this model show that, among ever-married people, non-natal residents have a lower probability of asking for support from natal residents than natal residents themselves. However, the magnitude of this difference is very slight (in both villages, a difference of roughly 0.5% in the probability of a tie: 4.0% vs. 3.5% in Aḷakāpuram; 5.2% vs. 4.7% in Teṉpaṭṭi).

3.2 Are kin in the village more likely to provide social support?

We first look solely at the role of genetic relatedness (Model 2 in Figure 5 and Tables S8 and S9). As expected, ERGMs show that consanguineal relatives are more likely to report

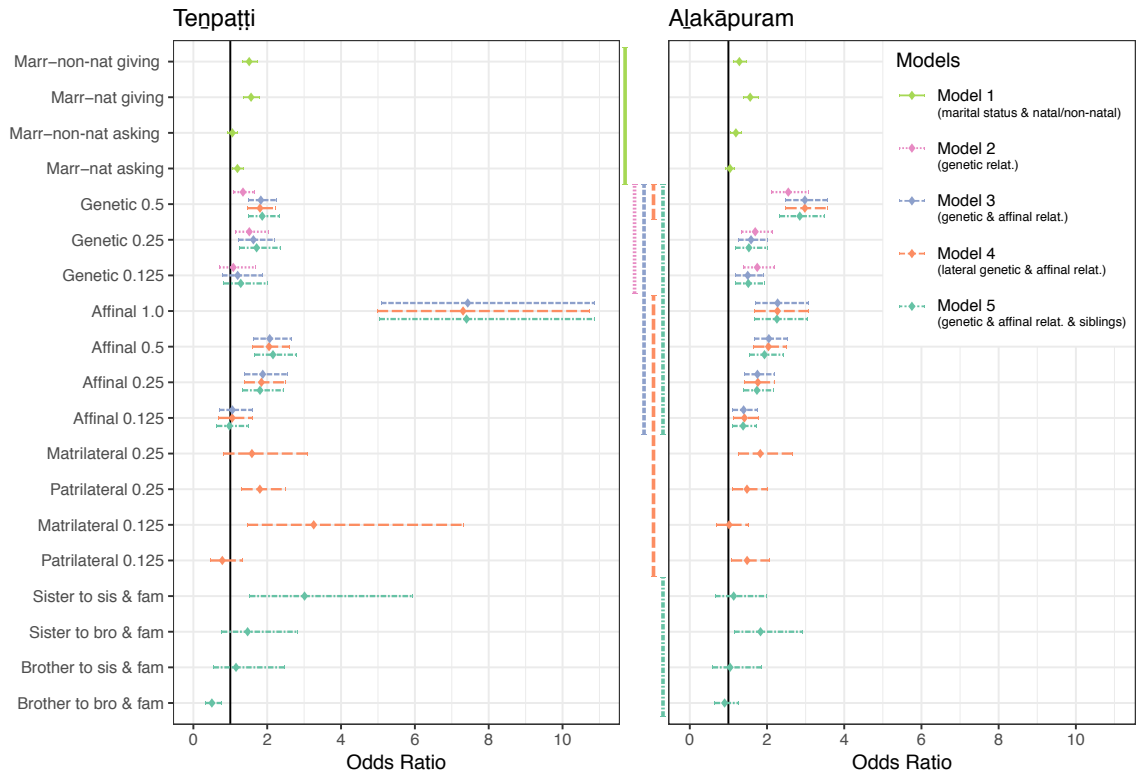

Figure 5: Odds ratios (with 95% confidence intervals) for the variables of interest across each of the main ERG models, for each village.

having supportive relationships with each other than with non-kin, however the attrition of support with lesser relatedness is not consistent in this model. Binomial regressions show that non-natal residents (who have fewer consanguineal relatives present) more readily call upon those relatives, if they have them, than natal residents (Figure 4a and Table S11).

We next add in model terms for affinal kin to the ERGMs, with terms for spouses and for affinal kin up to a relatedness of 0.125. Including these affine terms substantially improves model fit (Model 3 in Figure 5 and Tables S8 and S9) relative to the model with relatedness only. In both villages, there is a lower likelihood of support with more distant relatives (both for affines, and now also for consanguineal relatives), but the differences are not statistically significant. In the binomial regressions, we find that, in Aḷakāpuram, non-natal residents are more likely to name affines (specifically, their spouses' relatives) as providing them with support than natal residents (Figure 4a and Table S11). While this does not hold for Teṉpaṭṭi, the ERGMs suggest that more distant affinal kin (those with an affinal relatedness of 0.125, such as a spouses' cousins), are not more likely to be called upon than non-kin in this village. Accordingly, when only closer affines are considered, non-natal residents in both villages are more likely to call upon them for support than natal residents (Table S11).

3.3 Are matrilateral or patrilateral kin more likely to provide social support?

When we break out the relatedness matrix to distinguish between relatives who are matrilateral or patrilateral, we find no clear evidence of either side being consistently favoured (Model 4 in Figure 5 and Tables S8 and S9). Further, breaking out these groups results in almost no improvement to the model log-likelihood, so any difference between them explains relatively little variance in the data.

Binomial regressions show that, if they have them living in the village, non-natal residents are generally more likely than natal residents to call upon either matrilateral and patrilateral relatives (Figure 4a), although in Tenpaṭṭi, we do not find a significant difference between natal and non-natal residents for calling upon matrilateral relatives, likely due to low power. The fitted model probabilities for these regressions in Alakāpuram indicate that the overall probability of naming a matrilateral relative as a source of support is slightly greater than the probability of naming a patrilateral relative, for both natal and non-natal residents: Natal residents of Alakāpuram have a 16% chance of calling upon a matrilateral relative and a 12% chance of calling upon a patrilateral relative. For non-natal residents, their probabilities are 28% for matrilateral kin and 24% for patrilateral.

3.4 Is the mother's brother in particular more likely to provide social support?

To explore whether men are especially supportive of their sisters and their children, we run a final model (Model 5 in Figure 5 and Tables S8 and S9) that includes additional terms capturing relationships between co-resident siblings and their siblings' immediate families. Contrary to our expectations, we find that brothers are not more likely to be named as a source of support by their sisters and their sisters' immediate family. Instead, in Tenpaṭṭi, brothers are *less* likely to help their brothers and their brothers' immediate family, while sisters are more likely to help their sisters and their sister's immediate family, and in Alakāpuram sisters are more likely to help their brothers and their brother's immediate family. However, we note that some of these relationships are relatively rare, especially those with sisters (e.g., there are only 11 women with co-residing sisters in Tenpaṭṭi), so these results should be interpreted cautiously.

3.5 Factors beyond kinship

Finally, we make a few observations about the other covariates in our models and how they interact with kinship. Caste-based homophily is strong in these networks: within-caste support ties are 1.9 to 2.2 times as likely in Tenpaṭṭi and 2.4 to 3.0 times as likely in Alakāpuram (based on Model 3). Reciprocity and transitivity appear to be major features of the networks, and the coefficients for these terms remain relatively consistent across the models despite the addition of relatedness matrices that are symmetric and represent many transitive relationships. For this reason, the reciprocity observed in these networks appears not to be a simple side effect of more frequent interactions among kin (or even within castes).

4 Discussion

Our results suggest that whether consanguineal, affinal, matrilateral, or patrilateral, when someone is seen as kin, they are more likely to be named as providing support. Among those who are seen as kin, the ordering of relatedness terms (whether genetic or affinal) does suggest a lessening of support with more distant kin, as has been seen in many primates and in humans [11, 47], although the differences between the relatedness levels are generally not significant in our ERGMs. Instead, the clearer difference between the various categories of kin is in their availability, both generally, and for specific groups of people. Those residing in their natal village tend to have many more close consanguineal relatives present, and because of local marriage patterns, these tend to be patrilateral relatives. Those who are not residing natally—who are more often women—have many fewer consanguineal relatives to draw upon, and so rely more heavily on whichever kin are present, affinal or otherwise.

Through marriage and residence patterns, kinship systems structure which kin are most likely to be co-resident. Those residing in their natal village might seem to be at an obvious advantage with their greater reserve of relatives (as seen in many non-human primates), but we find that the flexibility that this extension of kinship permits means that even people with few relatives present are able to compensate in other ways: we find that affinal kin are an important source of support for residents, on par with consanguineal relatives. This is clearest for those who have left their natal village: even though they may have many fewer consanguineal relatives, the number of support ties they have within the village is quite similar to that of natal residents. This is at least in part because non-natal residents are more likely to call on whichever kin they have present, whether consanguineal or affinal. Practically, as they are less likely to have consanguineal relatives present, this means that non-natal residents are often more reliant on their affines.

