DOI: 10.1111/cdev.13839

EMPIRICAL ARTICLE

CHILD DEVELOPMENT

Parental history of positive development and child behavior in next generation offspring: A two-cohort prospective intergenerational study

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Funding information
Australian Research Council, Grant/Award Number: DP130101459, DP160103160 and DP180102447; National Health and Medical Research Council, Grant/Award Number: APP1082406 and APP1175086; National Institute of Child Health and Human Development, Grant/Award Number: 5 RO1 HD32948; New Zealand Health Research Council

Abstract

This study examined whether positive development (PD) in adolescence and young adulthood predicts offspring behavior in two Australasian intergenerational cohorts. The Australian Temperament Project Generation 3 Study assessed PD at age 19–28 (years 2002–2010) and behavior in 1165 infants (12–18 months; 608 girls) of 694 Australian-born parents (age 29–35; 2012–2019; 399 mothers). The Dunedin Multidisciplinary Health and Development Parenting Study assessed PD at age 15–18 (years 1987–1991) and behavior in 695 preschoolers (3–5 years; 349 girls) and their New Zealand born parents (age 21–46; 1994–2018; 363 mothers; 89% European ethnicity). In both cohorts, PD before parenthood predicted more positive offspring behavior (β_{range} = .11–.16) and fewer behavior problems (β_{range} = −.09 to −.11). Promoting strengths may secure a healthy start to life.

Abbreviations: ATPG3, Australian Temperament Project Generation 3 Study; DPS, Dunedin Parenting Study; G1, Generation 1; G2, Generation 2; G3, Generation 3; GEE, generalized estimating equations; PD, positive development; POMP, proportion of maximum percentage.

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Recent intergenerational research underscores the importance of parental preconception mental health problems in the behavioral development of future offspring (Letcher et al., 2020; Spry et al., 2020). This suggests that targeted investments aimed at preventing mental health difficulties may have positive implications for future progeny. Most intergenerational research has focused on identifying risk processes within the preconception period—prior to pregnancy, during adolescence, and young adulthood. Much less is known about the role of preconception promotive factors, that is, assets and resources that might influence the next generation's development (Olsson et al., 2020). However, there is a growing acknowledgment that traditional approaches to intervention involving the treatment of symptoms and deficits may benefit from complementary, strengths-based, capacity-building initiatives which promote psychosocial health and wellbeing across the life course (VanderWeele et al., 2020).

Adolescence and young adulthood represent watershed periods in the life course, during which transitions to adult roles and responsibilities create unique windows of opportunity to promote positive development (PD) and establish secure foundations for later life and the next generation (Lerner et al., 2018). In order to extend research on preconception promotive factors back to these earlier developmental periods (adolescence and young adulthood), we draw on two large, prospective intergenerational studies (based in Australia and New Zealand). These studies have followed population cohorts well prior to becoming parents. In both cohorts we explore whether—and how—overall PD (and its domains of life satisfaction, strengths and competencies, social connectedness, and community engagement) forecasts next generation offspring behavior.

Theoretical foundations

Developmental theories stipulate that positive functioning in one or more domains during one developmental period may influence other domains and cascade to foster psychosocial wellbeing in subsequent periods (Masten & Tellegen, 2012). Thus, many socioemotional skills and capacities commencing in adolescence are thought to persist or cascade over time into young adulthood, contributing to future wellbeing and subsequently to parenting the next generation (Cheng et al., 2016; Raby et al., 2015). Positive functioning likely reflects cumulative assets (internal resources and social and community connections) in addition to heritable individual behavioral traits. It is logical that such preconception assets, either individually or in combination, lay foundations for improved parent–child relationships and constructive parenting. From a social learning perspective, children's behavior is presumed to be shaped by behavior observed in their caregivers. According to both social learning and attachment theories, responsive parenting and modeling of social skills such as empathy and emotional regulation facilitate psychologically healthier child development (Mazzucchelli, 2018; van Ijzendoorn & Bakermans-Kranenburg, 2019). In sum, a developmental history of overall PD, and its facets, plausibly facilitates the provision of nurturing care, management of child behavior, and support of social–emotional development, thereby both increasing positive behaviors and competencies in children and reducing problem behaviors.

Conceptualizing and measuring positive development

While there is no single way to conceptualize and operationalize PD, current perspectives generally recognize it to be a multidimensional construct, encompassing not only emotional health but also broader indicators of social connection and community engagement (Hides et al., 2016; Keyes, 2007; Seligman, 2011). Furthermore, PD and problem behavior (internalizing and externalizing) are generally considered to be distinct even if related constructs, because the absence of problems does not necessarily ensure the presence of positive functioning (Keyes, 2007; O'Connor et al., 2011). Core components of PD may include individual factors (e.g., life satisfaction, strengths, and values), interpersonal or relational factors (e.g., parent and peer attachment, social competence), and social or community factors (e.g., social connectedness, community contribution, and civic engagement). Evidence supporting the importance of all of these with respect to later PD is mounting (Kerr et al., 2009; Kosterman et al., 2019). Nevertheless, there remains a paucity of studies examining long-term correlates of positive youth development. Rarer still are studies with sufficient maturity to investigate multigenerational pathways.

