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Intergenerational effects of the Fast Track intervention on the home environment: A randomized control trial

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Abstract

Background: Maladaptive family environments harm child development and are passed across generations. Childhood interventions may break this intergenerational cycle by improving the family environments children form as adults. The present study investigates this hypothesis by examining follow-up data collected 18 years after the end of the childhood Fast Track intervention designed to prevent externalizing problems.

Methods: We examined whether Fast Track assignment from grades 1 to 10 prevented the emergence of maladaptive family environments at age 34. A total of 400 ($n = 206$ in intervention condition, $n = 194$ controls) Fast Track participants who were parents at age 34 were surveyed about 11 aspects of their current family environment. The hypotheses and analytic plan were preregistered at <https://osf.io/dz9t5> and the Fast Track trial was registered at clinicaltrials.gov (NCT01653535).

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Conflict of interest statement: No conflicts declared.

Supporting information

Additional supporting information may be found online in the Supporting Information section at the end of the article:

Appendix S1. Supplemental Methods section.

Appendix S2. Supplemental Results section.

Table S1. Preintervention and demographic means for the G2 parent subsample, G2 nonparent sample, G2 intervention parent subsample, and G2 control parent subsample by intervention status.

Table S2. Fast Track Intervention Main Effects by intervention condition and sex based on Full Information Maximum Likelihood Models.

Table S3. Equivalence testing for Fast Track Intervention Main Effects by intervention condition and sex based on Full Information Maximum Likelihood Models.

Figure S1. CONSORT flow chart.

Results: Multiple group linear regression models revealed that mothers who participated in the Fast Track intervention as children had lower depression symptoms, alcohol problems, drug problems, corporal punishment use, and food insecurity compared to control group mothers. All effects were modest in magnitude. However, for these same mothers, the Fast Track intervention had no effect on cannabis problems, experiences of romantic partner violence, or maternal use of physical aggression or warmth with their children. Additionally, mothers in the Fast Track intervention group reported higher levels of family chaos than those in the control group, but this effect may be a byproduct of the higher number of children per household in the intervention group. No intervention effects were found for fathers who participated in the Fast Track intervention as children.

Conclusions: Childhood assignment to Fast Track has some beneficial effects for girls, but not boys, on the family environments these individuals formed as adults 18 years later.

Keywords

Prevention; intervention; family environment; intergenerational; externalizing

Introduction

Maladaptive family environments (i.e., environments marked by high chaos and violence, food insecurity, parent aggression and lack of warmth, and parent mental health and substance use problems) are linked with the development of child mental health disorders, substance problems, and neurocognitive deficits (Kerr & Capaldi, 2019; Rothenberg, Solis, Hussong, Chassin, 2017). Worryingly, maladaptive family environments are also passed across generations (Kerr & Capaldi, 2019). Specifically, maladaptive family environments created by Generation 1 (G1) parents precipitate the emergence of externalizing (Rothenberg, Hussong, & Chassin, 2016) and internalizing (Rothenberg, Hussong, & Chassin, 2018) problems in Generation 2 (G2) children. These problems persist across time, becoming pathways to the recreation of such maladaptive family environments when G2s grow into adulthood and have their own Generation 3 (G3) children (Kerr & Capaldi, 2019). Prevention scientists have long wondered whether preventative interventions delivered to children in one generation (G2) could ‘ripple’ across generations and prevent the emergence of maladaptive family environments in the families such children create as adults (i.e., in the G2-G3 home). Unfortunately, children who received preventative interventions have rarely been followed into adulthood so this question remains understudied.

The current study fills this gap by examining the effects of a preventative intervention (The Fast Track Program; Conduct Problems Prevention Research Group [CPPRG], 2020) delivered and evaluated in childhood (via a randomized control trial). Crucially, the Fast Track intervention aimed to prevent the emergence of serious conduct and other externalizing problems, and therefore targeted the aforementioned externalizing pathway that sustains the intergenerational transmission of maladaptive family environments (CPPRG, 2020). Additionally, children who initially received the Fast Track intervention in 1st to 10th grade have now been followed until the present day, when they are aged 34 and have started their own families, which makes it possible to examine if Fast Track can indeed prevent the emergence of maladaptive family environments in adulthood.

Identifying maladaptive aspects of the family environment

The current study measures risk factors that have been found to both contribute to maladaptive family environments, and be passed across generations (Kerr & Capaldi, 2019). Parent difficulties with mental health, especially parent depression and substance problems, are large contributors to maladaptive family environments and can be passed across generations (Kerr & Capaldi, 2019; Rothenberg et al., 2017). Similarly, violent conflict between parents significantly degrades the family environment and shows intergenerational continuity (Kerr & Capaldi, 2019). Moreover, parent lack of warmth and greater physical aggression and corporal punishment create deleterious family environments across generations (Kerr & Capaldi, 2019; Lansford et al., 2014; Rothenberg et al., 2016, 2017, 2022). Family environments can also become maladaptive when chaos and lack of routine (Rothenberg et al., 2016) or economic insecurity (Kerr & Capaldi, 2019) pervade the entire family context. Therefore, the present study examines intervention effects on each of these risk factors to discover if childhood interventions can prevent the emergence of aspects of adult deleterious family environments that otherwise would be passed across generations (Kerr & Capaldi, 2019).

