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# Infant allocare in traditional societies

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ABSTRACT

Across human societies infants receive care from both their mothers and others. Reproductive cooperation raises two important questions: how does allocare benefit mothers and infants, and why do caretakers help mothers when they could spend their time in other, perhaps more valuable ways? We use behavioral and biological data from three small-scale societies to evaluate 1) how allocare affects a nursing mother's time, 2) whether a mother's birth interval length, surviving fertility and infant weight vary as a function of the childcare help that she receives, and 3) the opportunity cost for helpers to spend time caring for children. Across our hunter-gatherer and agricultural samples we find that on average mothers provide 57% of the direct care that an infant receives and allocaretakers 43% ( ± 20%). Model results show that for every 10% increase in allocare the probability that a mother engages in direct care diminishes by 25%, a potential savings of an estimated 165 kcals per day. While allocare has a significant immediate impact on mother's time, no detectable effect on delayed fitness measures (birth interval and surviving fertility) or on infant weight status was evident. Cross culturally we find that other than mothers, siblings spend the most time caretaking infants, and they do so without compromising the time that they might otherwise spend in play, economic activities or education. The low opportunity cost for children to help offers an alternative explanation why juveniles are common caretakers in many societies, even in the absence of delayed indirect fitness benefits. While we expect specific patterns to vary cross culturally, these results point to the importance of infant allocare and its immediate time benefits for mothers to maintain flexibility in balancing the competing demands to support both older and younger children.

## 1. Introduction

Maternal investment is crucial to infant survival and wellbeing in all but the most wealthy, industrialized societies. Yet infancy presents an allocation problem for mothers who have young as well as older children to care for at the same time. Unlike other primates who usually terminate maternal provisioning at weaning, human mothers often have multiple dependents and face a tradeoff about whether to invest their time and energy in infant care or in activities, such as food production or wage labor, that benefit their older children [1]. Human mothers also are unusual in that others help them raise their offspring. Allocare, and more generally cooperative breeding, is a reproductive and social strategy in which group members other than parents assist mothers or their young [2]. Although relatively rare as a species-typical pattern in mammals, cooperative breeding occurs across diverse taxa, including primates, primarily small New World monkeys [3–6]. However because cooperative breeding is not a behavior shared by other great apes [7,8], it raises questions about why it emerged in humans and its relevant benefits and costs [9–13]. Here we specifically focus on allocare directed at infants (rather than juvenile care) to address how mothers benefit from help and at what cost to helpers who could spend their time and energy in other ways.

Interest in infant allocare in traditional societies has a rich history of study in anthropology, psychology and demography. While methodological approaches to mothers, infants and helpers vary across disciplines and researchers, several general observations can be made about infant care. First, in traditional societies the amount of assistance that mothers receive is variable, but often considerable. For example at 18 weeks, allo-caretakers provide 60% of the care that an Efe (Ituri forest hunter-gatherers) infant receives [11]. When observed in camp, Aka (central African hunter-gatherers) mothers held their young infants (1–4 months old) 51% of daylight hours, fathers 22% and others 28% [14:pg 269]. For the Hadza (east African hunter-gatherers), the time that infants interact with someone other than their mother doubles between the first and second year, increasing from 22% to 56% [15]. When aggregated over the first four years of life, Hadza children are held 31% of the time by allomothers [16]. Among the Savanna Pumé (native South American hunter-gatherers), 49% of the direct care

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received by a breastfeeding infant is provided by someone other than the mother. In contrast to other groups of hunter-gatherers, Howell [17] notes that !Kung (Kalahari hunter-gatherers) mothers account for 75–80% of all physical contact that an infant receives in the first 20 months of life [18]. These case studies make the point that allocare is both prevalent and variable in human societies.

The second general observation is that allocare appears to be an effective strategy to offset maternal constraints in supporting both younger and older children. For example, among Aka hunter-gatherers and Ngandu agriculturalists of central Africa, although mothers hold their infants less when they are engaged in work, allomothers compensate for this decrease in maternal care [19,20]. Among the Kipsigis, African pastoralists, the quality of care that allo-caretakers and mothers provide was found to be comparable as measured by infant distress [21]. Rural Brazilian women who have social support, which includes childcare, food provisioning, subsistence and domestic help, lost less weight during lactation than women without social support [22]. In managing the competing demands of younger and older children several studies show that mothers, depending on their subsistence base, spend less time foraging for food, in agricultural work, domestic activities, or wage employment when they have a nursing infant. Instead, mothers give priority interest to childcare [1,15,23–25]. For example, among Maya subsistence farmers, mothers with young nursing infants spend no time working in the fields, a food production investment that benefits older children and requires mothers to travel several kilometers from home [25]. In these cases fathers, siblings and others compensate for the reduction in maternal economic activity. Other studies find that mothers with young children do not spend less time foraging or in other productive work [20,26], rather they receive more help caring for young children [19].

To consider who helps infants cross culturally, we assemble published data from nine traditional societies (Fig. 1). To be both comparable to each other and consistent with the behavioral-observation data used in our analyses, the studies included use similar time allocation methods and report on who provides the direct care that an infant receives (e.g. infants receive a certain amount of care, mothers provide some portion of that care, and others provide the balance). In most of these ethnographic cases direct care includes physical contact such as breastfeeding, holding, carrying, feeding and grooming [11]. While mothers devote the most time to infant care, allo-caretakers provide nearly half of the care infants receive. This regularity is striking and in part may reflect that maternal breastfeeding constitutes a large proportion of the direct care that a child receives. For example, among the study populations analyzed here, breastfeeding comprises on average 38% of a mother's direct care. Since infant survival in traditional societies is dependent on mother's milk [27], there is likely a limit to the minimum amount of time mothers spend in direct care regardless of the availability of helpers.