Two Australasian intergenerational cohort studies that are positioned to advance understanding are the Australian Temperament Project Generation 3 Study (ATPG3; Vassallo & Sanson, 2013) and the Parenting Study arising from the Dunedin Multidisciplinary Health and Development Study (Poulton et al., 2015). Instrumentation of both cohorts has been similarly informed by key theoretical perspectives in the wellbeing literature such as subjective wellbeing (Park, 2004), virtue ethics (Irwin, 1994), and developmental systems theory (Lerner et al., 2018). This has resulted in a set of broadly aligned measurement domains across cohorts, including indicators of life satisfaction, strengths and competencies, social connectedness, and community engagement. In addition to these common measurement domains, the ATPG3 assessments of PD focus on young adulthood (19, 23 and 27 years) and include aspects of social capital such as trust, tolerance of others, and civic engagement (Stone, 2001). The Dunedin

Parenting Study (DPS) measurements target mid-to-late adolescence, including additional developmentally relevant relational indicators of wellbeing of attachment to parents, peers, and school (Olsson et al., 2013). In both studies, indicators of PD form empirically validated, parsimonious, higher-order latent models (Hawkins et al., 2017; Olsson et al., 2013), demonstrating that PD is a cohesive construct in both adolescence and young adulthood.

Prospective associations

In the ATP study, the global PD construct has been validated by O'Connor et al. (2011) and Hutchinson et al. (2019) who found it to be positively related to earlier indicators of adaptive functioning (e.g., social responsibility). Furthermore, Hawkins et al. (2012) found consistent evidence of associations between more PD at 19–20 years of age and better physical wellbeing and friendship relationship quality and lower ratings of antisocial behavior and mental health symptoms 4 years later. Similarly, in the Dunedin Study, PD in adolescence was predicted by childhood indicators of social connectedness (e.g., peer social inclusion, prosociality) and in turn predicted a multidimensional measure of wellbeing at 32 years (Olsson et al., 2013).

Especially notable given the present report are DPS findings showing that the composite measure of adolescent socioemotional wellbeing reflecting life satisfaction, psychosocial strengths, social attachments, and community engagement positively predicted sensitive and responsive parenting of the next generation (McAnally et al., 2021). Notably, this association persisted after accounting for adolescent mental health problems, thereby suggesting that promoting wellbeing in adolescence may have a unique role to play in shaping later parenting. Another intergenerational study of fathers found that aggregate positive adjustment reflecting better academic skills, self-esteem, and peer relations during adolescence predicted both more constructive parenting and less offspring externalizing behavior at 5–7 years (Kerr et al., 2009). Such results underscore the claim that PD in the preconception period is associated with developmentally supportive parenting and the behavioral development of the next generation. Adolescent PD may play a foundational role in offspring behavioral outcomes. As positive traits and behaviors become more consolidated, positive impacts on next generation offspring may also be evident during young adulthood.

Notably, though, developmental scholars have yet to prospectively examine whether—and the extent to which—both maternal and paternal PD during adolescence or young adulthood predict both positive and negative offspring behavior. Furthermore, few studies have attempted to disentangle the effect of preconception PD from concurrent problem behaviors. Doing so would afford insight into the potential importance (or otherwise) of specifically investing in positive youth development initiatives. Additionally, there may be sensitive periods within early childhood (infancy and preschool years) during which parental characteristics with preconception origins affect children's developmental trajectories more than during other childhood periods; however, there is no clear consensus about this issue (Knauer et al., 2019; Landry et al., 2008). Intergenerational impacts may also be be greater for offspring competencies than problems; they may also differ by parent PD domains. However, no study has yet examined these possibilities.

Knowledge about sex effects is also lacking. Girls and young women have generally shown higher levels of socioemotional functioning than their male counterparts (Benson et al., 2006; Hawkins et al., 2011; O'Connor et al., 2012). There is also some evidence that early child behavior problems are more strongly related to preconception mental health problems of mothers compared with fathers (Letcher et al., 2020). However, sex differences in intergenerational associations are yet to be explored.

The current study

Here we examine the role of PD prior to becoming a parent in forecasting next generation offspring behavior in infancy and early childhood. In bringing together rare data from two prospective intergenerational studies, our primary objective was to conduct a series of exploratory analyses designed to advance an emerging body of knowledge on preconception determinants of offspring behavior. Our first aim was to explore the extent to which preconception PD prospectively reported during young adulthood (ATPG3) and adolescence (DPS), predicts subsequent competencies and behavior problems in infant (ATPG3) and toddler (DPS) offspring.

Our second aim was to assess whether there was an independent effect of preconception PD, above and beyond preconception internalizing and externalizing problems, in predicting next generation outcomes. It is possible that preconception PD plays a unique role in forecasting child behavior over and above preconception problems. However, it is also possible that any long-term effect of preconception PD is attenuated (or removed) after accounting for preconception problem behaviors.

Our third aim was to examine whether intergenerational associations differ by parent sex. The literature reviewed above suggests that associations between parental PD and offspring child behavior may be stronger for mothers compared with fathers. However, paternal effects may become more evident when father involvement tends to increase during the preschool years.

METHOD

Data derive from two intergenerational cohorts within the Australia and New Zealand Intergenerational Cohort Consortium (Olsson et al., 2020): the ATPG3 and the DPS arising from the Dunedin Multidisciplinary Health and Development Study (Poulton et al., 2015). These efforts employed slightly different designs. Both assessed PD prior to parenthood (ATPG3 across young adulthood; DPS across adolescence). The ATPG3 study assessed offspring behavior in each identified G3 child at 1 year postpartum. In the DPS, offspring behavior was assessed at 3–5 years postpartum in the first child. Details follow.

Participants and procedure

ATPG3

The ATP is an ongoing prospective study of infants born to a population-based cohort that has followed the socioemotional development of children and their parents across 39 years (16 waves). The initial sample, comprising 2443 Generation 2 (G2) infants aged 4–8 months (52% male) and their Generation 1 (G1) parents, was recruited through maternal and child health centers in 20 urban and 47 rural local government areas in 1983 and was representative of the state of Victoria.