Evidence for the externalizing pathway to the intergenerational transmission of maladaptive family environments

Having identified measurable aspects of maladaptive family environments, we now briefly review the evidence for the intergenerational transmission of maladaptive family environments. Several prospective longitudinal studies suggest that maladaptive family environments can be transmitted from G1-G2 to G2-G3 homes years later (Kerr & Capaldi, 2019; Rothenberg, 2019). Perhaps, the most well-researched mechanism that accounts for this intergenerational transmission is the externalizing pathway (Rothenberg, 2019). Maladaptive family environments increase the likelihood that a child develops externalizing behavior because children may learn from observing and participating in family interactions that the best way to achieve goals in such environments is to act aggressively (Patterson, 1982; Rothenberg, 2019). Because children learn that such externalizing behaviors allow them to achieve their social goals, they may continue to exhibit such behavior into adulthood (Rothenberg, 2019). When they partner and have children, their externalizing behaviors may lead to the creation of the same maladaptive family environments they grew up in (Rothenberg, 2019).

The externalizing pathway could lead to this recreation by influencing each of the risk factors that contribute to maladaptive family environments defined above. Substance misuse behaviors core to the externalizing pathway in young adulthood can persist as G2s form their own families and impair G2s in their roles as parents and spouses within those families (Riggs, Chou, & Pentz, 2009). These same externalizing behaviors also make holding a steady job and staying out of prison more difficult, which subsequently makes it more likely that G2s' adult families are economically and food insecure (Dodge et al., 2015). Moreover, the externalizing pathway can catalyze the emergence of G2 perpetration of romantic partner violence and use of corporal punishment, aggression, and little warmth with their G3 children as G2s employ the same externalizing behaviors that have allowed them to achieve their social goals throughout their lifetime to their interactions with family

members (Rothenberg et al., 2019). Consequent G2 depression is likely to emerge as these difficult patterns of family interactions precipitate high conflict among family members, leading to even greater G2 family dysfunction as G2 depression leads to greater withdrawal from and less involvement in family contexts (Rothenberg et al., 2018). Collectively, each of these consequences of G2s' traversing the externalizing pathway makes it more likely that high levels of family chaos and conflict will be passed across generations (Kerr & Capaldi, 2019).

Interestingly, research that examines maladaptive, high-conflict family environments indicates that the entire intergenerational transmission process in general, and the emergence of the externalizing pathway in particular, is stronger in G2 women, compared to men (Rothenberg et al., 2018). Prevention scientists have speculated that this may be because even in contemporary society, women are still more often tasked with the roles involving child-rearing and creation of family routines and climate (Kerr & Capaldi, 2019; Rothenberg, 2019). Therefore, interventions that interrupt the externalizing pathway may have stronger effects in women than in men.

Evidence that preventative interventions can halt the intergenerational transmission of maladaptive family environments

The Fast Track prevention program is a prime candidate to halt the intergenerational transmission of maladaptive family environments because it was designed to break the externalizing pathway. Specifically, the Fast Track intervention blended parent behavior-management training, child social-cognitive skills tutoring, home visiting, and classroom social-ecology change across grades 1–10 to prevent children with early-emerging externalizing problems from experiencing such problems in adulthood (CPPRG, 2020). The intervention appears to have done so. Throughout elementary school, Fast Track decreased aggressive and disruptive behaviors at home and school and also improved social emotional well-being, positive peer relations, parental warmth, and use of appropriate discipline (CPPRG, 2020). The positive impacts from the intervention diminished during middle school (CPPRG, 2020) but re-emerged during high school and into adulthood (Godwin & CPPRG, 2020). In the most recent evaluation at age 25, G2 participants in the intervention experienced fewer externalizing, internalizing, and substance problems, and used less corporal punishment with their children, compared to those in the control group (Dodge et al., 2015). Notably, this age-25 evaluation primarily examined G2 mental health outcomes but did not investigate whether the family environments G2s create were improved due to the Fast Track intervention. We attempt to build on this work in the current study by examining these G2-created family environments 9 years later, at age 34, when substantial numbers of G2s have become parents.

In sum, findings through age 25 reveal that Fast Track may prevent the emergence of a maladaptive G2-G3 family environment because it improves both the G2 externalizing symptoms that may lead to such an environment, and several of the G2 mental health problems (i.e., depression and substance problems) and parenting behaviors (corporal punishment) that may characterize such an environment.