Even the additional consanguineal relatives that natal residents have are not necessarily a boon; instead, they can be a source of potential conflict. If people are competing for scarce resources with their co-resident kin, they may be less inclined to assist one another [51, 52]. Where wealth is heritable, siblings may be in competition over inheritance (such as land) [53,54], uniquely creating competition among some kin, but not others. We see some evidence of this with the suggestion of aversion between brothers in Teṉpaṭṭi, who, in this context, are the group of siblings most likely to be in conflict over inheritance. Further, people are often understood to have a duty (as well as an incentive) to help their kin. When the obligations that are created through kinship ties go unfulfilled, it can lead to substantial tension. This holds especially for those relationships with the greatest expectations, such as a Tamil man's duty to look out for his sister's family, and potentially even to form marital alliances with her daughters (through his own marriage, or that of his sons). If these obligations are met, the relationship may be an especially close one; if not, it may be strained or even severed entirely [31, 40, 55]. Beyond the fundamental issue of low statistical power, such ambivalence might contribute to the null finding for our hypothesis (following Tamil valuations) that brothers should be a particularly important source of support for sisters and their families.

These different expectations for particular types of kin are closely linked to the distinctions

that kinship systems draw between groups of kin based on lines of inheritance and descent, most obviously between matrilineal and patrilineal kin. Despite being nominally patrilocal and patrilineal, we find matrilateral kin to be present relatively often (32% of people have at least one co-resident matrilateral relative). While we had expected that laterality might influence the propensity of kin to provide support, we instead find no strong evidence of greater solicitude from matrilateral than patrilateral relations in either village. Instead, in agreement with our findings for affinal kin, the particular category of kin involved does not seem to be especially important in structuring these dyadic support ties. Still, the fact that we observe essentially bilateral support is in some sense surprising, given that this is a male-biased kinship system. While in this setting there may be a bias towards males in inheritance and the reckoning of descent, supportive relationships with matrilateral relatives continue to be important. So, while these delineations of kin may help organise some cultural practices (such as inheritance), they do not imply that relationships with kin from either side are neglected or negligible [50].

While we have so far emphasised the distinctions between matrilateral and patrilateral relatives and between consanguineal and affinal relatives, it is important to note that these categories are often merged within persons. Close kin marriages, for example, inherently entail some relatives becoming affines as well as consanguines, and such entanglements regularly occur even without such prescriptions (as when two sisters marry two brothers). Such layering of kinship relations should presumably result in yet stronger relationships between multiply articulated kin.

Not only can these multiple categories of kinship strengthen bonds between relatives, but they may also broaden who counts as kin. In this setting, members of the same caste are often seen as an extended group of relations (*contam*), both colloquially and in actuality, as caste endogamy means that caste-mates are often distantly related by blood and/or by marriage. Not surprisingly, then, in all of our models, caste homophily has a large positive effect, with people being roughly twice as likely to have a supportive relationship if they are of the same caste. In other settings (e.g., [48–50]), cultural kinship and extended kinship groups have been shown to be particularly helpful for coordination and cooperation. Overall, this suggests that kinship systems can substantially increase the pool of potential partners that a person has to call upon [19, 20].

Finally, while kin are clearly important, we should not forget that the majority of supportive partners are neither close consanguineal nor close affinal kin (out to our relatedness thresholds of 0.125). As our ERGMs show, and as the large literature on cooperation also establishes [56], there are other foundations on which to build cooperative relationships. Some of these mechanisms, such as direct reciprocity, rest on direct, rather than indirect, fitness benefits, and reciprocity is one of the largest predictors of a tie in our ERGMs. When people are of the same caste, have shared partners, or live near one another, they are again more likely to have a supportive relationship. Each of these factors may lead to recurrent interactions between people, such that supporting a person now may lead to future benefit, whether it is directly reciprocated or not. Importantly, all of these other mechanisms may also be at

work among kin, who are almost always of the same caste, share many common connections, and live close to one another. Kinship systems, then, may produce favourable conditions that promote cooperation not only through inclusive fitness, but also through these other mechanisms, the effects of which are difficult to disentangle.

Through these analyses, we have started to explore how kinship helps predict the presence or absence of supportive relationships between residents, but future work could extend our analyses in a number of important ways. First, we have yet to explore how kinship may influence not just the existence of a supportive relationship, but also its strength, tenor, and substance. It is particularly those relationships that are strong, stable, and emotionally supportive that may be most crucial for success [57,58], so determining how kinship interacts with relationship quality may give a better sense of the various benefits of kinship. Future work could also focus on how kinship might differentially structure distinct types of supportive ties. Second, given the nature of our data, we have specifically modelled who people say they turn to for support. Data showing the actual provisioning of support or the decision to provide it might reveal important divergences from our findings, potentially highlighting conflicts between kin [59]. Third, we limited our analyses to relationships within the village, but it is clear that relationships—especially those with kin—extend far beyond its boundaries; indeed, the ability to maintain ties across time and space crucially distinguishes humans from other primates [19]. Future work should explore how people's reliance on such relationships varies between individuals and between settings (e.g., with residence, across the age course, or in stable or stochastic environments). Fourth, we have truncated our measures of relatedness (both genetic and affinal) at 0.125, and found that kin with a relatedness of 0.125 are not consistently more likely to provide support than non-kin. To better establish how cooperative relationships may decrease with greater kinship distance, calculations of relatedness might need to be extended to include more distant relatives. Work could also move closer to a full evaluation of inclusive fitness by creating calculations of shared stake in future generations, which importantly erases some of the distinction between consanguines and affines [22,23,26]. Finally, more research remains to be done on how different mechanisms (e.g., inclusive fitness, direct and indirect reciprocity, mutualism) combine to enable cooperation among kin; and we have only begun to investigate how cultural notions of kinship may further complicate or facilitate these dynamics. Already, it is clear that understanding the importance of kin to cooperation in both male- and female-biased kin systems requires examining relationships with all types of kin, for different types of help, and at different scales of cooperation.

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Ethics

The fieldwork was approved by the Human Subjects Institutional Review Boards of Stanford University and the University of Cincinnati.

Data Access

Those interested in accessing the anonymised data should contact the first author. R code is available through GitHub: https://github.com/eapower/Kinship

Author Contributions

E.A.P. collected the data, designed the research, analysed the data and wrote the paper. E.R. designed the research, analysed the data and wrote the paper.

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Supplementary Information for:
"Cooperation beyond consanguinity: Post-marital residence, delineations of kin, and social support among South Indian Tamils"

Eleanor A. Power & Elspeth Ready

S1 Background Information

The first author has been conducting fieldwork in "Alakāpuram" and "Tenpaṭṭi" since 2011. While some basic demographic information was originally gathered in 2011, the material studied here is primarily based on fieldwork conducted between July and September 2017. The villages are connected by bus to nearby market towns, as well as to the city of Madurai. Residents of these villages mostly engage in a mix of agriculture and wage labour work, although with growing educational attainment and increasing mobility, younger people are often now aspiring to more skilled work. Most young people now complete secondary school, and many continue on to pursue diploma courses or bachelor degrees. They hope for work as line workers and mechanics in factories, as electricians, as shop workers in retail, as employees at private businesses, as teachers, as government officers, etc. Young men often also go to work abroad, working as drivers, construction workers, etc. Older residents continue to work planting and harvesting (on their own fields, as well as those of others), doing construction work, cutting wood for coal, making bricks, etc. In general, both men and women actively contribute earnings to their households.

Though neighbouring one another and similar in size, the caste and religious composition of the two villages differs somewhat (Supplementary Table S1). Scheduled Castes include Aruntatiyar, Paḷḷar, and CSI Paṟaiyar; all other castes are Backward Castes. The Akamuṭaiyār, Maṟavar, and Kaḷḷar castes are the three branches of the Tēvar community. Protestants here (all Church of South India) are of the Paṟaiyar caste, and Roman Catholics (RC) are either Veḷḷāḷars (in Alakāpuram) or Yātavars (in Tenpaṭṭi). While the village of Tenpaṭṭi comprises one contiguous settlement, Alakāpuram has two distinct hamlets outside the main village, one occupied almost exclusively by the CSI Paṟaiyar residents, and one occupied exclusively by Hindu Yātavars.

Most households are relatively small, consisting of two to four members, including one or two adults. Residence is generally patrilocal, and inheritance (especially of land) is generally patrilineal, meaning that extended families (related patrilineally) often reside near one another in the villages. Often, women do in some sense receive some of their parents' land, but only insofar as land is sold to buy gold for a daughter's marriage (women are rarely given the land outright). Broadly speaking, newly married couples establish their own household, often near the husband's parents. However, women are expected to return to their natal village and their mother's home to give birth, and reside there for some time before and after the birth. This is especially the case for a woman's first birth, but is also expected for subsequent ones. This practice continues today, although births take now place in hospitals (for this population, generally government hospitals), and additional pre- and post-natal care is provided by government health and creche workers. Hospital and health officials often work to promote "family planning" (generally sterilisation or an IUD) following delivery, and the vast majority of women in these villages now undergo "family planning" after their second or third child.

Over the past several decades, Tamil Nadu—and all of South Asia—has undergone substantial socioeconomic and demographic shifts that are impacting family composition. The wider region of South Asia has seen a substantial fall in mortality and fertility rates since the 1970s, with South India and Tamil Nadu being at the forefront [1–3]. This is certainly reflected in Alakāpuram and Tenpaṭṭi, where women are now having fewer children over a shorter reproductive period, thanks to a delay of first birth (and of marriage) and to a foreshortening of reproduction as a result of family planning initiatives [4]. Due to the sizeable generational shifts in completed family size, and to the fact that we only have measures of current, not past, social relationships, we do not currently have data that would appropriately evaluate the fitness consequences of relationships with kin and others.

