The Evolution of Early-Life Effects on Social Behaviour – Why Should Social Adversity Carry Over to the Future?

Online Supplement

Bram Kuijper & Rufus A. Johnstone

S1 Supplementary Figures

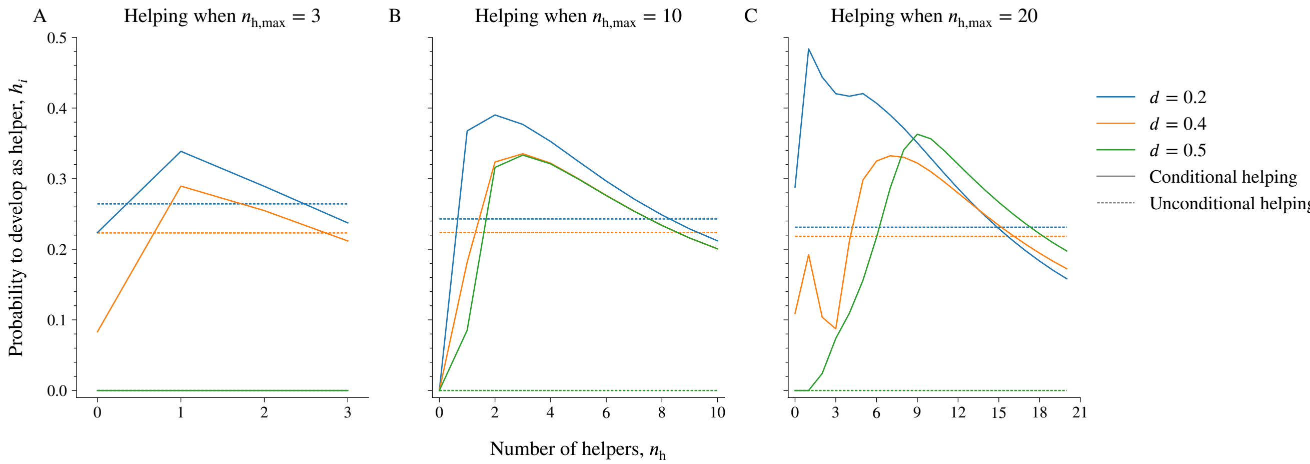

Figure S1: The evolution of the tendency to help h_i while varying the maximum number $n_{\mathrm{h,max}}$ of helpers that can be recruited to any local patch. Parameters: $n_{\mathrm{b}} = 2$, $\phi_0 = 1.0$, $\phi_1 = 5$, $\phi_2 = 1.0$.