All G2s were born in Australia. Approximately 30% of G2s had one or both parents born outside Australia; the majority came from Europe (27%) with the most common country of origin being the United Kingdom (12%). Only 1% came from New Zealand or other Pacific nations. At recruitment in 1983, less than a third of G2s (27%) had one or both parents reporting their highest level of education being less than a secondary school qualification; a further 34% had a secondary school qualification while 21% had a post-secondary school qualification and 18% had a tertiary qualification. Since recruitment, G1 (and G2s from 11–12 years) have completed mail surveys approximately every 2 years until 19–20 years and every 4 years thereafter. Further information regarding the sample characteristics and procedures of the ATP are available elsewhere (see Vassallo & Sanson, 2013).

The ongoing, prospective ATPG3 study commenced in 2012, with recruitment of infant offspring of G2 participants and their partners. Pregnancies were identified via participant email or phone every 6 months between 2012 and 2018 when participants were aged 29–35 years, representing the peak period of first births in Australia. Telephone or web-based surveys were conducted with parents at the third trimester of pregnancy, and at 2 months and 1 year postpartum. Follow-ups in early and middle childhood are also underway.

The present study used data collected at 1 year postpartum from G2 cohort participants and their non-cohort partners over 2012–2019. Cohort parents were asked to nominate "the person who spends most of their time taking care of the infant's physical and emotional needs." This person (usually the mother) was asked to complete the primary caregiver survey which captured information on a range of indicators relevant to the social and emotional development of the 1-year-old and their own wellbeing. A brief survey was also offered to the secondary caregiver, which included their emotional health and experiences of being a parent. If eligible, parents could participate with more than one child.

ATPG3 participants were included in the current analysis if parents had participated in the study for at least one wave in both the preconception and perinatal phases. To assess bias due to attrition, ATP G2 participants were compared on characteristics collected at baseline (1983, aged 4–8 months), including G2 sex, difficult temperament, and behavior problems, as well as G1 education and country of birth. Compared with all ATP participants, those who were screened for ATPG3 had marginally lower rates of parents born outside Australia and with less education. Those who were eligible for ATPG3 were similar to the recruited ATPG3 sample on baseline characteristics.

The analysis sample consisted of 1165 Generation 3 (G3) infants of 694 participants, 399 (57%) mothers of 696 infants, and 295 (43%) fathers of 469 infants; three infants were stepchildren. Of those in the analysis sample, 27% had one or both parents born outside Australia, with 26% coming from Europe and 2% coming from New Zealand and other Pacific nations. G2 education was assessed at the time of participation in the ATPG3 study. Only 3% of G2 participants reported having no secondary school qualification; a further 8% had a secondary school qualification while 26% had a post-secondary school qualification and 62% had a tertiary qualification. G2 participants reported 333 pregnancies or offspring not enrolled in ATPG3 as they were outside the eligibility window.

DPS

The Dunedin Study is a longitudinal investigation of 1037 people (52% male) born between April 1972 and March 1973 at the Queen Mary Maternity Hospital, in Dunedin, New Zealand. Study participants (G2) were assessed at birth and ages 3, 5, 7, 9, 11, 13, 15, 18, 21, 26, 32, 38, and 45 years. Ninety-four percent of the 997 living participants continue to participate. The cohort was representative of the population of the South Island of New Zealand and are primarily of New Zealand European ethnicity (97%); 7.5% self-identified as Māori, with participants being able to identify with more than one ethnicity (Poulton et al., 2015).

The DPS commenced in 1994 to assess the parenting behaviors and attitudes of the Dunedin Study members (G2) with their first preschool-aged child or stepchild (G3)

during a home visit (Belsky et al., 2005). Study members reported on their status as parents both during assessments (ages 18, 21, 26, 32, 38, 45) and as part of study tracing protocols. Home visits were conducted over 1994 to 2018 as close as possible to the third birthday of Dunedin Study members' first child or step-child. G2s were aged between 17.7 and 43.1 years at the time of their child's birth.

Parent–child interactions were conducted with the Dunedin Study participant and their child and filmed in three semi-structured situations lasting a total of 45 min (National Institute of Child Health and Human Development Early Child Care Research Network, 1999). The situations were: (1) "free play," during which a standard variety of age-appropriate toys were set out on the floor in a quiet area of the home and parents were instructed to engage the child as they might if they had free time on their hands and; (2) "competing-task" situation, during which the child was given only a single soft toy to play with while the parent completed a questionnaire and was asked not to permit the child to engage a second set of clearly visible and attractive toys (e.g., puzzles, building toys) which were purposefully placed within easy reach; and (3) using the toys from the competing-task activity, the parent and child were asked to complete a series of activities. Parents were requested to provide whatever assistance the child needed to complete the tasks without doing the tasks themselves.

At the time of analysis, 719 Dunedin participants had participated in the Parenting Study and 12 eligible participants had refused to participate. The current analysis sample consisted of 695 participants, 363 (52%) mothers of 363 children, and 332 (48%) fathers of 332 children, who provided observational child behavior data; there were 18 step- or adopted children. Only 14% of DPS participants reported having no secondary school qualification by age 26; 17% had a secondary school qualification; 47% had a post-secondary school qualification; and a further 23% had a tertiary qualification. At age 26, 97% of DPS participants reported New Zealand European ethnicity—in line with the findings from the whole sample (i.e., including those who were not parents).

Measures

Parental preconception positive development

Positive development was assessed by both cohorts with constructs tapping life satisfaction, capacity for social connection, and community engagement. Tables 1 and 2 summarize the measures used for ATPG3 and DPS respectively.