Just as encouragingly, a recent study of a prevention program very similar to Fast Track, the Raising Healthy Children intervention, found that provision of the intervention to G2 children in the 1980s resulted in better outcomes for those G2s' G3 children in the present day, including improved early G3 child developmental functioning and lower G3 behavioral problems and drug use (Hill et al., 2020). Similarly, past work examining multigenerational effects of a 5-year drug abuse prevention trial for children starting in sixth grade found that this program reduced marijuana use at age 26, which subsequently increased participants' warm parenting at age 30 and reduced their children's impulsivity (Riggs et al., 2009). Therefore, recent work has highlighted that Fast Track and similar interventions have effects on precursors to (i.e., G2 externalizing behavior), some aspects of (i.e., G2 depression and substance problems), and consequences that result from (i.e., G3 functioning) maladaptive G2-G3 family environments. The next step is to directly test whether Fast Track actually affects the G2-G3 family environment itself.

The current study

The current study examines whether a prevention program delivered in childhood can ripple across generations and prevent the emergence of maladaptive family environments in adulthood. We make two hypotheses. First, we hypothesize that children of families that received the Fast Track intervention will have an improved home environment as evidenced by lower levels of G2-G3 family chaos, G2 mental health problems, G2 substance problems, G2 violence, and G2 lack of warmth. Furthermore, we hypothesize that the beneficial effects of the Fast Track intervention will be evident in the home environments of both G2 men and G2 women who participated in the intervention. However, given the sex effects reviewed above, our second hypothesis is that Fast Track intervention effects on the family environment will be stronger in G2 female participants. All hypotheses were preregistered on the Open Science Framework (<https://osf.io/dz9t5>).

Methods

Participants

High-risk elementary schools ($n = 55$) were selected for Fast Track participation based on neighborhood crime and poverty rates in four geographic areas: Durham, NC; Nashville, TN; rural Pennsylvania; and Seattle, WA. Within site, clusters of schools were matched on demographics and randomly assigned to intervention or control conditions. Then, G1 parents and their G2 children were recruited into the study in three consecutive intervention cohorts (1991 to 1993) of high-risk G2 kindergarten children who were enrolled using a screening procedure that identified the children at highest risk for behavior problems (i.e., children who scored in the top 20% of the sample on a standardized combined parent- and teacher-reported severity-of-risk score; see Appendix S1 for further detail). A total of 979 G2 children (10% of those screened) were invited to participate in the intervention, which yielded a sample of 891 participating children (91% consent; intervention group, $N = 445$; control group, $N = 446$; see Figure S1 CONSORT Diagram). At the time of selection, the participant mean age was 6.58 years ($SD = 0.48$). Race varied (Black, 51%; White, 47%; Other, 2%) and 69% were boys. Written, informed consent from parents and oral assent from children were obtained, participants were compensated for participation, and study

IRB approval was obtained. To ensure that intervention effects estimates were precise, the 29 variables listed in Table S1 were examined prior to the intervention and included as covariates in all analyses. Further description of these variables can be found elsewhere (www.fasttrackproject.org) and prior work indicates no robust statistical differences in these scores between intervention and control groups (CPPRG, 2020).

At age 34, these G2 participants were invited to complete a follow-up survey. Of the 891 original participants, 848 participants were still alive (95%). Of these 848 participants, 568 agreed to participate at the age-34 follow-up (67% of the living sample). A total of 409 of these participants (72% of all G2s who agreed to participate at age-34) met criteria for reporting on their family environment which were: (a) had at least 1 G3 child <18 years old and (b) lived 20% or more of the time with the G3 child or the G2 parent reported active involvement in their child's parenting. Of these 409 eligible participants, 400 (98% of eligible G2s; $n = 206$ intervention group, $n = 196$ control group) completed family environment measures ($M_{G3age} = 9.39$ years, $SD = 4.40$; no significant difference between intervention and control groups). G2 participants in the control group had $M = 2.01$ children under 18 living in their home ($SD = 1.36$), whereas those in the intervention group had $M = 2.11$ children under 18 living in their home ($SD = 1.49$; no significant difference between the intervention and control groups). The G2 parent subsample and initial G2 sample, and the G2 parent intervention and control samples, did not differ in systematic ways given that there were only nine significant differences across 58 tests of differences in these samples (see Table S1 and Appendix S1 for further detail). However, we did find that G2s who participated in the age 34 parent sample scored significantly lower on their original externalizing behavior standardized risk scores (which combined G1 parent and teacher report) measured 28 years prior in kindergarten than those G2s who did not participate (Table S1). Similarly, we found that G2s in the age-34 intervention group scored significantly lower than G2s in the control group on this same measure (Table S1). Therefore, though we concluded that attrition did not systematically alter the representativeness of the study sample, we did include all 29 variables listed in Table S1 (including the externalizing behavior standardized risk scores) as covariates in all study analyses to account for any systematic differences emerging due to attrition.