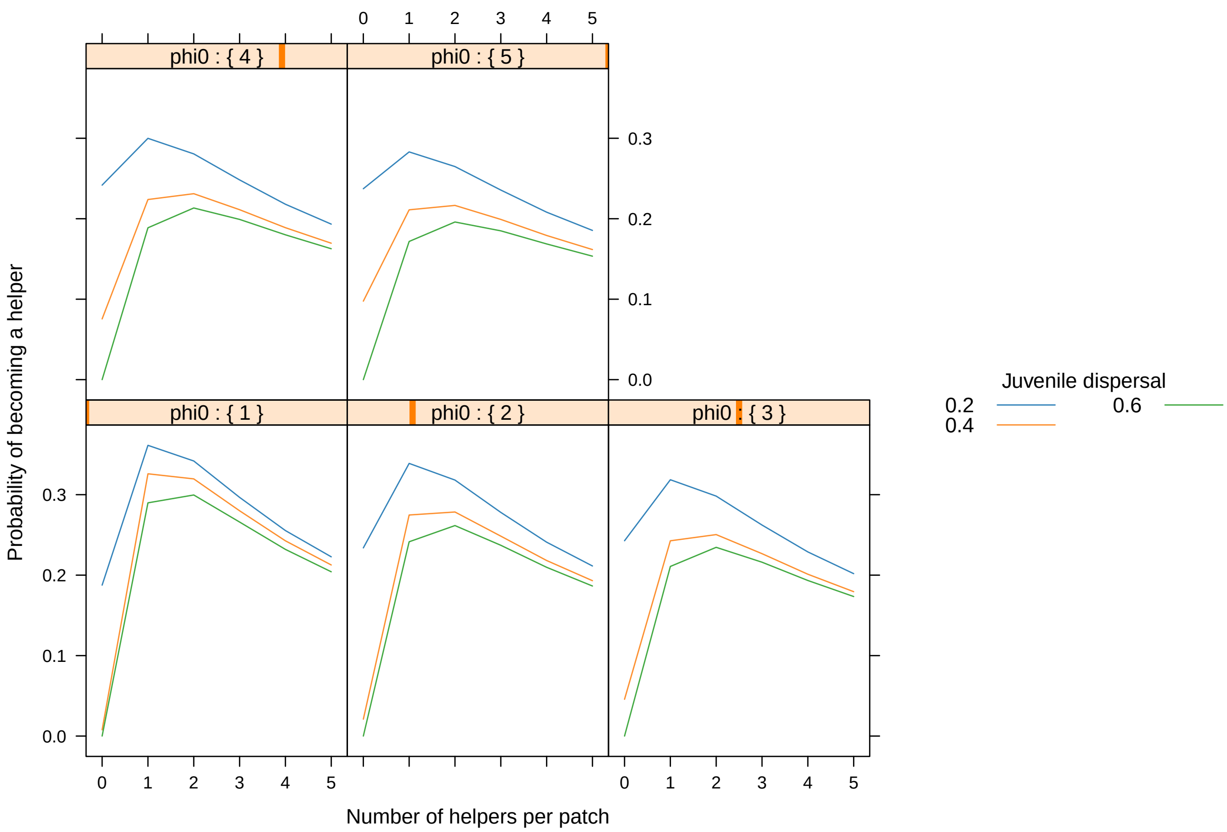

Figure S2: The evolution of the tendency to help h_i in Figure 1 is robust to varying the baseline fecundity ϕ_0. Parameters: $n_b = 2$, $\phi_1 = 5$, $\phi_2 = 1.0$.