ATPG3

Positive development at 19–20, 23–24, and 27–28 years (years 2002–2010) was assessed with five domains: (1)

TABLE 1 Summary of Australian Temperament Project positive development domains at 19, 23, and 27 years

Young adult construct	Measure	Source
Social competence	*Empathy* (5 items); e.g., I show my concern for others when they experience difficulties. *Responsibility* (4 items): I can be relied on to do things right. *Self-control* (3 items): I can assert my opinion without arguing or fighting. Rated on a 5-point scale from "never" to "always"	Developed by Smart and Sanson (2003) following Gresham and Elliot's (1990) model of child and adolescent competence
Life satisfaction	19 years (8 items); e.g., How satisfied are you with your social life? Rated on a 4-point scale from "not at all satisfied" to "very satisfied" 23 and 27 years (3 items); e.g., I've got my life together Rated on a 5-point scale from "never/almost never" to "always/almost always"	Adapted from National Survey of Families and Households (Sweet & Bumpass, 2002) and Rosenthal et al. (1981)
Civic action and engagement	Participation and donations to social and community groups (9 groups at 19 years; 14 groups at 23 and 27 years; e.g., sporting, arts, political groups); Sum of yes/no responses Civic action (6 items); e.g., Took part in demonstration or march. Rated on a 5-point frequency scale from "no" to "five or more times"	Adapted from Stone (2001) and Stone and Hughes (2002)
Trust and tolerance	19 years (3 items); 23 and 27 years (4 items); e.g., Having people from different ethnic and cultural backgrounds makes Australia better Rated on a 5-point scale from "disagree completely" to "agree completely"	Individual items from Stone and Hughes (2002)
Trust in authorities and institutions	Trust in organizations, trust in governments, and confidence in police; e.g., How confident are you that the following organizations can be relied on to act in a fair or reasonable manner? (e.g., local council) Rated on a 4-point scale from "not at all confident" to "very confident"	Adapted from Stone and Hughes (2002) and Flanagan and Longmire (1995)

TABLE 2 Summary of Dunedin Multidisciplinary Health and Development Study positive development domains at 15 and 18 years

Adolescent construct	Measure	Source
Strengths	Self-report (22 items; yes/no); Parent or significant other report (18 items: yes/somewhat/no); e.g., "confident," "helpful" and "friendly." Responses were summed	Strengths scale: Williams and McGee (1991)
Life satisfaction	(a) Satisfaction for life as a whole; (b) satisfaction with activities engaged with in spare time; (c) getting on with people and (d) satisfaction with the future. Rated on a 4-point scale from "very unhappy" to "very happy"	See Olsson et al. (2013)
Participation in clubs and groups	"Do you belong to any organized clubs or groups or activities outside school—e.g., scouts, gym, soccer, cricket, music, or ballet?" Responses were recorded verbatim (McGee et al., 2006) and classified as either participation in cultural and youth groups (ages 15 and 18), or participation in sporting groups (age 18)	McGee et al. (2006)
Quality of social attachments	*(a) Attachment to parents* and (b) *attachment to friends* Rated on a 4-Point Likert scale from almost never/never to almost always/always *(c) Attachment to school*: Visual analog scale of five concentric circles where adolescents were asked to imagine the circles represented everything taking place at their school and then rate "how far from the center of things" they are (d) Have someone to talk to if they "had a problem or felt upset about something" Yes/no	Shortened version of Inventory of Parent and Peer Attachment (Armsden & Greenberg, 1987; Nada-Raja et al., 1992) Attachment to school: Elliott and Voss (1974)

social competence; (2) life satisfaction; (3) civic action and engagement (4) trust and tolerance; and (5) trust in authorities and organizations. Further details are provided in Hawkins et al. (2017) and Table 1. While some items within domains varied by age, necessitating some changes in measures across time, the measures tapped the same constructs and confirmatory factor analysis showed this multidimensional model represented a good fit of the data at each time point (Hawkins et al., 2017). Higher scores reflect better outcomes on these domains.

Given varied response options, mean scores for each subscale were derived using the proportion of maximum percentage (POMP) approach (Cohen et al., 1999), whereby each mean score reflects a percentage of the maximum possible score. Additionally, at each time point an overall mean score for PD was derived from the mean of the five POMP standardized subscale scores. An average young adult PD score was then derived across the three time points. The final PD score reflected the participant's mean percentage of the maximum possible scores available on the five subscales.

DPS

G2 adolescent PD at ages 15 and 18 (years 1987–1991) was indicated by four constructs validated in prior work (McAnally et al., 2021; Olsson et al., 2013): (1) quality of social attachments; (2) participation in clubs and groups; (3) self-perceived competencies or strengths; and (4) life satisfaction. Table 2 summarizes the adolescent measures used in this study.

As for ATPG3, we used the POMP approach to equalize the domain scales (Cohen et al., 1999). Scores on each of the four domains were recoded to the percentage of the maximum possible score. The overall PD score reflected the participant's mean percentage of the maximum possible scores on the four subscales.

Child behavior

ATPG3

Infant behavior problems at 1 year postpartum were reported by the primary caregiver using the Brief Infant-Toddler Social and Emotional Assessment (BITSEA), a validated, developmentally appropriate parent-report measure of social–emotional and behavioral problems and competencies in 12- to 36-month-olds (Briggs-Gowan & Carter, 2006). The 31-item Problem Total score captures a range of problem areas including internalizing, externalizing, dysregulation, atypical, and maladaptive behaviors, with higher scores denoting higher levels of problem behavior. The 11-item Competencies Total score comprises items addressing social–emotional competencies (such as compliance, attention skills, mastery motivation, prosociality) and aspects of social relatedness that are expected in early childhood. Parents rated items on a 3-point scale, from 0 (not true/rarely) to 1 (somewhat true/sometimes) to 2 (very true/often).