Procedures

Intervention procedures.—In grades 1–5, intervention families were provided weekly to monthly 2-hr group interventions that included children's social skill training and parent-child behavior management training. Additional weekly 30-min reading and social skills training was provided for children through first grade and tutoring was provided on an ad hoc basis for all academic subjects in subsequent years based on participant need. Furthermore, a teacher-implemented social-emotional learning curriculum was provided at all sites through Grade 5 except for Durham, NC (where school mergers after grade 1 prohibited further implementation). During grades 5–6, children received a middle school transition program and four parent-youth groups on topics of adolescent development (alcohol, tobacco, drugs, and decision-making). In grades 7–8, eight youth forums taught about vocational opportunities, life skills, and summer employment. In grades 7–10, individualized interventions targeted parent monitoring, peer affiliations, academic

achievement, and social cognition (CPPRG, 2020). Parent and child participation in programming was high, as was implementation fidelity (Dodge et al., 2015). See Appendix S1 for further detail. The Fast Track intervention is registered at clinicaltrials.gov, registry number [NCT01653535](https://clinicaltrials.gov/ct2/show/study/NCT01653535).

Age-34 interview procedures.—At age 34, original participants were invited to complete the survey that assessed their family environment, parenting behaviors, and mental health. Participants completed a consent form and then completed the survey via an email link, on the phone, or in person and were modestly compensated for their participation. If participants did not respond to initial invitations, they were recontacted on a biweekly basis.

Measures

Preintervention and demographic covariates.—All 29 of the preintervention and demographic covariates listed in Table S1 were included in all analyses as control variables. These 29 variables are described in greater detail elsewhere (www.fasttrackproject.org).

Intervention status.—Intervention status (0 = control group member, 1 = intervention group member) was the main independent variable used to predict age-34 family environment outcomes.

Measures of family environment.—We measured 11 dependent variables (Table 1) that collectively captured functioning in the family environment by assessing aspects of G2 parent mental health (i.e., G2 depression, alcohol problems, cannabis problems, and drug problems), G2 romantic partner violence, G2 parenting (G2 parent use of physical aggression, corporal punishment, and warmth), and overall G2 family chaos and food insecurity. Finally, we created a composite measure (the Overall Family Environment Index) to capture poor functioning across all family environment indicators.

G2 Depression.—G2 parents reported their past-week depressive symptoms on the Beck Depression Inventory-II (BDI-II; Beck, Steer, Ball, & Ranieri, 1996) which asks participants to rate 21 symptoms (e.g., ‘I feel sad’) on a 0–3 scale where higher scores indicate more severe depressive symptoms. Items were summed to create a total depression score. The BDI-II is well-validated and demonstrated excellent internal consistency in this sample ($\alpha = .94$).

G2 alcohol problems.—G2 parents reported on their past-year alcohol problems using the Alcohol Use Disorder Identification Test (AUDIT; World Health Organization, 2001), a 10-item measure assessing harmful alcohol problems (e.g., ‘How often do you have six or more drinks on one occasion?’) on a 0–4 scale, where higher scores indicate more harmful alcohol problems. Items were summed to create a total alcohol problems score. The AUDIT is well validated and demonstrated excellent internal consistency in this sample ($\alpha = .81$).

G2 cannabis problems.—G2 parents reported on their past 6-month cannabis problems using the Cannabis Use Disorders Identification Test (CUDIT; Adamson & Sellman, 2003), a 10-item measure assessing harmful cannabis problems on a 0–4 scale (e.g., ‘How often were you “stoned” for 6 or more hours?’) where higher scores indicate more harmful

cannabis problems. Items were summed to create a total cannabis problems score. The CUDIT is well-validated and demonstrated adequate internal consistency in this sample ($\alpha = .71$).

G2 drug problems.—G2 parents reported on their past-year drug problems using the Drug Abuse Screening Test (DAST-20; Skinner, 1982), a 20-item measure assessing problems related to drug misuse by having participants indicate whether they have experienced specific drug use consequences (e.g., “Have you ever lost friends because of your use of drugs?”). Items were summed to create a total drug problems score. The DAST is well-validated and demonstrated excellent internal consistency in this sample ($\alpha = .94$).

G2 romantic partner violence.—G2 romantic partner violence was assessed by a single dichotomous item asking whether the G2 had engaged in any physical assault against their romantic partner in the past year.

G2 parent use of physical aggression and corporal punishment.—G2 parent past-year use of physical aggression and corporal punishment were measured using the physical aggression and spanking subscales of the Conflict Tactics Scale (Straus, 1979) which is designed to measure family violence and conflict. Items (e.g., ‘spanked your child’) were rated by parents on a 0–6 scale, where higher scores indicate more harmful physical aggression/corporal punishment. A mean was taken of both physical aggression and corporal punishment items to create their respective subscales. The Conflict Tactics Scale is well-validated and both the physical aggression ($\alpha = .95$) and spanking ($\alpha = .70$) subscales demonstrated adequate internal consistency in this sample.

G2 parent warmth.—G2 parent warmth was measured using the 8-item warmth subscale from the Parent Acceptance-Rejection Questionnaire-Short Form (PARQ-SF; Rohner, 2005), which assesses parent warmth-related behavior (e.g., ‘I make my child feel wanted and needed’) on a 1 = *never or almost never* to 4 = *everyday* scale. A mean of warmth items was taken to capture overall parent warmth. The PARQ-SF has been used, validated, and found reliable in over 60 cultures worldwide (Rohner, 2005) and demonstrated good internal consistency in this sample ($\alpha = .86$).