Most household property is usually amassed at marriage, when a new house is constructed, and furniture, appliances, and other household items are purchased. Here we use a measure of household wealth based on property holdings, as reported by female heads of household (save for the rare cases when there is no female head, in which case the male head of household was queried) in September 2017. This measure approximates the monetary value of all of the property of the household (house and facilities, land holdings, vehicles, livestock, furniture, kitchen implements, cell phones, etc.). Full calculations can be found in R code files available through GitHub: https://github.com/eapower/Kinship.

Broadly, Tamils distinguish between *contam* and *anniyam*: "own" and "that which is not one's own," or more generally, relatives and non-relatives. Tamil kin terminology is reckoned according to four basic classifiers [5]: gender, generation, birth order, and what could be called "crossness." Gender differentiates sons from daughters, and the like. Generations differentiate children, parents, grandparents, etc. Birth order, or age more generally, differentiates younger from older: there is no single term for "sister" or "brother" in Tamil, but instead only *elder* or *younger* sister, brother, uncle, etc. Finally, "crossness" differentiates "parallel" from "cross," with the former being relations linked through the parents' same-gendered siblings (mother's sisters and father's brothers) and the latter being relations linked through the parents' opposite-gendered siblings (mother's brothers and father's sisters). Parallel cousins are seen as siblings (and are unmarriageable), while cross cousins are seen as potential marriage partners. Preferential marriages among Tamils are generally for a man to marry his elder sister's daughter (so for a woman to marry her mother's younger brother) or for cross-cousin marriages, with a man marrying either his father's sister's daughter (so, for a woman to marry her mother's brother's son) or his mother's brother's daughter (so, for a woman to marry her father's sister's son) [6]. Tamils draw further distinction between consanguineal and affinal kin, although kinship terms do not always distinguish these. This is partially because the preference for marrying close kin means that affines and consanguines can become merged. So, for example, *attai* can be used (and translated) as either aunt (more specifically, father's sister) or mother-in-law (the former typically consanguineal relatives, the latter typically affinal; but embodied in the same person in the case of a marriage between a man and his father's sister's daughter). And finally, there is the further distinction of matrilateral and patrilateral relatives. In general laterality is not reflected in kinship terms (so, for example, the terms for grandparents are generally interchangeable), although it is in some specific instances (e.g., the mother's brother can be called not simply *māmaṉ* (uncle), but *tāymāmaṉ* (literally, mother uncle)). Note that for the analyses here, we put most of these distinctions to the side. We do not formally consider birth order, generation, or "crossness" when constructing terms. Gender and age are, however, included as independent terms. Our main focus here is on the

broader distinction between consanguineal and affinal relatives, and on matrilateral versus patrilateral kin.

The changes to health, reproduction, and fertility that South Asia has experienced in the preceding generations have had a significant impact on the composition of families and the presence of kin: the small nuclear family, rather than the traditional large joint family, is increasingly the norm, and people now have many fewer kin than they would have had 50 years ago [7]. These demographic changes have been accompanied by larger socioeconomic shifts in India, with industrialisation, urbanisation, the expansion of higher education opportunities, and increasing integration into the global economy. These, too, have changed family composition, as, for example, when labour migration results in nuclear families being distant from kin or in women returning to reside in their natal village while their husbands work abroad. There are also current shifts in marriage practices. First, there is a growing expectation of dowry for women, and this has grown rapidly in these communities, from a simple set of gold earrings and nose ring to many sovereigns (*pavuṉ*) of gold jewellery costing many tens of thousands of Indian Rupees [4]. Second, the traditional favouring of close kin marriages is becoming less of a default, and there is instead a growing preference for "stranger marriages" [8, 9]. Collectively, this situation of flux means that we have substantial variation in marriage partners, post-marital residence, and co-resident kin in these villages. As Guilmoto recently noted [7]:

> The combination of slowly declining numbers of multigenerational households and the reduction in the average number of children [in India] is resulting in a rapid reduction in the number of close family members, and it is not yet clear how this will impact current modes of sociability and their potential extension toward other family members (including affines), caste fellows, neighbours, friends and colleagues. (32)

We hope that this article can be a first attempt at evaluating the current state of sociality in Tamil Nadu, given all of these changes.

	Aḻakāpuram			Teṉpaṭṭi		
	Households	Residents	Adults	Households	Residents	Adults
Caste (*jāti*)						
Ācāri	0	0	0	12	28	24
Akamuṭaiyār	1	3	3	38	119	97
Aruntatiyar	4	13	9	6	16	11
Hindu Veḷḷāḷar	1	2	2	1	1	1
Hindu Yātavar	21	55	46	15	55	36
Īḷavar	1	4	2	0	0	0
Jāṉāṉ	1	4	4	0	0	0
Kaḷḷar	0	0	0	2	5	3
Kulālar	11	48	33	1	6	3
Maṟavar	12	40	27	0	0	0
Paḷḷar	107	344	252	35	101	76
Paṇṭāram	1	2	2	0	0	0
CSI Paṟaiyar	25	87	61	0	0	0
Piḷḷamār	2	2	2	0	0	0
Catholic Veḷḷāḷar	4	11	9	0	0	0
Catholic Yātavar	0	0	0	44	160	114
Reservations						
Scheduled Castes	136	444	322	41	117	87
Backward Castes	55	171	130	113	374	278
Religion						
Hindu	162	517	382	110	331	251
Roman Catholic	4	11	9	44	160	114
Protestant (CSI)	25	87	61	0	0	0
Total	191	615	452	154	491	365

Table S1: The number of households (N = 345), residents (N = 1106), and adult residents (N = 817) of Aḻakāpuram and Teṉpaṭṭi, broken down by caste and religious denomination. This is a full accounting of all residents of the villages, and so includes persons who did not complete the social support survey. The Paḷḷar caste is often also referred to as Tēvēntira (Devendra), and three caste groups recorded as distinct here form a larger caste community: the Akamuṭaiyār, Kaḷḷar, and Maṟavar groups are collectively called Tēvar (also called the Mukkulattōr).

S2 Kinship Network Data

In census data gathered by the first author in 2011, household heads described not only the kinship relationships among household members, but also among all of their descendants (so, including children and grandchildren and their family, even if not resident in the village). They also reported the kinship relationships between members of their household and other village residents (so, siblings and other kin in other households). Kinship ties were again elicited in 2017, to supplement and update this earlier record. At that time, household heads were asked to report the parents and grandparents of all household members. When this was not fully known, respondents were prompted to identify any relatives present in the village, up to the level of cousins. Despite these extensive records, there are almost assuredly to be some missed relationships in our records here, which means that (1) in our analyses, we limit ourselves to include only relatedness to 0.125, as we cannot be confident in our coverage of more distant relatives, and (2) we assume that our measures of relatedness are a lower bound.

Plots of the kinship networks (Figure 1) suggest considerable differences in the overall network structure between the two villages, with Aḷakāpuram being dominated by a primary component connecting most of the Paḷḷar residents, and Teṉpaṭṭi being defined by a number of smaller components, with some connected by inter-caste marriages (which, it should be noted, often means ostracism and the severing of any social ties). However, residents of the two villages are actually quite comparable in the assortment of kin they are surrounded by (see Figure 2). The impact of the large Paḷḷar component in Aḷakāpuram seems to primarily result in a few individuals having a large number of consanguineal relatives.

For the ERGMs (discussed further in Section S4), we construct a series of matrices that represent different types of kinship relations between residents (see Table S2 for a summary of the matrices).

First, we create genetic relatedness matrices (used in Models 2, 3, and 5) that represent the estimated coefficients of relatedness between the residents of each village, truncated at $r = 0.125$. The values in these matrices were calculated using the pedigree function in the **kinship2** package in R, which draws of a list recording the mother and father of each individual. We use these values to define three different matrices, capturing the different coefficients of relatedness: *Genetic 0.5*, *Genetic 0.25*, and *Genetic 0.125*. We use these three values as the cut-offs, so the 0.5 matrix includes connections of 0.5 or above (because of some close kin marriages, a very small number of siblings in Aḷakāpuram have relatedness values of 0.625), the 0.25 matrix includes connections from 0.25 to under 0.5, and the 0.125 matrix includes connections from 0.125 to under 0.25. These are binary matrices, so all values within those ranges are recoded to 1.