DPS

Early child behavior problems in G3 children were reported by G2 parents using a modified version of the Behavioral Screening Questionnaire which included 18-items capturing a range of internalizing, externalizing, and toileting problems (Richman, 1977; Richman & Graham, 1971). Observed ratings of child positive and

negative behavior during the three parent–child interaction tasks were also used as outcomes. Film of the three situations was independently coded using ten 7-point scales (National Institute of Child Health and Human Development Early Child Care Research Network, 1999), four of which related to child behavior and were averaged across the three tasks. Two scales indicated positive child behavior (positive mood and sustained attention) and two indicated negative child behavior (negative mood and activity level). Positive mood ranged from 1 (no positive affect) to 7 (extensive and pervasive happy, enthusiastic periods). Sustained attention ranged from 1 (e.g., distracted, uninvolved in the world of objects) to 7 (high level of involvement or "focusing in" on objects or engagement in activities). Negative mood ranged from 1 (no negative affect) to 7 (e.g., frequent crying, whining, frowning, yelling, screaming, tense body). Activity level ranged from 1 (passive, inactive, very low level of motor activity) to 7 (highly active, constantly moving). Inter-coder reliability was previously assessed by having second coder recode a random selection of 15% of the videotapes. Measures of interrater agreement ranged from $r = .77$ to .96 across the observer ratings (see Belsky et al., 2005).

Potential confounding factors

Due to concern that any effects of PD might be due to mental-health problems when making preconception predictions, we controlled for G2's self-reported internalizing and externalizing behavior. Concern for other confounding factors led to controls for G1 family socioeconomic status and G2 sex, as well as postnatal factors of G2 age at time of G3 birth, G3 age at time of G3 assessment, and G3 sex (see Table S1).

Statistical analysis

Analyses were conducted separately for each cohort using Stata 15 (StataCorp., 2021). We estimated the associations between G2 preconception PD and G3 child behavior using linear generalized estimating equations (GEE). In ATPG3, the GEE accounted for potential correlations between offspring outcomes due to within-parent clustering (i.e., parents with multiple offspring).

To facilitate interpretation of regression effects, the PD POMP scores and offspring behavioral outcomes were *z*-scored prior to analysis. Consequently, our reported regression effects are standardized betas (β) which are interpreted as the predicted β standard deviation change in offspring behavior outcomes associated with a one standard deviation increase in the exposure (PD).

Associations were adjusted for G2 preconception characteristics assessed at the same time as PD and key sociodemographic variables: G1 family socioeconomic status, and G2 sex. We further assessed the interaction between PD and G2 sex in the fully adjusted models.

Multiple imputation was used to minimize the effects of sample attrition in ATPG3. On average, missing data on the 17 variables used in imputation was 13%. We imputed 20 complete datasets under a multivariate normal model separately for G2 males and females to allow for predicted values for missing data points to vary by sex. Under this approach, binary variables were imputed as continuous variables and then back transformed with adaptive rounding following imputation (Bernaards et al., 2007). We obtained all estimates by averaging results across the 20 imputed datasets with inferences under multiple imputation obtained using Rubin's rules (Rubin, 2004). In supplementary sensitivity analyses we also repeated ATPG3 analyses using complete case data. Due to low rates of missing data in the DPS (4.3% on average), multiple imputation was not used; results from complete cases analyses are presented.

Several additional supplementary analyses are presented. Firstly, unadjusted associations are reported. Secondly, we separately adjusted for G2 pre-exposure (rather than current) internalizing and externalizing problems. Thirdly, because more temporally proximal postnatal factors may also be relevant to child behavior outcomes, we further adjusted for G2 age at G3 birth, G3 sex, and G3 age at the postpartum assessment. ATPG3 analyses include additional adjustments of G2 caregiver status (primary caregiver or not) and G3 birth order (firstborn v. later born). Finally, additional analyses disaggregated the PD measure in order to explore the relative contribution of the different facets (five domains in ATPG3 and four domains in DPS) to offspring behavior.

RESULTS

Sample characteristics

Preconception and postnatal characteristics, and infant and preschooler outcomes are summarized in Table 3 and, for facets of PD, in Table S2. Mean ages of offspring were 1.2 and 3.3 years for ATPG3 and DPS respectively.

Preconception positive development and offspring behavior

ATPG3: Young adulthood to infancy

Higher levels of PD during young adulthood of G2 parents predicted lower levels of offspring behavior problems ($\beta = -.11$) and higher levels of competencies ($\beta = .16$) at

TABLE 3 Preconception and postnatal sample characteristics

Australian Temperament Project Generation 3 Study: ATPG3 (n = 1165 offspring, n = 694 parents)					**Dunedin Parenting Study: DPS (n = 695 parents and offspring)**				
Preconception: Young adulthood (19–27 years)	***M***	**SD**	**95% CI**	**Missing %**	**Preconception: Adolescence (15–18 years)**	***M***	**SD**	**95% CI**	**Missing %**
Overall positive development	56.05	7.65	(55.41, 56.70)	22	Overall positive development	56.17	10.25	(55.39, 56.94)	3
Postnatal: 1 year postpartum					Postnatal: 3 years postpartum				
Infant behavior problems	7.16	4.32	(6.90, 7.42)	8	Preschool behavior problems	11.16	4.84	(10.78, 11.55)	11
Infant competencies	16.12	2.79	(15.95, 16.29)	8	Preschool observed negative behavior	−3.88	1.49	(−3.99, −3.77)	0
					Preschool observed positive behavior	8.30	1.89	(8.16, 8.44)	0
G1 & G2 potential confounders					G1 & G2 potential confounders				
G1 socioeconomic status	0.11	0.90	(0.04, 0.18)	3	G1 socioeconomic status	3.52	1.14	(3.44, 3.61)	.5
G2 female sex: *n*, %	399	57	(54, 61)	0	G2 female sex: *n*, %	363	48	(44, 52)	0
Adolescent externalizing	0.20	0.24	(0.18, 0.22)	17	Early adolescent externalizing 11–13 years	−.04	.85	(−.11, .03)	18
Adolescent internalizing	3.00	1.92	(2.84, 3.16)	17	Early adolescent internalizing 11–13 years	.00	.76	(−.06, .07)	18
Young adult externalizing	0.03	0.06	(0.03, 0.04)	22	Adolescent externalizing	.01	.85	(−.05, .06)	3
Young adult internalizing	3.25	2.26	(3.06, 3.44)	22	Adolescent internalizing 15–18 years	.01	.71	(−.06, .07)	3
G2 and G3 postnatal covariates					G2 and G3 postnatal covariates				
G2 age at G3 birth	31.76	2.46	(31.62, 31.90)	0	G2 age at G3 birth	29.93	5.75	(29.50, 30.36)	0
G3 female sex: *n*, %	608	52	(49, 55)	0	G3 female sex: *n*, %	349	50	(46, 54)	0
G3 age at infant survey (months)	14.88	4.8	(14.64, 15.24)	8	G3 age at preschool assessment (months)	39.67	5.19	(39.29, 40.06)	0