G2 family chaos.—G2s reported on chaos in their G2-G3 home environment using the 6-item Confusion, Hubbub, and Order Scale that measures family chaos and disorganization (e.g., ‘You can’t hear yourself think in our home’; Matheny, Wachs, Ludwig, & Phillips, 1995) on 1 = *very much like my home* to 4 = *not at all like my home* scale. A mean was calculated to capture overall G2-G3 family chaos, with higher scores indicating more chaos. The internal consistency of this scale in this sample is moderate ($\alpha = .60$), so caution should be taken in drawing definitive inferences from this scale. We nevertheless included this measure because it was in our preregistration document.

G2 food insecurity.—G2s reported on their family’s pastyear food insecurity using four items from the Household Food Security Scale Short Form (Blumberg, Bialostosky, Hamilton, & Briefel, 1999). Two items were yes/no questions (e.g., ‘Were you ever hungry, but didn’t eat because you could not afford enough food?’) and two items asked parents to

respond on a 4-point *never to often* scale (e.g. ‘How often in the past 12 months could your family not afford to eat balanced meals?’). We standardized these items and then calculated a mean score such that higher scores indicated greater family food insecurity. This measure demonstrated excellent internal consistency in this sample ($\alpha = .89$).

Overall family environment index.—In an attempt to create an easily interpretable risk variable that captured poor outcomes across all family environment indicators, we created an Overall Family Environment Index wherein if a G2 parent scored in the top 25% of the sample on any of the aforementioned family environment measures, they were given a 1 and otherwise scored a 0. Then, we summed these risk indicators in an index with a possible range of 0 (scored in the top 25% on no maladaptive family environment indicators) to 10 (scored in the top 25% on all indicators).

Notably, 21% of G2 parents ($n = 83$) were missing data on at least one of the family environment measures. However, those G2 parents with versus without missing data did not differ on any of the 29 preintervention or demographic control variables except for G1-G2 family socioeconomic status. Those with missing data had higher socioeconomic status than those with complete data ($M_{\text{missing}} = 27.03$, $M_{\text{complete}} = 23.31$, $t(397) = -2.51$, $p = .01$). This variable was controlled for in all analyses.

Analytic plan

Linear regression models controlling for nesting by school were run in Mplus 8 to test the main effect of assignment to the Fast Track intervention on each of the family environment constructs (Hypothesis 1). Then, Mplus’s multiple group modeling function was utilized to test whether the main effect of intervention status on each family environment construct differed in subsamples of G2 mothers and fathers (Hypothesis 2). In all analyses, 29 preintervention and demographic covariates were controlled. Additionally, by running these models in Mplus, we utilized robust Full-Information Maximum Likelihood estimation procedures (MLR) to protect against non-normality in dependent variables and include cases with partially missing data in study analyses, ensuring that all G2 participants were included in analyses in alignment with best practice and intention-to-treat frameworks (Muthén & Muthén, 1998–2017).

Results

Did Fast Track assignment improve G2-G3 family environment regardless of G2 sex?

The ‘Sample Combining G2 Mothers & G2 Fathers’ column of Table 2 indicates that Hypothesis 1 was generally not supported: Assignment to Fast Track did not appear to improve the G2-G3 family environment across the entire combined sample of G2 parents. Only two significant differences emerged between the intervention and control groups in the combined sample, and as will be reviewed below, it appears that both of these effects are found only in G2 women. Consequently, we now interpret the G2 sex moderation findings that account for these effects.

Did Fast Track assignment improve G2-G3 family environment more in G2 mothers than G2 fathers?

As can be seen in the ‘G2 Mothers’ and ‘G2 Fathers’ columns of Table 2, Hypothesis 2 was largely supported: Fast Track improved aspects of the family environment in G2 mothers, but not fathers. Specifically, for G2 mothers, Fast Track improved outcomes on 5 of 11 measures of the family environment. G2 mothers in the intervention group had a lower rate of depressive symptoms, alcohol problems, and drug problems scores, used less corporal punishment with their G3 children, and had G2-G3 families that experienced less food insecurity, compared to G2 mothers in the control condition (Table 2). All of these effects were modest, ranging from .09 to .17 standard deviations differences between intervention and control groups. No other effects of intervention status emerged as significant in mothers. Importantly, findings were unchanged in post hoc sensitivity analyses that did not control for any of the 29 covariates, and simply predicted G2 family environment outcomes from intervention condition (Table S2). Unexpectedly, G2 mothers in the intervention group also had higher family chaos scores than G2 mothers in the control condition (Table 2). However, a reviewer of this manuscript suggested that post hoc sensitivity analyses be run to determine if this iatrogenic intervention effect remained after controlling for the average number of children in the household. These analyses revealed that in G2 women, having more children in the home was strongly associated with higher family chaos ($\beta = .43, p < .01$), and that once this variable was controlled, the Fast Track intervention effect was no longer significant ($\beta = .07, p = .26$). Therefore, it appears that the iatrogenic intervention effect on family chaos is a byproduct that is accounted for by having higher numbers of children in the household. No significant Fast Track intervention effects emerged in G2 fathers (Table 2). Appendix S2 provides an additional post hoc exploratory analysis evaluating whether intervention effects emerged in fathers who lived with their child more often. Even in this exploratory analysis, no significant intervention effects emerged for G2 fathers.