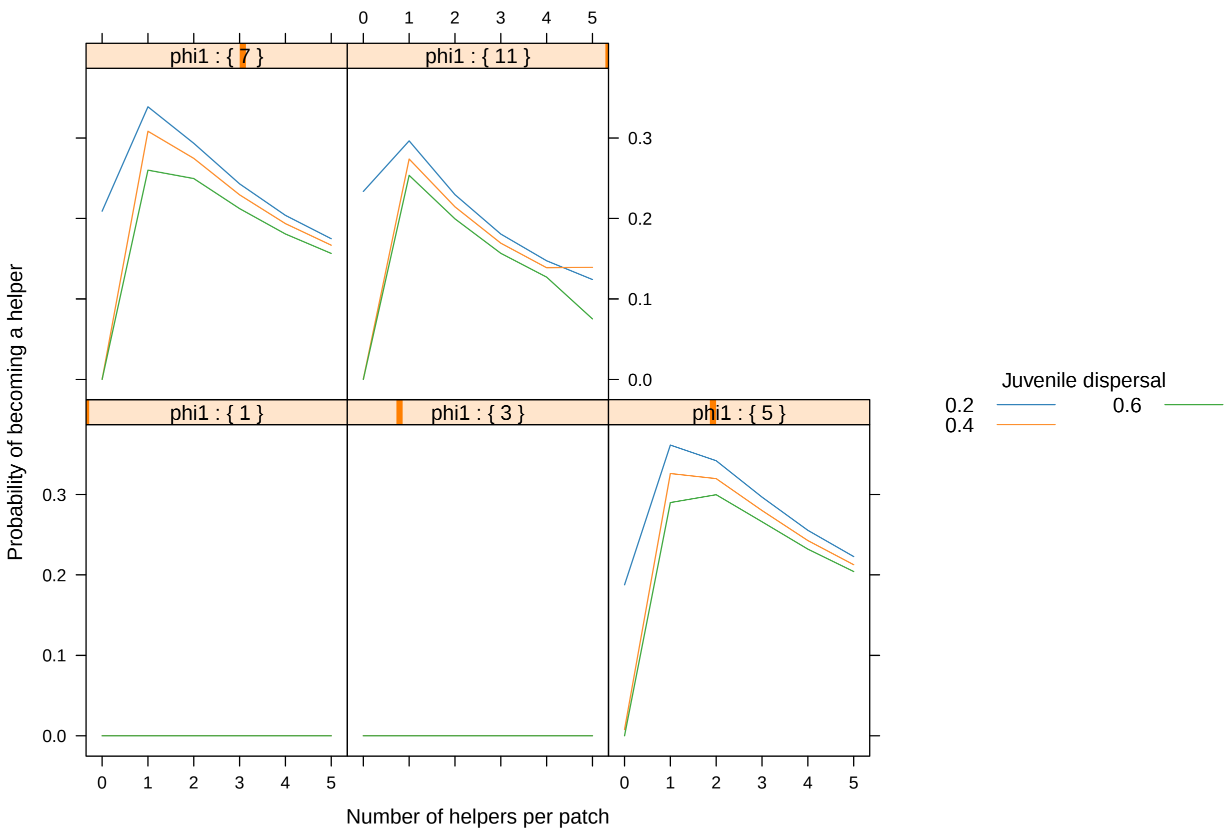

Figure S3: The evolution of the tendency to help h_i for varying benefits of help (measured by the strength ϕ_1 with which fecundity increases with increasing number of helpers). Parameters: $n_\text{b} = 2$, $\phi_0 = 1$, $\phi_2 = 1.0$.

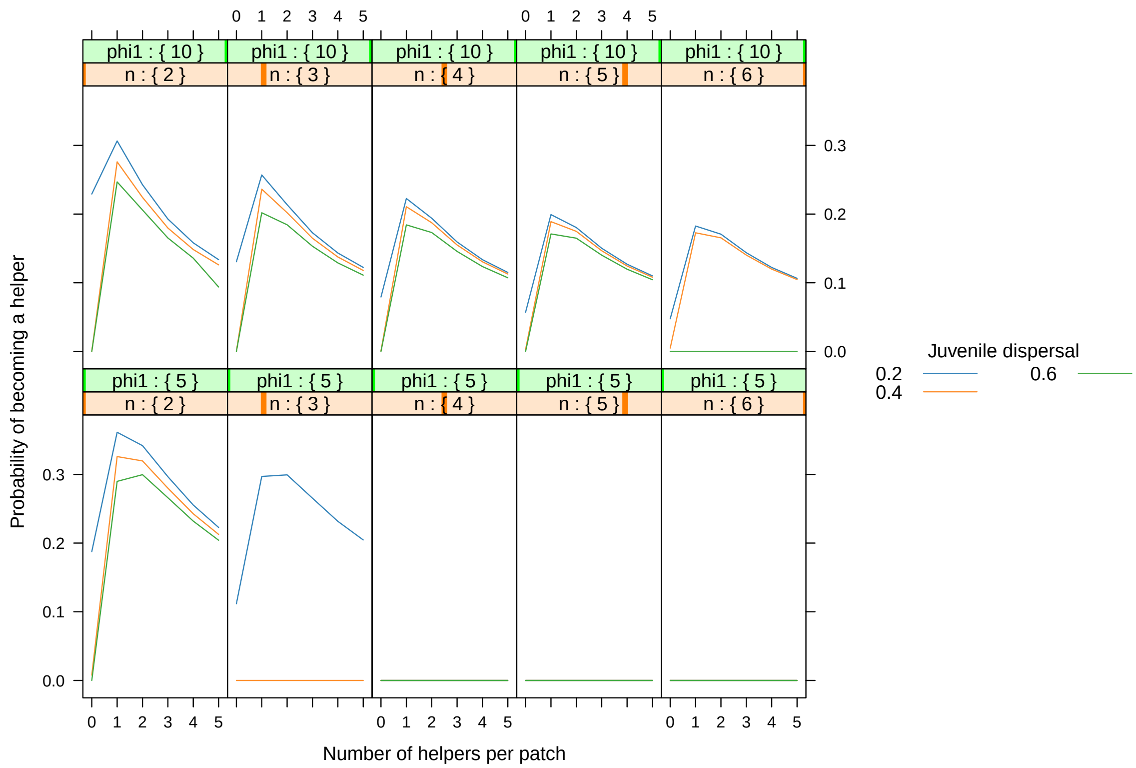

Figure S4: The evolution of the tendency to help h_i while varying the number of breeders per patch n_b and the benefits of help ϕ_1 (see also Figure S3). In line with classical results [1, 2], increasing the number of breeders per patch decreases the scope for the evolution of helping, unless offset by larger benefits of help ϕ_1. Parameters: $\phi_0 = 1$, $\phi_2 = 1.0$.