Note: Mean preconception positive development scores reflect the mean of the proportion of maximum percentage (POMP) subscale scores. In ATPG3, frequency estimates for preconception characteristics were calculated from the total number of participants. Frequency estimates for G3 offspring characteristics and behavior were calculated from the total number of infants. Table S1 provides detailed description of the covariates.

Abbreviations: G1, Generation 1 (grandparents); G2, Generation 2 (parents); G3, Generation 3 (offspring).

TABLE 4 Associations between parental preconception positive development and infant behavior: ATPG3

	Full sample				Mothers			Fathers		
Positive development	***β***	**95% CI**	***p***	**Sex interaction *p*-value**	***β***	**95% CI**	***p***	***β***	**95% CI**	***p***
Outcomes										
Infant behavior problems	−.11	(−.19, −.03)	.005	.049	−.19	(−.29, −.09)	<.001	−.04	(−.16, .08)	.529
Infant competencies	.16	(.08, .25)	<.001	.003	.27	(.17, .37)	<.001	.06	(−.06, .17)	.339

Note: All models adjusted for preconception of characteristics G1 socioeconomic status, G2 sex and G2 internalizing and G2 externalizing assessed at the same time as the assessment of G2 positive development.

1 year postpartum (Table 4). Parent sex moderated these associations, which were evident in mothers ($\beta = -.19$ for problems, $\beta = .27$ for competencies), not fathers ($\beta = -.04$ for problems, .06 for competencies). These findings were consistent with analyses using complete case data (see Table S3) and additional adjustments (see Table S4).

DPS: Adolescence to toddlerhood

Higher levels of adolescent PD in G2 parents predicted higher levels of observed positive behavior ($\beta = .11$) and lower levels of offspring behavior problems ($\beta = -.09$) at 3–5 years postpartum (Table 5). While parent sex did not statistically moderate the effect of adolescent PD on child behavior, associations were stronger for mothers compared with fathers for both preschool behavior problems ($\beta_{mothers} = -.13$; $\beta_{fathers} = -.01$) and observed positive behavior ($\beta_{mothers} = .13$; $\beta_{fathers} = .-09$). These findings were consistent with supplementary analyses using additional adjustments (see Table S5). Positive development had an unadjusted association with lower levels of observed preschool negative behavior which was not evident in any of the adjusted analyses. In addition, we found no difference in the interpretation of the results when we excluded the three items referring to toileting ("wet the bed at night," "wet pants during the day," and "bowel trained—never dirties pants") which may be less typically included in externalizing and internalizing measures.

To gain additional insight into the findings, we examined the extent to which the different facets of PD were associated with offspring outcomes. In ATPG3, higher levels of social competence and civic action and engagement predicted lower levels of offspring behavior problems and higher levels of competencies (see Table S6). Sex interactions showed that higher levels of life satisfaction, trust and tolerance, and trust in authorities and organizations predicted higher levels of infant competencies in the case of mothers but not fathers. In DPS, higher levels of parents' adolescent strengths predicted lower levels of their children's preschool behavior problems (see Table S7). Higher levels of participation in clubs and groups predicted more observed positive behavior. No sex interactions were found.

DISCUSSION

Using rare intergenerational data from two large-scale prospective Australasian studies, findings indicated that healthier socioemotional development during adolescence and young adulthood predicted more positive and less negative offspring development during early childhood. Effect sizes in the two cohorts, while small to moderate, are of notable public health interest given that parent assessments occurred up to 25 years prior to child assessment and that the origins of child behavior are multifactorial (Funder & Ozer, 2019). Also important to appreciate, and in contrast to many intergenerational studies based disproportionately on high-risk populations (e.g., Kerr et al., 2009), is that the current study's results pertain to a more general population sample, indeed representing the entire populations of the locations in which the studies were launched, at the time when launched.

Before considering specific findings, several important points should be highlighted. Given the observational nature of the research reported herein, there is no way to determine whether the associations detected across generations reflect effects of shared genes, actual environmental causation, or both. Nevertheless, we regard it as especially important that features of PD in the prior generation predict early development in the next generation even with the parent's adolescent and young-adult problematic behavior discounted. Clearly, whatever the medium of influence, positive experiences and exposures seem to be more than just the opposite of negative ones when it comes to predicting intergenerational effects. This seems especially notable given that some of the developmental outcomes predicted reflected problem behavior.