Finally, we also conducted post hoc equivalence tests to determine the extent to which our observed null effects are of no interest (Lakens, Scheel, & Isager, 2018). As seen in Table S3, none of the null effects demonstrated equivalence across groups. Therefore, even though null effects are not large enough to statistically differ across groups, they are also not small enough to dismiss as completely unmeaningful (see post hoc Equivalence section in Appendix S2 for further detail).

It is also important to note that in our original preregistered analyses, we planned to use the Overall Family Environment Index (<https://osf.io/dz9t5>) as our primary dependent variable, because it is easily understood and interpretable by readers outside of psychology. As noted above (and in Table 2), no intervention effect was found on this composite measure. We also preregistered our plan to examine each of the individual indicators separately and apart from this main analysis, so all the analyses reported above and in Table 2 were preplanned, but it is notable to point out that intervention effects were clearly more specific to individual indicators, and less broadly captured by our composite Overall Family Environment Index, than we expected.

Discussion

For girls, but not boys, the Fast Track intervention delivered to children across grades 1–10 has modest but significant beneficial effects on several aspects of the family environments these children formed as adults 18 years after the intervention. Specifically, Fast Track reduced food insecurity in G2 mothers' family environment as well as G2 mothers' depression, alcohol problems, drug problems, and use of corporal punishment. However, other Fast Track effects on G2 women's family environments were null or, in the case of family chaos, opposite of what was expected, and no significant effects emerged in G2 men's family environments.

Fast Track's beneficial intervention effects on age-34 family environments ranged in size from .09 to .17 standard deviation units (Table 2). These effects were similar to, if slightly smaller than, significant effects of Fast Track on G2 mental health and corporal punishment at age 25, where effect sizes ranged from .15 to .24 standard deviation units (Dodge et al., 2015). Additionally, these effect sizes are comparable to the median postintervention effects found in a meta-analysis of over 1,100 universal prevention programs (Tanner-Smith, Durlak, & Marx, 2018). Thus, in G2 women, Fast Track appears to be delivering effects on home environments 18 years and one generation after the end of intervention that are comparable to the average effects of prevention programs seen immediately after the program's conclusion.

Replicating and expanding on prior work

The present study replicates and expands on prior Fast Track and intergenerational research in at least three ways. First, current results extend prior Fast Track findings by revealing that the Fast Track intervention not only benefits G2 personal mental health through age 25 (Dodge et al., 2015) but also improves several aspects of the family environments that G2 mothers create for their G3s at age-34 (i.e., by lowering the likelihood that G3s are raised in homes with greater food insecurity, corporal punishment, or G2 depression, alcohol, or drug problems). Therefore, the current results extend age-25 findings by demonstrating the longevity and intergenerational benefits of the Fast Track intervention for G2 mothers. We note that women or men who did not become parents are not included in these analyses. Second, the current results also build upon the findings of the similar Raising Healthy Children intervention, which found that this intervention delivered in G2s' childhood reduced their G3s' externalizing problems approximately 20 years later (Hill et al., 2020), and of the findings of the Midwestern Prevention Project, which found that a drug abuse prevention program provided in G2s' adolescence ultimately led to greater G2 parental warmth and less G3 child impulsivity 15 years later (Riggs et al., 2009). Our results suggest that adaptive changes to the G2-G3 family environment may be one factor that contributes to the emergence of beneficial preventative intervention effects on G3s seen in these other studies. Third, the present work also builds on existing research examining the intergenerational transmission of family environments. This research suggests that intergenerational cycles of maladaptive family environments may be broken if childhood interventions target the externalizing pathway that facilitates this transmission process in G2 women (Rothenberg et al., 2016). The Fast Track intervention was specifically designed

to reduce childhood externalizing problems, and it is therefore notable that three of the five family outcomes that Fast Track beneficially improves in women (G2 parent alcohol problems, drug problems, and corporal punishment) are all outcomes that emerge from enduring externalizing behavior (Dodge et al., 2015; Rothenberg, 2019). Therefore, the present study adds to a small but growing body of literature (Dodge et al., 2015; Hill et al., 2020; Riggs et al., 2009) indicating that targeting the externalizing pathway in childhood could indeed alter family environments in adulthood.

Considering why intervention effects were only seen in G2 mothers

Research teams examining the intergenerational transmission of maladaptive family environments identify two potential targets of interventions that may halt the intergenerational transmission of maladaptive family environments: (a) the G2 behavioral precursors formed in G1-G2 family environments that persist across time and lead to the establishment of maladaptive G2-G3 family environments (e.g., the aforementioned externalizing pathway) and (b) the G2-G3 family environment itself (Kerr & Capaldi, 2019; Rothenberg, 2019). Though data are mixed, the preponderance of nascent intergenerational literature indicates that G2 women are both more likely to carry these behavioral precursors across ontogeny and shape these G2-G3 family environments (Kerr & Capaldi, 2019).