In Models 3, 4, and 5, we include matrices for different types of affines with affinal relatedness of 1, 0.5, 0.25, and 0.125. We use the estimated genetic relatedness of the linking spouse to calculate affinal relatedness (as is suggested by Hughes [10], see also [11]), essentially scaling with the shared genetic interest in future generations, simply being one degree further removed than genetic relatedness (i.e., halved once again). For example, a man's genetic relatedness to his sister's children is 0.25. We might expect his interest in those children's father (his brother-in-law) to then scale with that value. The affinal kinship value we assign between a man and his brother-in-law is 0.5 (as the linking spouse is the sister), double that of 0.25. To create these matrices, we first identified all spousal and consanguineal relationships between everyone in our database up to an estimated relatedness of 0.125, using the same list

of parents that generated the relatedness matrix above, with the programme Descent [12]. We then excluded spousal connections if the relevant couple was separated or divorced, and we included spousal connections if the relevant couple was married but childless. With this long list of relationships in hand, we then went about identifying the associated affinal relationships. Affines can be of two broad types: consanguineal relatives's spouses, and spouse's consanguineal relatives. We identified both, and created undirected matrices representing each set. Finally, we combine them, so that we consider all affines together. In some cases, people are connected in multiple ways (e.g., for a woman whose son marries her husband's sister's daughter, her daughter-in-law is also her niece-in-law). In these situations, we represent their relationship as that affinal relationship that is the closest. As with the genetic relatedness matrices, the affinal relatedness matrices are undirected (so, e.g., have a edge both from a woman to her daughter-in-law, and from that daughter-in-law to her mother-in-law).

Spouses, with an affinal relatedness of 1, comprise the *Affinal 1.0* matrix. The immediate family of spouses (parents and siblings) and sibling's spouses comprise the second matrix (*Affinal 0.5*), with an affinal relatedness of 0.5. *Affinal 0.25* comprises spouses' consanguineal relatives and consanguineal relatives' spouses with a relatedness of 0.25; practically, this amounts to affinal aunts and uncles (spouses' parents' siblings, and parents' siblings' spouses). (Note that we are not including spouses' parents' siblings' spouses, as they would essentially be "double" affines; we also do not include step-parents or other step-relations). Finally, *Affinal 0.125* comprises spouses' consanguineal relatives and consanguineal relatives' spouses with a relatedness of 0.125 (primarily spouses' cousins and cousins' spouses).

In Model 4, the genetic relatedness matrices are essentially divided into five distinct matrices: the *Genetic 0.5* matrix is carried over, but subsequent ones are defined by laterality: *Matrilateral 0.25*, *Patrilateral 0.25*, *Matrilateral 0.125*, and *Patrilateral 0.125*. The values for these matrices are in most cases equivalent to those values in the genetic relatedness matrices (see further clarification below). Matrilateral 0.25 includes consanguineal relatives through the mother with an expected coefficient of relatedness of 0.25: mother's parents, mother's siblings (full or half). Half siblings who share a mother are also included in this matrix. Matrilateral 0.125 includes consanguineal relatives through the mother with an expected coefficient of relatedness of 0.125: mother's grandparents (so, great-grandparents), mother's siblings' children (cousins), and mother's parent's siblings (great aunts/uncles). Patrilateral 0.25 and Patrilateral 0.125 include the same set of consanguineal relatives as for matrilateral matrices, but instead related through the father. For the matrilateral and patrilateral matrices, we assign values using not the relatedness matrices, but the expected relatedness based on the category of the relationship considered. We do this because in some cases, people are connected *both* matrilaterally and patrilaterally. For example, for the children of a woman who married her maternal uncle, their mother's mother is also their father's sister (their maternal grandmother is also their paternal aunt). To capture the varying closeness of those relationships, we therefore use the expected relatedness based on the relationship (using Descent) to define the matrilateral and patrilateral matrices (which, in this example, would both be 0.25), rather than the "actual" relatedness between those particular individuals. This has the effect of essentially breaking out the extent to which two people are matrilateral versus patrilateral relatives. In some cases, this also has the effect of "rounding down" relatedness: as the example above shows, two people may be more closely genetically related than a single one of their kinship relationships implies. As a consequence of this, there are some edges in the genetic relatedness matrices that are not included in either the matrilateral or patrilateral

matrices, as their one-sided kinship relationships would imply relatedness of less than 0.125, but their genetic relatedness is estimated to be 0.125 (and so within the cutoff for the Genetic 0.125 matrix, but not so for the other matrices). Similarly, there may be some cases where genetic relatedness is greater than the category (0.125, 0.25, 0.5) in which the relationship is included. These matrices are again undirected, meaning that they include edges both from a person to his/her (e.g.) mother's brother, as well as from that mother's brother to the (in this case) sister's child. When these matrices are included in the ERGMs, then, we are agnostic about the direction of support (we expect both that a father might report that his daughter supports him, and that a daughter might report that her father supports her).

In Model 5, we include four matrices that capture the support provided by siblings: *Sister to Sister & Family*, *Sister to Brother & Family*, *Brother to Sister & Family*, and *Brother to Brother & Family*. With these matrices, we are interested in whether people are particularly likely to help their siblings and their siblings' immediate family. More specifically, we expect brothers to be especially likely to help their sisters and sisters' children and spouses. While all other matrices included so far have been symmetric and undirected (we have been interested only in how a relationship status, e.g., parent-child, influences the likelihood of support, not whether it is parents helping children or children helping parents), these are not. Here instead we construct each matrix to only include flows of support from (1) women to their sisters and their sisters' immediate family, (2) women to their brothers and their brothers' immediate family, (3) men to their sisters and their sisters' immediate family, and (4) men to their brothers and their brothers' immediate family. (These can include half siblings). However, it is important to note that as the networks that we are modelling are actually of who people *request* support from, the matrices that we include in the ERGMs are actually the transpose of these, with ties from the nominator to the person who is being named as providing support. So, for example, within the Brother to Sister & Family matrix we would be including edges from a niece to her mother's brother, as this would mean that the mother's brother is providing help to his sister's daughter. We do *not* include the tie in the opposite direction, because a niece helping her mother's brother does not fit within the relationships of interest here.

Finally, in the regression models, we include four counts of kin: *Consanguineal*, *Matrilateral*, *Patrilateral*, and *Affinal*. Consanguineal is a simple tally of all of the consanguineal relatives (up to a estimated coefficient of relatedness of 0.125) that a person has in the village. For this and the other regressions here, this counts kin only among those residents who completed the support survey (so, e.g., resident children are not included). The Matrilateral and Patrilateral counts are similarly defined. The Affinal count here is intended to specifically measure affines who would be expected to be available to non-natal residents living in the natal village of their spouse, meaning the consanguineal relatives of their spouse. Consequently, in this case we tally the number of co-resident spouses' kin for each resident. In the analyses, we include both the overall count of available kin in each category, and also the count of those people in each category who are actually named by the individual as providing him/her with support. Histograms showing the overall counts of available kin are shown in Figure 2 in the main text. Table S3 reports the mean number of available kin of each type, as well as the percent of people who have no relatives of that type present in the village. Note that these histograms and the table include all survey participants, while the regressions include only those who have ever been married. Distributions for ever-married people only are presented in Figures S2 and S3.

Matrix	Sym?	Models	# Edges		Relationships Included
			Ala.	Ten.	
Genetic 0.5	Yes	2, 3, 4, 5	694	550	All consanguineal relatives with an estimated coefficient of relatedness of 0.5 or higher
Genetic 0.25	Yes	2, 3, 5	528	368	All consanguineal relatives with an estimated coefficient of relatedness of 0.25 to less than 0.5
Genetic 0.125	Yes	2, 3, 5	624	220	All consanguineal relatives with an estimated coefficient of relatedness of 0.125 to less than 0.25
Affinal 1.0	Yes	3, 4, 5	274	204	Current spouses
Affinal 0.5	Yes	3, 4, 5	598	446	Spouses' close family (parents and full siblings), and spouses of full siblings
Affinal 0.25	Yes	3, 4, 5	812	425	Spouses' grandparents, aunts and uncles, nieces and nephews, half siblings; spouses of aunts/uncles, nieces/nephews, half-siblings, and grandchildren
Affinal 0.125	Yes	3, 4, 5	882	304	Spouses' great-grandparents, great-aunts/uncles, great-nieces/nephews, and cousins; spouses of great-aunt/uncles, great-nieces/nephews, cousins, and great-grandchildren
Matrilateral 0.25	Yes	2, 3, 5	210	100	Consanguineal maternal relatives including grandparents with grandchildren, aunts and uncles with nieces/nephews
Matrilateral 0.125	Yes	2, 3, 5	294	78	Consanguineal maternal relatives including great-aunts/uncles with great-nieces/nephews, great-grandparents with great-grandchildren, and cousins
Patrilateral 0.25	Yes	2, 3, 5	316	258	Consanguineal paternal relatives including grandparents with grandchildren, aunts and uncles with nieces/nephews
Patrilateral 0.125	Yes	2, 3, 5	494	206	Consanguineal paternal relatives including great-aunts/uncles with great-nieces/nephews, great-grandparents with great-grandchildren, and cousins
Sis to Sis & Fam	No	5	86	46	Sisters (half/full) and their spouse & children
Sis to Bro & Fam	No	5	161	81	Brothers (half/full) and their spouse & children
Bro to Sis & Fam	No	5	126	66	Sisters (half/full) and their spouse & children
Bro to Bro & Fam	No	5	282	230	Brothers (half/full) and their spouse & children

Table S2: Description of kinship matrices included in the ERGMs. The sibling matrices represent the sister or brother being named as providing support to their sibling and his/her family. "Sym" refers to whether the matrix is symmetric.