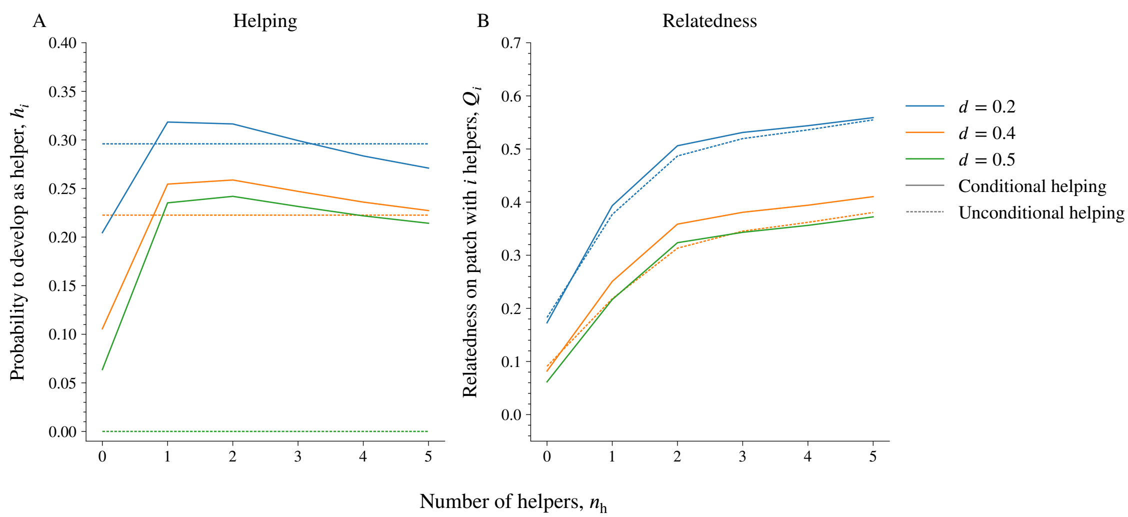

Figure S5: The evolution of the tendency to help h_i when the increase in patch productivity decelerates with an increasing number of helpers ($\phi_2 = 0.5$). Results are qualitatively similar to Figure 1 in the main text, although developmental plasticity in helping is more modest. Note that we do not display relatedness for unconditional helping when $d = 0.5$ as helping does not evolve in this example. Parameters: $n_b = 2$, $n_{h,max} = 5$, $\phi_0 = 1.0$, $\phi_1 = 5.0$.

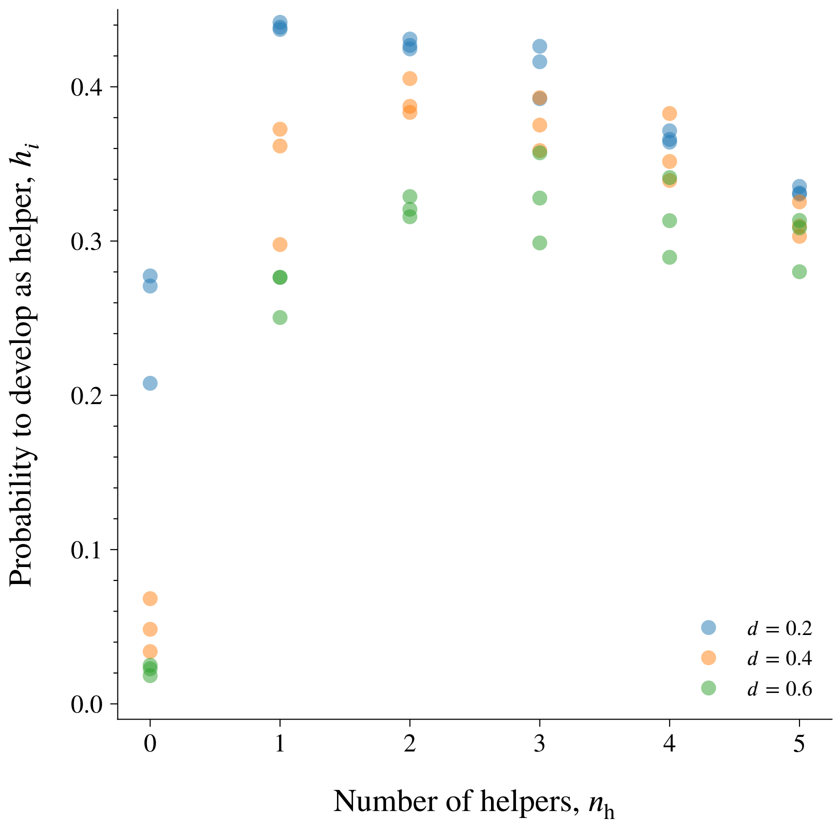

Figure S6: Stochastic, individual-based simulations show very similar results for the evolution of the tendency to help h_i when compared to Figure 1 in the main text. Each dot depicts the population average value of h_i evolved during a single simulation. Parameters: $n_b = 2$, $n_{h,max} = 5$, $\phi_0 = 0.4$, $\phi_1 = 5.0$, $\phi_2 = 1.0$.