Regarding specific findings, results from ATPG3 showed that overall PD in young adult women before parenthood predicted higher levels of socioemotional competencies and lower levels of behavior problems in infant offspring. Results from DPS indicated that these associations had even earlier antecedents, with PD across adolescence (male and female) forecasting higher levels of observed positive behavior and lower levels of parent-reported behavior problems in preschoolers. The strongest pathway was from PD to positive rather than

TABLE 5 Associations between parental preconception positive development and child behavior: DPS

	Full sample				Mothers			Fathers		
Positive development	***β***	**95% CI**	***p***	**Sex interaction *p*-value**	***β***	**95% CI**	***p***	***β***	**95% CI**	***p***
Outcomes										
Preschool behavior problems	−.09	(−.18, .01)	.064	.155	−.13	(−.25, −.01)	.035	−.01	(−.13, .10)	.803
Preschool observed negative behavior	−.05	(−.14, .04)	.249	.628	−.03	(−.15, .09)	.628	−.07	(−.19, .04)	.238
Preschool observed positive behavior	.11	(.02 .20)	.012	.653	.13	(.01, .25)	.035	.09	(−.03, .21)	.119

Note: All models adjusted for preconception characteristics of G1 socioeconomic status, G2 sex and G2 internalizing and G2 externalizing assessed at the same time as the assessment of G2 positive development.

negative offspring outcomes, suggesting intergenerational continuity in positive adjustment. And as already noted, the long-term effects of parent PD seen in both infant and preschool children persisted after adjustment for preconception internalizing and externalizing problems.

These findings extend on prior work showing that preconception depression and anxiety predict offspring behavioral development (Letcher et al., 2020; Spry et al., 2020) and the parent–child bond (Macdonald et al., 2022; Olsson et al., 2021), specifically, by showing that results are not just an unmeasured effect of internalizing and externalizing difficulties (i.e., being a proxy for limited PD). In so doing, the findings support calls for policies and programs designed to prevent problems in youth to be complemented by initiatives to promote and maintain PD (Benson et al., 2006).

The broad construct of PD used in the present research was a composite measure capturing competencies, life satisfaction, and community engagement in both studies. Despite measurement differences between the two cohorts, the higher-order parsimonious construct in both ATPG3 mothers and DPS mothers and fathers was predictive of child behavior above and beyond contemporaneous problematic child functioning. In ATPG3, the individual predictors most strongly associated with infant functioning were social competence (i.e., higher empathy, responsibility, and self-control), civic action, and engagement and life satisfaction. In DPS, at the individual variable level, strengths predicted lower preschool behavior problems while participation in clubs and sports predicted positive preschool behavior; these findings might indicate the intergenerational significance of both perceived competencies and broader community engagement during adolescence and young adulthood.

Of interest, fewer facets of PD were predictive of offspring outcomes in DPS compared with ATPG3. One explanation may be that specific components of PD assessed in adolescence have lower valence for offspring outcomes than the specific facets of PD assessed in young adulthood. More time and experience accrued between the parent and offspring assessments may have attenuated the effect of any legacy of preconception PD qualities on next generation outcomes. However, cohort differences in measurement and age of parents and offspring preclude firm conclusions being drawn. Regardless, the finding that the broad empirically validated, cohesive PD construct predicted offspring behavior (infant and toddler) in both cohorts demonstrates the relevance of a parental history of PD during both adolescence and young adulthood.

In contrast to many intergenerational studies, the current inquiry included both mothers and fathers in two cohorts and examined early behavioral development of offspring (in infancy and preschool). Interactions involving sex of parent in ATPG3 suggest that a father's overall positive socioemotional history may carry less influence in the prediction of infant behavior problems and competencies. This accords with prior ATPG3 findings with respect to preconception parental mental health problems which were associated with infant problems for mothers but not fathers (Letcher et al., 2020). It is not unusual for mothers to be more involved in childrearing than fathers, especially in the early years. So time spent caring may at least partially account for these sex differences. We investigated this possibility by including primary caregiver status in our ATPG3 supplementary analysis (primary caregiver status was not available in DPS). The association between maternal PD and offspring behavior was independent of primary caregiver status, suggesting a minimal role for the extent of childrearing involvement.

In any event, it should not be forgotten that at the level of individual PD measures, there was evidence that ATPG3 father preconception civic action and engagement predicted offspring competencies. While it is possible that a father's psychosocial history becomes more influential for offspring during the preschool years as fathers assume a greater role in the development of the exploratory system of the child (Cabrera et al., 2014), differences in timing of assessments, sampling and informant issues limit the conclusions that can be drawn. For example, infant behavior ratings were only available from the primary carer (typically the mother) and the stronger

effects seen in ATPG3 mothers compared with fathers could be partly accounted for by shared method variance. Further work is required to explore other potential moderating factors, such as time spent in the caregiving role, which may influence associations between parental and offspring behavior at different periods of development.

Strengths and limitations

This study brought together data from two prospective intergenerational cohort studies with repeated assessments of PD during adolescence or young adulthood in males and females, affording exploration of associations with infant and child behavior up to two decades later. It is notable that findings were generally consistent across cohorts despite differences in populations and measures, including different timing and mode of assessments of both parental developmental histories and child outcomes. Some limitations of one cohort were offset by strengths of the other. Shared method variance is a greater concern for ATPG3 which relied herein solely on parent reports (predominantly mothers), while DPS included independent ratings of observed child behavior. In addition, DPS included a broader age range of participant parents (from 18 to 43 years; mean age 29.9 years) while ATPG3 included infants born to participants over the peak reproductive years (age range 29–35 years; mean 31.8 years). It is possible that associations would differ in older and younger parents. Children in the DPS were mostly first born and aged 3–5 years (mean age 3.3 years; *SD* 0.43), while parents in the ATPG3 could participate with more than one infant (mean age 1.2 years; *SD* 0.40).