Sex differences in G2 behavioral precursors could account for intervention effects found on adults G2 mothers' mental health (i.e., the beneficial effects of Fast Track on G2 women's alcohol problems, drug problems, and depression). Existing naturalistic longitudinal intergenerational work indicates that the externalizing pathway that mediates the intergenerational transmission of high-conflict family environments emerges more strongly in G2 women (Rothenberg et al., 2016). As an intervention designed to prevent externalizing behavior, Fast Track is well suited to ameliorate such a pathway before it reaches the G2-G3 home, as evidenced by Fast Track's ability to reduce externalizing behavior at age 25. If Fast Track successfully ameliorated this pathway, then indicators in the G2-G3 family environment that have historically been highly associated or comorbid with G2 externalizing behavior (including G2 parent depression, alcohol problems, and drug problems) should be among those most readily affected (Rothenberg et al., 2018). That is exactly what we observe in our current results. We believe that Fast Track's effects on aspects of the G2s' adult mental health (i.e., depression, alcohol problems, and drug problems) are evidence of Fast Track successfully targeting the externalizing pathway that emerges as an intergenerational pathway primarily in women and serves as a behavioral precursor to maladaptive G2-G3 family environments.

When explaining intervention effects on G2 mothers' parenting (i.e., lower G2 corporal punishment in the intervention group) and lower food insecurity, we turn to considering how Fast Track can directly impact the G2-G3 family climate itself. Intergenerational researchers have identified that even in contemporary society, women are still tasked with a greater proportion of child-rearing responsibility, and still more often called to create family routines and climate (Kerr & Capaldi, 2019; Rothenberg, 2019). Therefore, the beneficial Fast Track effects on corporal punishment and family food security may emerge only in G2 mothers because mothers are still primarily responsible for the provision of parenting and

procurement of resources for family meals, and consequently more likely to benefit from such intervention effects.

Making sense of the family chaos findings

Current results indicate that the Fast Track intervention might have an iatrogenic effect on family chaos; family chaos scores were higher for G2 mothers who participated in the intervention than for control mothers. However, post hoc sensitivity analyses reveal that this iatrogenic effect is accounted for by the number of children in the household. Though the intervention group had only slightly (and nonstatistically significantly) more children in the household (2.11) compared to the control group (2.01), the positive association between higher number of children in the household and greater family chaos is so strong in this sample that it appears even a slight increase in number of children per household is enough to account for intervention effects. These findings speak to the powerful effects of demography and family structure on the family environment, even when competing with extensive prevention programs like Fast Track.

Making sense of null effects in G2 mothers

Though we discuss why we see null results in G2 fathers above, it is hard to decipher why some Fast Track effects on G2 mothers were null, while others were not. We offer some potential explanations for these effects below. First, it may be that no intervention effect was found on G2 mother cannabis problems because cannabis use has become much more normative, and is perceived as less problematic in the generational cohort G2s are a part of (Rothenberg et al., 2020). Therefore, any intervention effects may have been erased by the generation-wide trend toward perceiving cannabis use and problems as normative. Second, we do not have a clear explanation for why no beneficial intervention effect was found on G2 mother family chaos, romantic partner violence, parent physical aggression, and parent warmth, especially when beneficial intervention effects were seen on other parenting behaviors, depression symptoms, and substance use problem that often are associated with, or co-occur with, such behaviors. Future evaluations of the intergenerational effects of interventions are needed to determine if these null effects were a fluke or a generalizable pattern.

Finally, null results for some family environment indicators in mothers and fathers indicate that differences in some aspects of the family environment were not sufficiently large to detect a significant difference across the intervention and control groups. However, our post hoc equivalence tests also indicate that our null findings were not sufficiently small to say that the intervention and control groups were equivalent on these family environment outcomes. Therefore, null findings identified in this study need follow-up in future meta-analyses or larger intergenerational studies to determine definitively the size and meaning of these null effects (Lakens et al., 2018).

Strengths and limitations

The current study has several notable strengths, including its randomized control trial design, longitudinal follow-up, preregistered hypotheses, and robust control for covariates. However, it also has limitations. First, all measures of the family environment were G2

parent-reported and therefore potentially subject to reporter bias. Future studies could supplement parent self-reports of the family environment with reports from other family members or observational measures. Second, while the current study captured G2 home environment variables, it did not investigate G3 child mental health outcomes. Future work should do so.