Because much of infant care is provided by someone other than a mother, allocare has important implications for understanding both female life history and the costs and benefits of reproductive cooperation. We use three behavioral and biological datasets, two from a group of subsistence farmers and the other from a group of hunter-gatherers, to address 1) whether the help a mother receives affects the time she allocates to direct care, breastfeeding or economic activity, 2) how the help mothers receive affects long-term fitness outcomes (birth intervals, surviving fertility) and child weight status, and 3) whether those who spend the most time caring for infants compromise the time that they might spend in other activities, such as education, economic work or play. Before turning to the analyses, we discuss human life history and how infant care differs from other kinds of helping behaviors.

### 1.1. Infant care and how it differs from other helping behaviors

Since most mammalian cooperative breeders raise offspring to independence during infancy, helpers assist breeding females and their

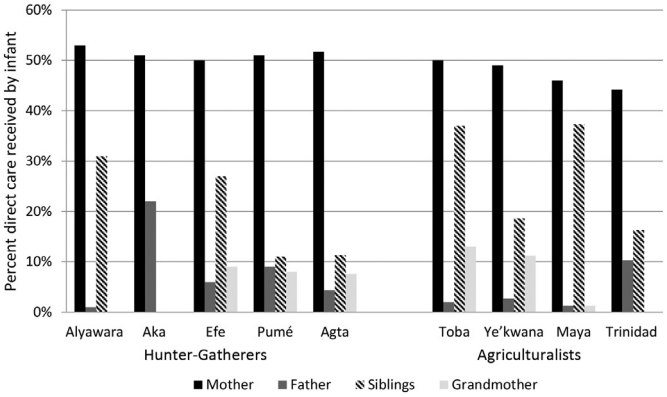


**Fig. 1.** Percent of direct care received by an infant that is provided by mothers and allo-caretakers. Missing values indicate no reported data. Unless otherwise specified below, direct care includes nursing, feeding, carrying, holding, grooming (dressing, bathing, delousing, minor medical) and playing with an infant. Any comparative assessment between studies should consider differences in methods. Within group values sum close to 100% in all cases except for the Agta for unreported reasons.
Sources: **Alyawara** [114:pg 264]; observation period unspecified; infant focal follow data; n = 495 observations, n = 18 infants (ages unspecified); values reported for carrying an infant only. **Aka** [14:pg 269]; observation period 6:00 am–6:00 pm; infant focal follows; n = 6 children ages 1–4 months; values reported for the mean percent of time mother, father and others held focal infants during daylight hours (because infants are held 100% of daylight hours, this is equivalent to the proportion of care receive by an infant); observations are for babies while they are in camp only; values reported for holding only (because holding includes playing with, carrying, cleaning, nursing and feeding it is largely inclusive of what other studies refer to as direct care); in addition to fathers, 'others' are reported to hold focal infants 27.8% of daylight hours, but who 'others' refers to is unspecified. **Efe** [Ivey unpublished data]; observation period 12 daylight hours; focal follow data; n = 20 children (ages unspecified). **Pumé** [Kramer and Greaves unpublished data]; observation period 6:00 am–6:00 pm; instananeous scan sampling data; n = 892 observations, n = 11 breastfeeding children ages birth to 3. **Agta** [115:pg 1206]; observation period 5 am–7 pm; scan sampling data recorded at 8 standardized time points across the day; n = 282 child days for children under age 11; specific activities included as childcare unspecified. **Toba** [93:pg 106]; observation period dawn to dusk; instananeous scan sampling data; n~24 infants < 24 months. **Ye'kwana** [23:pg 245]; observation period 7:00 am–7:59 pm; instaneneous scan sampling data; n = 16 children ages 0–40 months. **Maya** [116:pg 227]; observation period 7 am–6 pm; instaneous scan sampling data; n = 314 observations, n = 9 breast feeding children ages birth to 3. **Trinidad** [117:pg 66]; observation period unspecified, instantaneous scan sampling data; children ages 0–4, n unspecified; grandmothers are not reported separately, but included as 'other'.

milk-dependent young [2]. In humans, children are weaned at a young age and juveniles are at least partially subsidized with food, shelter and other resources. The redistribution of offspring dependence across these two life stages is significant to questions about cooperative breeding because helping an infant versus a juvenile has very different implications [28] (Fig. 2). First, caring for an infant entails carrying, holding, feeding, babysitting and the like, which are activities that helpers do not otherwise do for themselves. Second, assistance flows in one direction, from helpers to infants; others help infants, but infants are too young to reciprocate. In contrast, juveniles consume adult foods and resources and provisioning a juvenile is embedded in the same suite of tasks that helpers otherwise do to support themselves. Further, in most preindustrial societies, juveniles are important food producers, share food with others, contribute to household labor and take care of their younger siblings [29–34]. For example, Hadza children living in sub-Saharan Africa spend 5–6 h a day foraging for food. By the age of 5, they supply about 50% of their own calories during some seasons [35:pg 367]. !Kung children spend little time foraging [17], but by the age of eight crack most of the mongongo nuts they eat, which constitutes a substantial portion of their diet [36]. Specific to the groups that are the subject of this analysis, Maya children produce 50% of what they consume by age six [37], and much of what they produce is shared with other household members. Among the Savanna Pumé, South American hunter-gatherers, juveniles make important contributions to