	Alakāpuram								Tenpaṭṭi							
	F Nat N = 96		F NoNat N = 156		M Nat N = 160		M NoNat N = 28		F Nat N = 62		F NoNat N = 127		M Nat N = 145		M NoNat N = 10	
	μ	%0	μ	%0	μ	%0	μ	%0	μ	%0	μ	%0	μ	%0	μ	%0
Support	7.48	0	6.98	0	7.76	0	7.75	0	7.31	0	6.84	1	7.57	1	5.50	0
Resident Consan.	6.81	4	1.37	46	5.86	8	1.43	32	5.19	2	1.09	50	4.65	6	0.30	70
Resident Aff.	7.46	12	5.29	6	5.64	6	4.29	4	4.77	11	4.17	5	3.72	8	4.20	0
Resident Matri.	1.89	48	0.50	85	1.45	49	0.46	86	0.95	53	0.17	92	0.68	63	0.00	100
Resident Patri.	3.20	28	0.34	87	2.77	34	0.21	89	2.32	27	0.20	90	2.03	25	0.00	100
Named Consan.	1.59	20	0.63	61	1.46	30	0.46	64	1.61	21	0.51	69	1.26	34	0.20	80
Named Aff.	1.26	32	1.14	38	0.86	48	1.43	18	1.06	31	1.13	26	0.95	37	1.60	20
Named Matri.	0.39	77	0.13	90	0.24	82	0.07	96	0.18	82	0.04	98	0.10	90	0.00	100
Named Patri.	0.32	75	0.08	95	0.42	74	0.04	96	0.45	63	0.08	94	0.26	79	0.00	100

Table S3: The mean number & the percent of respondents with zero: (1) support partners, (2-5) kin of different types resident in the village, and (6-9) kin of different types named as sources of support, broken out by gender and natal/non-natal residency, for all survey respondents in Alakāpuram and Tenpaṭṭi. We present the mean, despite these being count variables, as the number of relatives available and named are right-skewed, with zero often being the mode and median (see Figure 2 in the main text). Consanguineal relatives combines Genetic 0.5, 0.25, and 0.125; Affinal relatives combines Affinal 1.0, 0.5, 0.25, and 0.125; Matrilateral relatives combines Matrilateral 0.25 and 0.125; Patrilateral relatives combines Patrilateral 0.25 and 0.125 (see Table S2). "Nat" means "natal" and "NoNat" means "non-natal," "F" means Female and "M" means Male.

S3 Social Support Network Data

Social support network surveys were conducted with all available adult residents (788 individuals, 96% of the 817 residents age 18 and older) in Aḷakāpuram (97%) and Teṉpaṭṭi (94%) in 2017. The majority of the 29 individuals not surveyed were not included because while they may technically they live in the village, practically they do not. For example, a number of "residents" actually reside at or near their place of work, and return only occasionally to their official residence. As a complete network is required for the ERGMs, the networks analysed here are reduced to only those who completed the survey. Surveys were conducted by research assistants employed by the Chella Meenakshi Centre for Educational Research and Services, who were trained in administering the survey by the first author and CM Centre employees. All interviewees provided oral consent, and the survey project was approved by Human Subjects Institutional Review Board of the University of Cincinnati.

The social support network questions were name generators for which respondents were able to name as many individuals as they liked for each support type. The survey was developed and conducted in Tamil. The text of all of the questions used to generate the support networks examined here is included in Figure S1. In practice, ten lines for responses were included on the form (filled out by the interviewer), but additional names were written if named by the respondent. After each prompt had been answered, the interviewer then made further inquiries about each of the people mentioned. For nominated individuals who lived in the village (and their immediate families), full demographic data had already been gathered as part of the household survey, so the unique identifier for that person was recorded. For individuals not included in the demographic census, the interviewee reported the gender, age, place of residence, employment, and caste of that person, as well as their kinship relationship with that person, whether they had a fridge and/or motor vehicle, and whether they were an important person of high position (*mukkiya patavi vakippavar*).

12 name-generators were asked of the interviewees, but not all are included in the analyses conducted here. First, we excluded two questions because they were "double sampled," i.e., those questions where we asked people about who they *provided* support to, after having asked them who they requested it from. For consistency with the other questions (which ask only about requesting support), these were excluded from the networks. Second, we excluded some questions based on the gender of the respondent. To align with a comparative research project that helped fund this fieldwork, two sets of questions asked interviewees to think not only of themselves, but of other household members, divided by gender. To construct these networks, we exclude those answers given for the question aimed at the opposite gender of the interviewee (so, for male interviewees, we exclude the answers they gave to the questions about who supports the women in their household, and for female interviewees, we exclude the answers they gave about the men in their household). Third, we exclude two questions which are primarily aimed at eliciting relationships outside the village (one asking about government officials, NGO employees, and others of "high position" who could assist the person, and one asking about people in distant cities or abroad who could assist the person).

For the questions included here (and censored as described) the 788 interviewees reported a total of 14,289 ties, linking together 3,124 people through 9,365 directed edges. Here, a directed edge from one individual to another represents the former naming the latter as providing him/her with some form of social support. People named an average of 12 people a total of 18 times (as people could be named repeatedly, in response to each question). For

all analyses here, this larger network is reduced down to include only ties between people who completed the survey. In this reduced network, each resident named an average of 7 other survey respondents. Network summary statistics of the reduced networks studied here are presented in Table S4. Table S5 shows the interaction between support and kinship, presenting both the proportion of support ties (for the merged support network, and for each constituent support type) provisioned by kin of various types, as well as the proportion of kin of various types named as providing each type of support. Networks were created in R using the **igraph** package (version 1.2.1) [14] and the **statnet** suite of packages [15].

1. If you had an unexpected emergency expense, such as a hospital medical treatment, from whom could you get a loan of 2000 Rs or more? [a weeks wages]
1. உங்களுக்கு எதிர் பாராத அவசர தேவைகள் ஏற்பட்டால், உதாரணமாக, மருத்துவ சிகிச்சைக்கு – நீங்க யார்கிட்ட குறைந்த பட்சம் ரூ இரண்டாயிரம் அல்லது அதற்கும் மேலே கடனாக வாங்க முடியும்?

3. For your basic essentials such as rice, sugar, oil and other groceries and household needs, who could you immediately ask and get?
3. எப்பொழுதாவது, உங்களுக்கு தேவையான வீட்டு உபயோக பொருட்களை உதாரணமாக சோறு, சீனி, அரிவாள், தீப்பெட்டி மாதிரி, யாரிடம் கேட்டு வாங்கிக்குவீங்கா?

5/6. For you and/or the other women/men in your household, who happily helps you with tasks [question in Tamil implies physical assistance]
5. உங்களுக்கும், உங்க வீட்டுலே மத்த பெண்களுக்கும்/ஆண்களுக்கும் தோழமையோடு உழைத்து கூட மாட காரியங்கள் செய்றவங்க யார் யார்?

7/8. For you and/or the other women/men in your household, who do you happily and casually have conversations with?
7. நீங்களும் இந்த வீட்டு மத்த பெண்களும்/ஆண்களும் உங்களுக்குள்ளே, நிறையநேரம் சந்தோஷமா, ஜாலியா பேசிக்கிறது யாரோட?

11. If you wanted to discuss important and confidential matters, who would you talk to?
11. நீங்கள் உங்களுடைய முக்கியமான விஷயங்களை பேச விரும்பினால் யாரிடம் பேசுவீர்கள்?

12. If you needed more or new wage work or a salaried job, who could you ask for help finding it?
12.உங்களுக்கு நாள் கூலி வேலை அல்லது சம்பளத்துக்கு புதிய வேலை கிடைக்க வேண்டுமென்றால் அணுகக்கூடிய நபர்கள் யார்?

Figure S1: The survey questions (in English and Tamil) used to elicit the support relationships under study.

	Alakāpuram	Tenpaṭṭi
Nodes	440	344
Edges	3266	2464
Nominations	5566	3780
Mean Degree	7.423	7.192
Mean Strength	12.650	10.988
Density	0.017	0.021
Reciprocity	0.306	0.305
Transitivity	0.220	0.197
Average Path Length	4.016	3.766
Diameter	9	10
# of Respondents with Out-Degree=0	0	2
# of Respondents with In-Degree=0	14	7

Table S4: Summary statistics of the networks for Alakāpuram and Tenpaṭṭi.