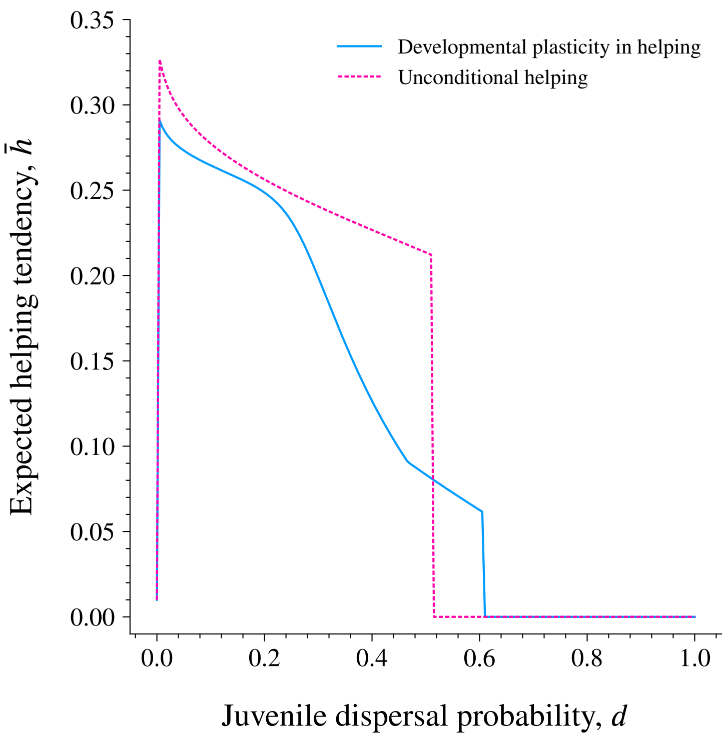

Figure S7: The average helping tendency $\bar{h}$ expressed by all mothers across the population for different levels of juvenile dispersal d. We find that unconditionally helping populations express higher average values of help, because all patches receive the same level of unconditional help. By contrast, patches with $n_{\mathrm{h}} = 0$ helpers receive little to no help in populations with developmental plasticity in helping (see Figure 1A in the main text). The average helping tendency was calculated as $\bar{h} = \sum_{i=0}^{n_{\mathrm{h,max}}} u_i h_i$, where u_i is the frequency of a patch with i helpers (see Table S1). Parameters as in Figure 1 in the main text.