Conclusion

The current preregistered, longitudinal randomized control trial provides evidence that childhood mental health interventions can break maladaptive cycles and promote the development of adaptive family environments when those children grow up and start families. In this study, these benefits to the family environment accrue in girls who become mothers by decreasing their depression, alcohol problems, drug problems, and use of corporal punishment with their children, and by increasing their family's food security. However, there were also limits to these intergenerational effects. For these same girls who become mothers, the Fast Track intervention had no effect on cannabis problems, experiences of romantic partner violence, or mother use of physical aggression or warmth with their children, and mothers in the Fast Track intervention group reported higher levels of family chaos than those in the control group. Moreover, no intervention effects were found for fathers who participated in the Fast Track intervention as children. Taken together, these results add to an emerging body of evidence (e.g., Hill et al., 2020) that early childhood mental health interventions are worthy investments not only because they promote healthy child development in the moment, but also because they promote several (but not all) aspects of healthy family environments for generations to come.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Key points

- Maladaptive family environments are associated with deleterious child development and can be passed across generations.
- We examined whether children who received the Fast Track intervention to prevent externalizing behavior from grades 1–10 developed improved family environments 18 years later in adulthood.
- Women (but not men) who participated in the Fast Track intervention had improved adult family environments. Women in the intervention group had lower depression, alcohol and drug problems, corporal punishment use, and food insecurity, but higher family chaos and no differences in cannabis problems, romantic partner violence, or use of physical aggression or warmth in parenting, compared to women in the control group. Results suggest that early childhood interventions have intergenerational effects.

Table 1
Family environment dependent variable means by intervention condition and G2 sex

Variable	Sample combining G2 mothers & G2 fathers						G2 mothers						G2 fathers					
	Intervention group		Control group		Intervention group		Control group		Intervention group		Control group		Intervention group		Control group			
	N	M or %	SD	N	M or %	SD	N	M or %	SD	N	M or %	SD	N	M or %	SD	N	M or %	SD
Overall Family Environment Index	206	2.07	1.62	194	2.09	1.55	79	1.77	1.52	88	2.14	1.64	127	2.25	1.67	106	2.05	1.48
Family chaos	206	1.82	0.61	194	1.72	0.56	79	1.92	0.61	88	1.74	0.61	127	1.75	0.60	106	1.71	0.53
Parent depression Score	206	7.59	9.13	192	9.74	11.52	79	8.14	8.94	86	11.38	12.63	127	7.25	9.26	106	8.40	10.40
Food insecurity Score	206	-0.05	0.83	194	0.06	0.91	79	-0.15	0.76	88	0.10	0.91	127	0.02	0.86	106	0.03	0.92
Parent alcohol problems	206	2.57	4.34	192	2.39	3.14	79	1.49	1.74	87	2.16	2.64	127	3.24	5.26	105	2.58	3.50
Parent cannabis problems	199	2.49	5.11	185	1.89	3.61	75	1.28	4.11	84	1.32	2.64	124	3.22	5.51	101	2.36	4.20
Parent drug problems	206	0.07	0.48	192	0.15	1.00	79	0.00	0.00	87	0.06	0.44	127	0.11	0.61	105	0.23	1.30
Parents who physically assaulted romantic partner in past year (%)	183	11%		175	6%		68	16%		81	5%		115	8%		94	7%	
Parent physical aggression	186	0.06	0.45	181	0.09	0.49	75	0.04	0.13	83	0.09	0.34	111	0.07	0.58	98	0.09	0.59
Parent corporal punishment	186	0.28	0.75	181	0.31	0.72	75	0.17	0.40	83	0.31	0.67	111	0.36	0.90	98	0.32	0.76
Parent warmth	201	3.79	0.43	188	3.82	0.45	79	3.84	0.33	85	3.89	0.31	122	3.76	0.49	103	3.76	0.53

Table 2

Fast track intervention main effects by intervention condition and sex based on robust full information maximum likelihood models^a

Variable	Fast Track Intervention Effect (Reported as difference between intervention and control groups in Standard Deviation units)								
	Sample combining G2 mothers & G2 fathers			G2 mothers			G2 fathers		
	β	SE	p	β	SE	β	β	SE	p
Overall Family Environment Index	-0.03	.05	.50	-0.12	.08	.14	0.02	.06	.79
Family chaos	0.08	.04	.05	0.14	.06	.02	0.05	.06	.44
Parent depression Score	-0.10	.05	.04	-0.17	.07	.02	-0.03	.07	.64
Food insecurity Score	-0.06	.04	.10	-0.15	.08	.04	0.00	.05	.97
Parent alcohol problems	-0.02	.05	.65	-0.15	.06	.02	0.05	.07	.49
Parent cannabis problems	0.05	.05	.33	0.00	.08	.99	0.06	.07	.38
Parent drug problems	-0.06	.04	.11	-0.09	.04	.01	-0.05	.05	.27
Parents who physically assaulted romantic partner in past year ^b (%)	1.96 ^b	.87	.27	18.10 ^b	28.21	.55	0.67 ^b	.38	.38
Parent physical aggression	-0.04	.04	.23	-0.08	.06	.20	-0.03	.06	.56
Parent corporal punishment	-0.04	.05	.46	-0.13	.06	.03	0.04	.08	.58
Parent warmth	-0.02	.05	.72	-0.08	.06	.17	0.02	.07	.72

^aModels controlled for site, cohort, nesting by school, sex (in the combined models), and whether G2 participant was Black, as well as the 20 preintervention control variables listed in Table S1.

^bOdds Ratio reported because this outcome was dichotomous.

Bold values indicate parameters that are significant at $p < .05$.