	Proportion of Support Type				Proportion of Kin			
	Consan.	Aff.	Matri.	Patri.	Consan.	Aff.	Matri.	Patri.
Alakāpuram								
Overall	0.15	0.15	0.03	0.03	0.27	0.19	0.19	0.14
Loan	0.18	0.14	0.03	0.04	0.11	0.06	0.08	0.05
Borrow Basics	0.10	0.12	0.03	0.03	0.07	0.06	0.07	0.05
Tasks	0.16	0.14	0.04	0.04	0.09	0.05	0.07	0.04
Conversation	0.16	0.11	0.02	0.04	0.09	0.04	0.05	0.05
Important Matters	0.31	0.25	0.05	0.05	0.13	0.08	0.07	0.04
Find Work	0.07	0.08	0.02	0.01	0.01	0.01	0.01	0.00
Tenpaṭṭi								
Overall	0.14	0.15	0.01	0.03	0.31	0.26	0.17	0.16
Loan	0.18	0.12	0.01	0.03	0.12	0.07	0.06	0.05
Borrow Basics	0.08	0.11	0.01	0.03	0.06	0.07	0.06	0.06
Tasks	0.15	0.14	0.01	0.04	0.09	0.07	0.04	0.06
Conversation	0.13	0.11	0.01	0.03	0.08	0.06	0.03	0.04
Important Matters	0.31	0.35	0.02	0.03	0.16	0.15	0.06	0.04
Find Work	0.04	0.05	0.00	0.01	0.01	0.01	0.00	0.01

Table S5: Interaction of the types of assistance included in the support network (see Figure S1) and different categories of kin: consanguineal, meaning all relatives with an estimated genetic relatedness of 0.125 or greater (Genetic 0.5, 0.25, and 0.125); affinal, including spouses and all in-laws with an estimated affinal relatedness of 0.125 or greater (Affinal 1.0, 0.5, 0.25, and 0.125); matrilateral and patrilateral, including consanguineal maternal or paternal relatives with a relationship implying a relatedness of 0.125 or 0.25 (Matrilateral 0.25 and 0.125 and Patrilateral 0.25 and 0.125). The left-hand columns show the proportion of support ties given by each category of kin, while the right-hand columns show the proportion of kin named as giving each support type (i.e., 18% of all loan-givers are consanguineal kin, while 11% of all consanguineal kin are named as loan-givers).

S4 ERG Models

Exponential random graph models (ERGMs) were conducted in R version 3.5.1 [13] using the **statnet** suite of packages [15], primarily the **ergm** package (version 3.8.0). Model selection followed guidelines laid out in Refs. [16] and [17]. The control variables included were selected using ethnographic intuition, as well as model information criteria. Model fit was evaluated by consulting AIC and BIC values, as well as MCMC diagnostic plots and goodness-of-fit plots showing the correspondence between summary statistics of networks simulated by the model and the actual observed network. For all models reported here, we use an MCMC sample size of 100,000 with a burn-in of 50,000 and an interval of 10,000.

Basic descriptions of the variables used in the ERGMs are included in Table S6 and descriptive statistics are included in Table S7. The household census provides us with information on residents' age, gender, marital status, caste, education, local leadership positions, and natal village, as well as the location of each household, and a basic inventory of household property, all of which are considered in some form in the ERGMs. Structural control terms (reciprocity and geometrically-weighted edgewise shared partnerships, or GWESP) are included both because reciprocity and transitivity were expected to be strong structuring forces, and because of their improvement to the model fit. The GWESP term accounts for the effect of the number of partners held in common by two connected individuals, making it possible to model whether "friends of friends" are more likely to have a connection [18]. The alpha value for the GWESP term is determined for each model through iterative fitting of the network object using the base model, settling on the one that results in the lowest AIC value for the network.

We first consider residence (Model 1), and then turn to relatedness and kinship (Models 2 - 5). Descriptions of the various kinship terms included in Models 2 - 5 are presented above in Section S2, and summarised in Table S2. We note that we do not consider the natal variables in the later models with relatedness because of the high correlation between these terms.

When we present fitted tie probabilities in the results, we calculate them for two people of the Hindu Yātavar caste, with a combined age of 70, the same level of education, a distance of roughly 150 m (5 with the transformation) between their households, an average wealth (3.6 with the transformation) for the incoming tie, and one shared partner. Unless specified otherwise, we consider two individuals of the same gender.

Variable	Term type	Description
Age	Node covariate	The person's age.
Gender Mix	Edge term	Whether two people are the same gender (the reference category) or different genders, distinguishing between when men name women and when women name men as providing support.
Same Caste	Edge term	Whether two people are of the same caste.
Caste	Node factor	The person's caste. This includes religious denomination, so, e.g., Catholic and Hindu Yātavars are distinct castes. In each village the reference category consists of the rare castes (all castes with fewer than 9 adult members).
Difference in Years of Education	Edge term	The absolute difference in the total number of years of education.
Household Wealth	Node in-covariate	The log-transformed ($log(x+1)$) monetary value of the person's household's property, in 10,000 rupee (approximately $150) units.
Ever Committee Member	Node in-factor	Whether the person has ever held a position in the informal village committee or the local panchayat.
Distance between Houses	Edge term	The log-transformed ($log(x+1)$) distance (in metres) between peoples' houses.
Reciprocity	Edge term	Whether adding a tie between two people creates a reciprocal tie.
Shared Partners	Edge term	Geometrically-weighted edge-wise shared partners (GWESP).
Marital and Residence Status	Node in-factor	Whether a person is unmarried (the reference category) or ever-married and non-natal or ever-married and natal. This terms models the effect of this status on giving support.
Marital and Residence Status	Node out-factor	As above, but this term models the effect of this status on asking for support.
Genetic 0.5	Edge term	Ties with consanguineal relatives with an estimated relatedness of 0.5 or higher.
Genetic 0.25	Edge term	Ties with consanguineal relatives with an estimated relatedness of 0.25 to less than 0.5.
Genetic 0.125	Edge term	Ties with consanguineal relatives with an estimated relatedness of 0.125 to less than 0.25.
Affinal 1.0	Edge term	Ties with current spouses.
Affinal 0.5	Edge term	Ties with affines with an affinal relatedness of 0.5.
Affinal 0.25	Edge term	Ties with affines with an affinal relatedness of 0.25.
Affinal 0.125	Edge term	Ties with affines with an affinal relatedness of 0.125.
Matrilateral 0.25	Edge term	Ties with matrilateral relatives with an est. relatedness of 0.25.
Matrilateral 0.125	Edge term	Ties with matrilateral relatives with an est. relatedness of 0.125
Patrilateral 0.25	Edge term	Ties with patrilateral relatives with an est. relatedness of 0.25
Patrilateral 0.125	Edge term	Ties with patrilateral relatives with an est. relatedness of 0.125
Sister to Brother & Family	Edge term	Ties representing sisters being named as helping their brothers and brothers' immediate family.
Sister to Sister & Family	Edge term	Ties representing sisters being named as helping their sisters and sisters' immediate family.
Brother to Brother & Family	Edge term	Ties representing brothers being named as helping their brothers and brothers' immediate family.
Brother to Sister & Family	Edge term	Ties representing brothers being named as helping their sisters and sisters' immediate family.

Table S6: Description of the variables used in the exponential random graph models. Node terms reflect the impact of a person's (node's) attributes on the probability of a support tie (an edge). "In" refers to terms that affect incoming ties (meaning, whether people name that person as providing them with support), and "out" refers to terms that affect outgoing ties (meaning, whether a person names others). Terms without the "in" or "out" qualifier include effects of the variable on both incoming and outgoing ties. Edge terms capture the effect of some kind of relationship between two people (a dyad) on the probability of a tie. Covariates are numeric predictors while factors are categorical. See Table S2 for more details on the various kinship matrices.

Variable	N	Mean ± SD	Median	Min	Max	# of Levels
Aḷakāpuram						
Age	440	44.44 ± 14.92	44	18	76	–
Gender	440	252 F, 188 M				2
Caste	440	–				13
Household Wealth (in 10000 INR)	440	71.35 ± 68.02	52.98	0.24	300.26	–
Years of Education	440	5.40 ± 5.14	5	0	16	–
Ever Committee Member	440	43 Yes, 396 No				2
Marital and Residence Status	440	5 UM, 52 UN, 179 EM, 204 EN				4
Household Distance (in metres)	193600	325.35 ± 258.97	265.37	0	1113.47	–
Teṉpaṭṭi						
Age	344	45.90 ± 16.77	46	18	76	–
Gender	344	189 F, 155 M				2
Caste	344	–				9
Household Wealth (in 10000 INR)	344	55.10 ± 58.83	36.21	0.23	455.22	–
Years of Education	344	6.15 ± 5.24	5	0	16	–
Ever Committee Member	344	21 Yes, 323 No				2
Marital and Residence Status	334	0 UM, 54 UN, 137 EM, 153 EN				3
Household Distance (in metres)	118336	107.85 ± 56.22	103.04	0	308.00	–

Table S7: Descriptive statistics of the variables used in the models. “U” means unmarried, “E” means ever-married, “N” means natal, “M” means migrant, so non-natal. “F” means female, and “M” means male.