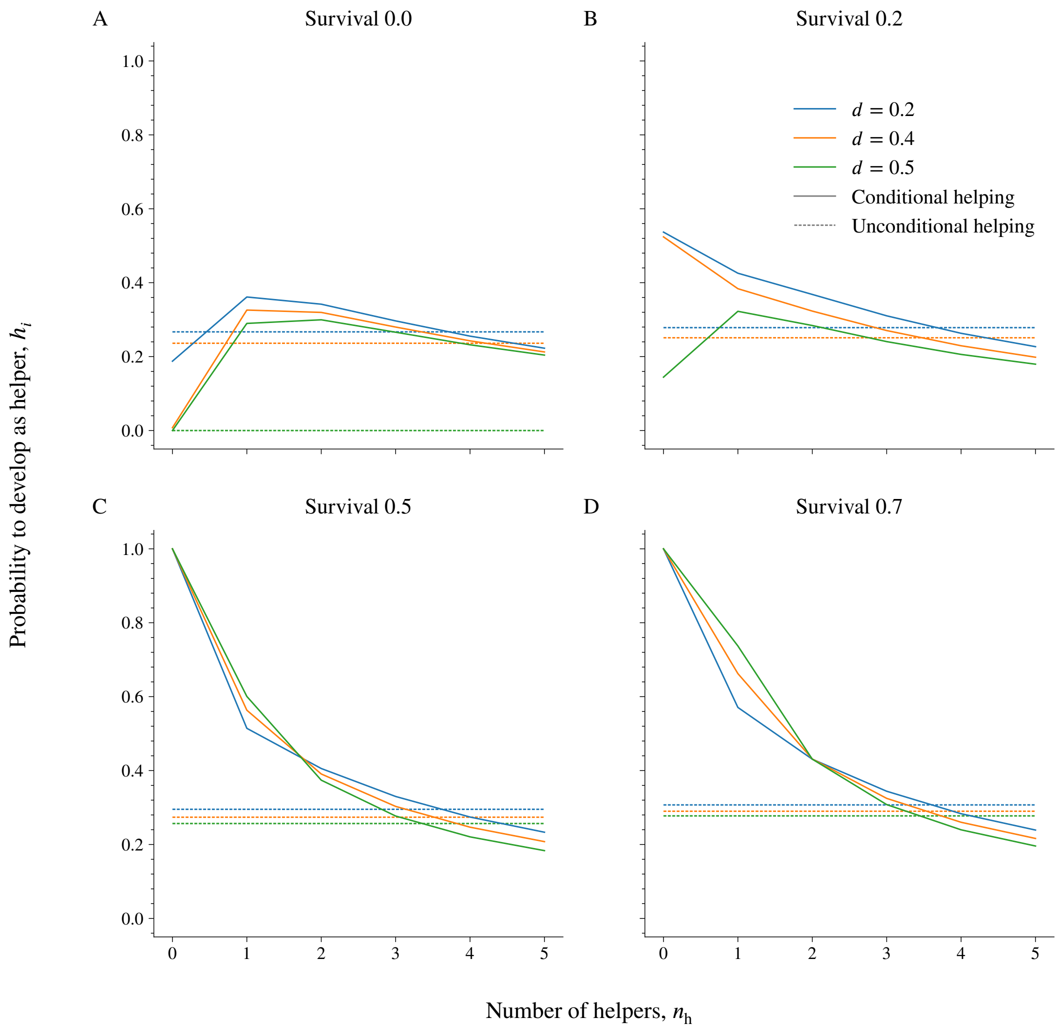

Figure S8: Effect of increasing amounts of generational overlap (measured by increased adult survival probabilities $1 - m$) on the evolution of developmental plasticity in helping tendencies h_i. In contrast to scenarios with nonoverlapping generations (panel A), overlapping generations cause helping tendencies to be very high in patches with no helpers, while helping tendencies are lowest in patches with many helpers. Parameters as in Figure 1.

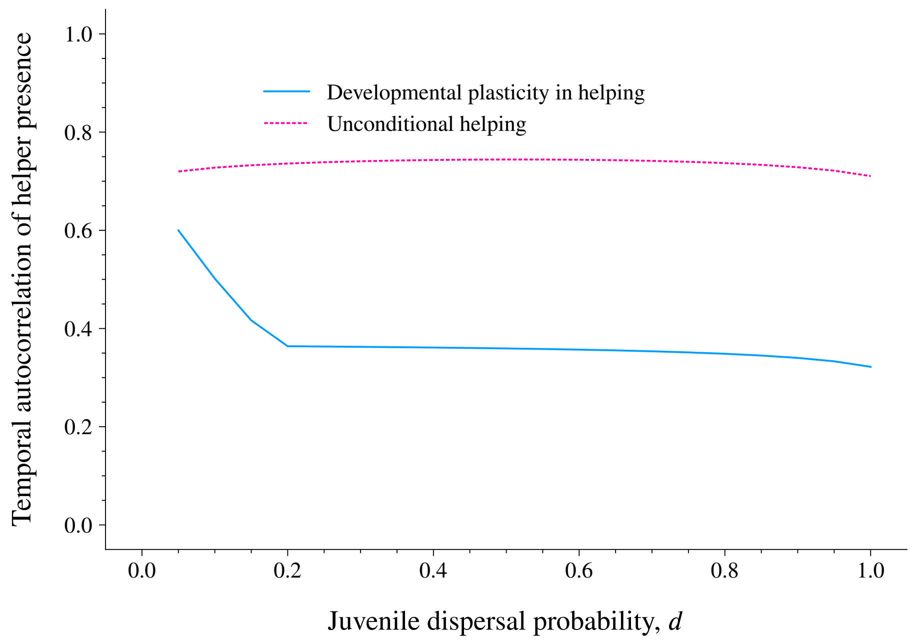

Figure S9: Autocorrelation in helper presence vs absence between parental and offspring generations, when generations overlap (adult survival during each timestep is $1 - m = 0.5$). In contrast to the scenario where generations are nonoverlapping (see Figure 3), helper presence/absence is a much poorer predictor of helper presence/absence in the future. This is because patches in which there is little help at time t may recruit more helpers in time $t + 1$ when generations are overlapping (see Figure S8C for $d = 0.2$). Vice versa, patches in which there are already a lot of helpers may be less effective at recruiting more helpers in the future. Parameters: $m = 0.5$. Other parameters as in Figure 1.