Selective attrition is a common problem in longitudinal studies (Fergusson & Horwood, 2001). Compared with the original sample, ATPG3 families retained in the study were less ethnically diverse and had higher education levels. We addressed potential biases due to non-participation using multiple imputation. In contrast, the DPS cohort remained representative of the community of its origin. To establish the generalizability of the findings, replication across more diverse ethnic and socioeconomic groups is required. Additionally, while we adjusted for key demographic variables and preconception characteristics, it remains possible that unmeasured confounding factors might influence both preconception PD and child outcomes, perhaps most notably—and as already mentioned—genes shared by parents and offspring. We also acknowledge a range of proximal biopsychosocial influences on child behavior, and included some of these (G2 parent age, G3 sex, G3 age at assessment) in supplementary analyses.

Future research

Notwithstanding the potential for unmeasured confounding, various mechanisms may account for the current findings and constitute avenues for future research. Positive functioning in adolescence may persist or cascade over time and contribute to how parents raise the next generation (Cheng et al., 2016). Attachment and social learning perspectives support the importance of responsive parenting and emotional regulation for better child development (Mazzucchelli, 2018). There is also evidence of a genetic propensity to psychosocial wellbeing which is in part independent of the genetic liability for internalizing psychopathology, meaning high levels of socioemotional functioning are possible even with an inherited genetic risk for psychopathology (Kendler et al., 2011). Furthermore, gene–environment interactions may also be at play: a high genetic predisposition to psychosocial wellbeing may buffer effects of adversity or enable individuals to create positive social environments that sustain and enhance wellbeing over time (Keyes et al., 2010). Future work should examine the role of genes, temperament, personality, parenting behaviors, and other relational factors such as partner relationship quality as mediating or moderating variables. Parenting and other mediating mechanisms will be explored in future analyses using Dunedin and ATP data (Olsson et al., 2020).

Implications and conclusions

The present study extends thinking about when to intervene to enhance the development of the next generation. Given the longstanding focus on the early years (World Health Organization, 2018), results of this report call attention to the preconception period, suggesting that PD during adolescence and young adulthood may also influence offspring psychosocial development in early childhood. Furthermore, our findings suggest that any comprehensive monitoring or intervention strategy would benefit from adopting a multidimensional approach to measurement and promotion of PD pathways. This view is in line with related evidence that universal, multidimensional school-based social and emotional learning programs have a range of positive effects (Durlak et al., 2011) with one program targeting child competencies showing benefits well into the 30s (Kosterman et al., 2019); and that programs run beyond education settings that seek to promote positive emotions and behaviors (Bolier et al., 2013) and those that target both mental distress and wellbeing are also efficacious (Gloster et al., 2020).

The promotion of PD requires the attention of multiple sectors, including education, health, social services, and community organizations, especially during young adulthood when post-secondary education is not attended by all and when programs promoting young adult life skills are rare (Oesterle, 2013). There are many sociocultural climates that could influence PD trajectories including those defined by the local community within which children and young people live (e.g., socioeconomic

advantage vs disadvantage), state and federal sociopolitical contexts (e.g., inclusive vs discriminatory policies) and the macro-level global influences (e.g., wars and pandemics; Bronfenbrenner & Morris, 2006). Each of these domains of influence warrants further study. Taking a holistic full-cycle life course perspective, interventions and policies targeting PD have the potential to yield a triple dividend (Patton et al., 2016)—improving social and emotional health for young people not only at the time of intervention but also as future adults and for their children.

ACKNOWLEDGMENTS

The Australian Temperament Project (ATP) and Generation 3 studies are located at The Royal Children's Hospital Melbourne and are a collaboration between Deakin University, The University of Melbourne, The Murdoch Children's Research Institute, The Australian Institute of Family Studies, The University of New South Wales, The University of Otago (NZ), La Trobe University and the Royal Children's Hospital; further information available at https://www.melbournechildrens.com/atp/. This work was supported by the Australian Research Council (DP130101459; DP160103160; DP180102447) and the National Health and Medical Research Council of Australia (APP1082406). We acknowledge all collaborators who have contributed to the ATP, especially Profs Ann Sanson, Margot Prior, Frank Oberklaid, and Dr Diana Smart. We would also like to sincerely thank the participating families for their time and invaluable contribution to the study. The Dunedin Multidisciplinary Health and Development Study is supported by the New Zealand Health Research Council. The Parenting Study data collection was funded by the New Zealand Health Research Council and a National Institute of Child Health and Human Development Grant 5 RO1 HD32948 to Belsky. Further funding came from a grant from the Australian Research Council (DP180102447). We thank the Dunedin Study founder, Dr Phil Silva and the current director Prof Richie Poulton. The authors would like to thank the Dunedin and Parenting Study members and their families and friends for their participation and ongoing support. Open access publishing facilitated by Deakin University, as part of the Wiley - Deakin University agreement via the Council of Australian University Librarians.

ETHICS STATEMENT

ATPG3 protocols have been approved by the Royal Children's Hospital Human Research Ethics Committee. Prior ATP waves were approved by the relevant committee at the time. Written informed consent was obtained from participants. Each assessment phase of the Dunedin Study was approved by the appropriate ethics committees at the time. G2 Participants, and in earlier phases, their G1 parents, gave signed, informed consent for each assessment. Participants in the Parenting Study provided signed informed consent to be filmed with their G3 child.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Letcher, P., Greenwood, C. J., McAnally, H., Belsky, J., Macdonald, J. A., Spry, E. A., Thomson, K. C., O'Connor, M., Sligo, J., Youssef, G., McIntosh, J. E., Iosua, E., Hutchinson, D., Cleary, J., Sanson, A. V., Patton, G. C., Hancox, R. J., & Olsson, C. A. (2022). Parental history of positive development and child behavior in next generation offspring: A two-cohort prospective intergenerational study. *Child Development*, *00*, 1–14. https://doi.org/10.1111/cdev.13839