	Base	Model 1	Model 2	Model 3	Model 4	Model 5
Edges	−0.796***	−0.983***	−1.129***	−1.346***	−1.347***	−1.324***
	(0.134)	(0.141)	(0.137)	(0.143)	(0.142)	(0.143)
Age	−0.003***	−0.005***	−0.003***	−0.003***	−0.003***	−0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Male names Female	−0.422***	−0.374***	−0.439***	−0.495***	−0.495***	−0.501***
	(0.044)	(0.047)	(0.044)	(0.046)	(0.046)	(0.046)
Female names Male	−1.044***	−1.116***	−1.052***	−1.121***	−1.120***	−1.116***
	(0.053)	(0.056)	(0.054)	(0.056)	(0.056)	(0.056)
Same Caste (No = 0)	0.907***	0.918***	0.950***	0.984***	0.986***	0.981***
	(0.058)	(0.058)	(0.057)	(0.058)	(0.058)	(0.058)
Caste: Rare	[ref: Akamuṭaiyār, Īḷavar, Jāṇāṉ, Paṇṭāram, Piḷḷamār, Veḷḷāḷar]					
Caste: Aruntatiyar	−0.368***	−0.325***	−0.411***	−0.436***	−0.430***	−0.431***
	(0.080)	(0.083)	(0.081)	(0.082)	(0.082)	(0.083)
Caste: Hindu Yātavar	−0.561***	−0.576***	−0.587***	−0.609***	−0.609***	−0.606***
	(0.051)	(0.051)	(0.050)	(0.051)	(0.051)	(0.051)
Caste: Kulālar	−0.452***	−0.465***	−0.478***	−0.509***	−0.510***	−0.506***
	(0.053)	(0.053)	(0.052)	(0.053)	(0.053)	(0.053)
Caste: Maṟavar	−0.328***	−0.349***	−0.368***	−0.399***	−0.400***	−0.398***
	(0.056)	(0.057)	(0.055)	(0.057)	(0.057)	(0.057)
Caste: Paḷḷar	−0.710***	−0.724***	−0.754***	−0.786***	−0.787***	−0.784***
	(0.049)	(0.049)	(0.048)	(0.050)	(0.049)	(0.049)
Caste: Paṟaiyar	−0.579***	−0.584***	−0.599***	−0.620***	−0.621***	−0.619***
	(0.050)	(0.050)	(0.049)	(0.050)	(0.049)	(0.050)
Difference in Years of Education	−0.029***	−0.026***	−0.033***	−0.031***	−0.031***	−0.031***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Household Wealth (log)	−0.023†	−0.015	−0.022†	−0.023†	−0.023	−0.025*
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.012)
Ever Committee Member (No = 0)	0.434***	0.405***	0.392***	0.379***	0.379***	0.385***
	(0.042)	(0.045)	(0.042)	(0.042)	(0.042)	(0.042)
Distance Between Houses (log)	−0.591***	−0.600***	−0.521***	−0.460***	−0.460***	−0.465***
	(0.014)	(0.014)	(0.015)	(0.016)	(0.016)	(0.017)
Reciprocity	1.009***	1.025***	0.887***	0.803***	0.803***	0.808***
	(0.078)	(0.079)	(0.080)	(0.083)	(0.083)	(0.083)
Shared Partners (GWESP, $\alpha = 0.4$)	0.964***	0.941***	1.014***	1.045***	1.045***	1.042***
	(0.027)	(0.027)	(0.028)	(0.029)	(0.029)	(0.029)
Unmarried Giving			[reference category]			
Married Non-Natal Giving		0.250***				
		(0.068)				
Married Natal Giving		0.447***				
		(0.065)				
Unmarried Asking			[reference category]			
Married Non-Natal Asking		0.177**				
		(0.061)				
Married Natal Asking		0.040				
		(0.059)				
Genetic 0.5			0.937***	1.092***	1.092***	1.047***
			(0.094)	(0.093)	(0.094)	(0.105)
Genetic 0.25			0.527***	0.461***		0.426**
			(0.120)	(0.123)		(0.138)
Genetic 0.125			0.558***	0.406**		0.416**
			(0.116)	(0.125)		(0.126)
Affinal 1.0 (Spouse)				0.822***	0.820***	0.814***
				(0.154)	(0.155)	(0.154)
Affinal 0.5				0.717***	0.711***	0.660***
				(0.109)	(0.109)	(0.117)
Affinal 0.25				0.561***	0.567***	0.553***
				(0.114)	(0.112)	(0.113)
Affinal 0.125				0.332**	0.348**	0.323**
				(0.120)	(0.119)	(0.120)
Matrilateral 0.25					0.602**	
					(0.196)	
Patrilateral 0.25					0.393*	
					(0.158)	
Matrilateral 0.125					0.019	
					(0.210)	
Patrilateral 0.125					0.395*	
					(0.169)	
Sister to Sister & Family						0.128
						(0.287)
Sister to Brother & Family						0.605*
						(0.240)
Brother to Sister & Family						0.042
						(0.297)
Brother to Brother & Family						−0.103
						(0.177)
AIC	21884.499	21814.587	21751.972	21667.499	21672.154	21667.676
BIC	22057.410	22028.183	21955.398	21911.609	21936.607	21952.471
Log Likelihood	−10925.249	−10886.293	−10855.986	−10809.749	−10810.077	−10805.838

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{\dagger}p < 0.10$

Table S8: Stepwise ERGM results for Aḻakāpuram. See Table S6 for details on terms. Numbers in parentheses are standard errors for the coefficient estimates.

	Base	Model 1	Model 2	Model 3	Model 4	Model 5
Edges	−0.679***	−0.916***	−0.792***	−1.394***	−1.372***	−1.354***
	(0.166)	(0.177)	(0.171)	(0.171)	(0.173)	(0.174)
Age	−0.003***	−0.006***	−0.003***	−0.003***	−0.003***	−0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Male names Female	−0.566***	−0.626***	−0.567***	−0.684***	−0.682***	−0.690***
	(0.052)	(0.059)	(0.052)	(0.055)	(0.055)	(0.056)
Female names Male	−1.189***	−1.170***	−1.192***	−1.372***	−1.370***	−1.355***
	(0.065)	(0.070)	(0.065)	(0.072)	(0.072)	(0.073)
Same Caste (No = 0)	0.762***	0.781***	0.748***	0.698***	0.697***	0.702***
	(0.040)	(0.041)	(0.040)	(0.040)	(0.040)	(0.040)
Caste: Rare	[ref: Hindu Veḷḷāḷar, Kaḷḷar, Kulālar]					
Caste: Ācāri	−0.324***	−0.276***	−0.322***	−0.295***	−0.294***	−0.290***
	(0.065)	(0.068)	(0.064)	(0.061)	(0.062)	(0.063)
Caste: Akamuṭaiyār	−0.473***	−0.472***	−0.481***	−0.466***	−0.466***	−0.464***
	(0.059)	(0.061)	(0.058)	(0.054)	(0.055)	(0.056)
Caste: Aruntatiyar	−0.241**	−0.240**	−0.247**	−0.232**	−0.233**	−0.237**
	(0.076)	(0.077)	(0.075)	(0.071)	(0.074)	(0.074)
Caste: Hindu Yātavar	−0.322***	−0.328***	−0.335***	−0.340***	−0.340***	−0.329***
	(0.059)	(0.062)	(0.059)	(0.056)	(0.057)	(0.057)
Caste: Paḷḷar	−0.516***	−0.485***	−0.522***	−0.489***	−0.489***	−0.486***
	(0.058)	(0.061)	(0.057)	(0.053)	(0.054)	(0.055)
Caste: RC Yātavar	−0.533***	−0.515***	−0.539***	−0.516***	−0.518***	−0.517***
	(0.058)	(0.061)	(0.057)	(0.053)	(0.054)	(0.055)
Difference in Years of Education	−0.038***	−0.032***	−0.040***	−0.035***	−0.035***	−0.036***
	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Household Wealth (log)	0.016	0.032*	0.017	0.028†	0.028†	0.027†
	(0.016)	(0.016)	(0.015)	(0.015)	(0.015)	(0.015)
Ever Committee Member (No = 0)	0.356***	0.315***	0.345***	0.311***	0.315***	0.326***
	(0.059)	(0.061)	(0.058)	(0.057)	(0.057)	(0.058)
Distance Between Houses (log)	−0.661***	−0.674***	−0.632***	−0.513***	−0.517***	−0.517***
	(0.017)	(0.018)	(0.019)	(0.021)	(0.021)	(0.021)
Reciprocity	0.876***	0.875***	0.843***	0.682***	0.677***	0.680***
	(0.096)	(0.096)	(0.098)	(0.102)	(0.102)	(0.102)
Shared Partners (GWESP, $\alpha = 0.4$)	0.998***	0.972***	1.016***	1.094***	1.093***	1.092***
	(0.031)	(0.031)	(0.031)	(0.031)	(0.032)	(0.031)
Unmarried Giving		[reference category]				
Married Non-Natal Giving		0.413***				
		(0.073)				
Married Natal Giving		0.447***				
		(0.071)				
Unmarried Asking			[reference category]			
Married Non-Natal Asking		0.055				
		(0.068)				
Married Natal Asking		0.177**				
		(0.064)				
Genetic 0.5			0.296**	0.603***	0.590***	0.623***
			(0.108)	(0.106)	(0.107)	(0.118)
Genetic 0.25			0.415**	0.486**		0.538**
			(0.153)	(0.153)		(0.164)
Genetic 0.125			0.078	0.182		0.249
			(0.228)	(0.227)		(0.232)
Affinal 1.0 (Spouse)				2.006***	1.989***	2.001***
				(0.195)	(0.196)	(0.196)
Affinal 0.5				0.726***	0.718***	0.768***
				(0.127)	(0.126)	(0.134)
Affinal 0.25				0.631***	0.612***	0.590***
				(0.155)	(0.154)	(0.156)
Affinal 0.125				0.055	0.052	−0.024
				(0.219)	(0.220)	(0.224)
Matrilateral 0.25					0.461	
					(0.342)	
Patrilateral 0.25					0.589***	
					(0.165)	
Matrilateral 0.125					1.182**	
					(0.413)	
Patrilateral 0.125					−0.244	
					(0.278)	
Sister to Sister & Family						1.102**
						(0.348)
Sister to Brother & Family						0.385
						(0.334)
Brother to Sister & Family						0.144
						(0.392)
Brother to Brother & Family						−0.691**
						(0.219)
AIC	16601.090	16543.945	16593.146	16451.691	16446.466	16434.364
BIC	16765.622	16747.191	16786.714	16683.972	16698.104	16705.359
Log Likelihood	−8283.545	−8250.972	−8276.573	−8201.845	−8197.233	−8189.182

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{\dagger}p < 0.10$

Table S9: Stepwise ERGM results for Teṉpaṭṭi. See Table S6 for details on terms. Numbers in parentheses are standard errors for the coefficient estimates.

S5 Regression Models

We present two sets of regression models examining the relationship between dispersal, the presence of co-resident kin, and support ties. Models were conducted using the glm function in R. In the first set of models (Table S10), we use Poisson regressions to compare whether residents who are living in their natal village have more kin present than non-natal residents, examining all consanguineal relatives, as well as matrilateral, patrilateral, and affinal kin (specifically, spouse's consanguineal relatives). In the second set of models (Table S11), we examine whether natal and non-natal residents differ in terms of their overall number of support ties (using a Poisson regression) and in terms of which kin they receive support from (using binomial regressions). In all of these models, we consider only individuals who have ever been married, as unmarried individuals do not have affines of this type and are almost all living in their natal village. Figure 2 in the main text shows histograms of the number of kin available and the number of kin named for each of the four categories of kin for all survey participants (including unmarried people). Figures S2 and S3 show violin and dot plots with the distributions for only those ever-married individuals (those included in the regressions).

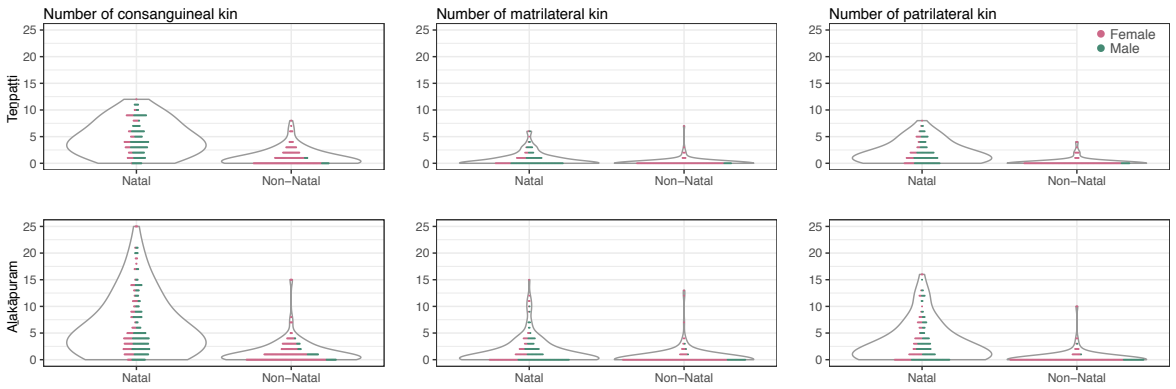

Figure S2: Violin and dot plots showing the number of consanguineal relatives (left), number of matrilateral relatives (centre), and number of patrilateral relatives (right), for ever-married residents broken out between those who are living in their natal village and those who have migrated to it, for each village.

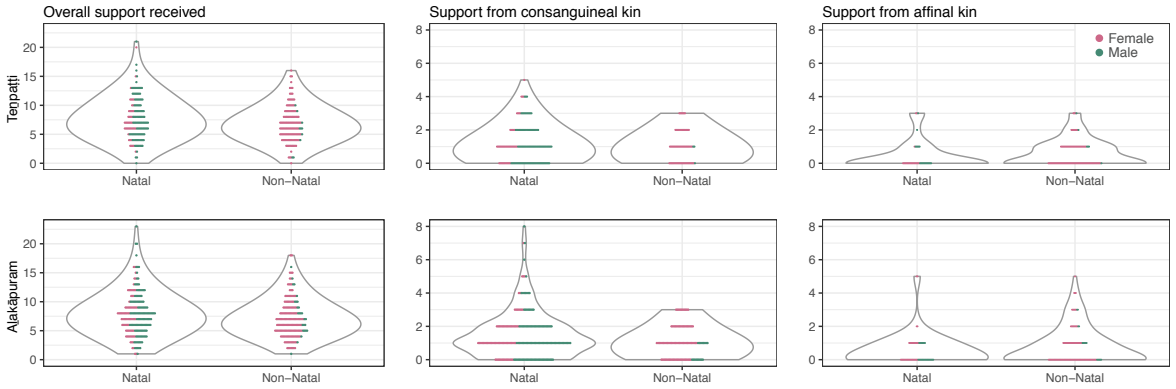

Figure S3: Violin and dot plots showing the number of support ties (left), number of support ties from consanguineal relatives (centre), and number of support ties from spouse's consanguineal relatives (right), broken out between those who are living in their natal village and those who have migrated to it, for each village. The plots for support from consanguineal and affinal kin include only individuals who have any of those kin present to call upon.

	Teṉpaṭṭi	Aḷakāpuram	Teṉpaṭṭi	Aḷakāpuram
	Consanguineal		Affinal	
Intercept	1.536^{***}	1.832^{***}	-0.148	0.453^{***}
	(0.038)	(0.028)	(0.087)	(0.056)
Residence (Natal=0)	-1.500^{***}	-1.594^{***}	0.938^{***}	0.499^{***}
	(0.092)	(0.072)	(0.104)	(0.073)
Null deviance	970.373	2080.750	911.969	1753.201
Deviance	616.234	1405.764	823.462	1704.959
Num. obs.	290	383	290	383
	Matrilateral		Patrilateral	
Intercept	-0.243^{**}	0.453^{***}	0.693^{***}	1.136^{***}
	(0.091)	(0.056)	(0.057)	(0.040)
Residence (Natal=0)	-1.633^{***}	-1.364^{***}	-2.355^{***}	-2.316^{***}
	(0.237)	(0.130)	(0.204)	(0.141)
Null deviance	451.973	1113.370	700.201	1633.647
Deviance	385.693	973.740	452.221	1133.707
Num. obs.	290	383	290	383

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

Table S10: Poisson regression models of the relationship between residence in natal village and the number of co-resident kin of different types. Only ever-married individuals are included in the models. Affinal relatives here are only spouse's consanguineal relatives. Numbers in parentheses are standard errors for the coefficient estimates.

	Teṉpaṭṭi	Aḷakāpuram	Teṉpaṭṭi	Aḷakāpuram
	All support		Consanguineal	
Intercept	2.045^{***}	2.064^{***}	-1.135^{***}	-1.253^{***}
	(0.029)	(0.025)	(0.087)	(0.067)
Residence (Natal=0)	-0.137^{**}	-0.092^{*}	1.022^{***}	1.068^{***}
	(0.044)	(0.037)	(0.189)	(0.149)
Null deviance	475.664	627.540	369.613	577.237
Deviance	465.931	621.463	341.288	528.052
Num. obs.	290	383	209	286
	Matrilateral		Patrilateral	
Intercept	-1.735^{***}	-1.643^{***}	-1.866^{***}	-2.026^{***}
	(0.256)	(0.151)	(0.168)	(0.124)
Residence (Natal=0)	0.571	0.688^{*}	1.396^{**}	0.853^{*}
	(0.573)	(0.304)	(0.437)	(0.341)
Null deviance	80.927	173.676	142.454	233.741
Deviance	79.993	168.829	133.356	228.195
Num. obs.	72	129	124	161
	Affinal		Affinal (≥ 0.25 only)	
Intercept	-1.912^{***}	-2.133^{***}	-1.846^{***}	-1.939^{***}
	(0.260)	(0.181)	(0.311)	(0.239)
Residence (Natal=0)	0.454	0.736^{***}	0.682^{*}	0.949^{***}
	(0.299)	(0.216)	(0.348)	(0.277)
Null deviance	144.064	291.097	148.802	248.073
Deviance	141.627	278.567	144.588	234.996
Num. obs.	134	180	133	169

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

Table S11: Regression models of the relationship between residence in natal village and the number of support ties ("All Support," Poisson regression) and the probability of naming different types of kin as providing support (all other models, binomial regressions). Only ever-married individuals are included in the models. Affinal relatives here are only spouse's consanguineal relatives. Numbers in parentheses are standard errors for the coefficient estimates.

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