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AUTHOR(S)

Niamh Dhondt, Colm Healy, Mary Clarke, Mary Cannon

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Title: Childhood adversity and adolescent psychopathology: evidence for mediation in a national longitudinal cohort study.

Authors: Niamh Dhondt[1], Colm Healy[1†], Mary Clarke[1,2], Mary Cannon[1,3].

1 Department of Psychiatry, Royal College of Surgeons in Ireland, Dublin 2, Ireland.

2 Department of Psychology, Royal College of Surgeons in Ireland, Dublin 2, Ireland.

3 Department of Psychiatry, Beaumont Hospital, Dublin 9, Ireland.

† Correspondence:

Colm Healy

Department of Psychiatry

Royal College of Surgeons in Ireland

2nd Floor Ardilaun House

111 Stephens Green

Dublin 2

Email: colmhealy@rcsi.com

Senior Author: Professor Mary Cannon

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Abstract

Background: Childhood adversity (CA) is a well-established risk factor for psychopathology, however, many who experience CA do not go on to develop psychopathology. Poor self-concept and poor parental support are known risk factors for adolescent psychopathology, which may account for some of this mechanism.

Aims: To investigate candidate mediators in the relationship between CA and psychopathology.

Method: We used data from the age 9 and 13 waves of the child cohort of the Growing Up in Ireland study. We undertook mediation analysis using path decomposition of the relationship between childhood adversity and psychopathology (internalising and externalising problems) at age 13 and persistent psychopathology. Candidate mediators were self-concept, parent-child relationship, and hobby participation at age 9.

Results: CA was reported by 28.2% of age 9 participants. CA was significantly associated with age 9 and 13 internalising and externalising problems. Parent-child conflict mediated the relationship between CA and both age 13 and persistent psychopathology, accounting for 52.4% of the relationship between CA and persistent externalising problems (indirect-OR:1.30, 95% CI:1.19-1.43) and 19.2% for persistent internalising problems respectively (indirect-OR:1.24, 95% CI:1.15-1.34). There was a small effect of self-concept on the relationship between CA and persistent psychopathology. Hobby participation and positive parent child relationship did not mediate these relationships.

Conclusions: Parent-child conflict explains almost half the relationship between CA and persisting externalising problems in adolescence, and a fifth of the relationship with persisting internalising problems. This suggests parent-child conflict is a good target for interventions in childhood to prevent adolescent psychopathology.

Introduction

Childhood adversity, stressful life events, and trauma have been repeatedly established as risk factors for psychopathology, and adversity has been estimated to be responsible for as much as 32% of the risk of psychopathology in adolescents[1]. This link has been established throughout the lifespan for different kinds of adversity and psychopathology[2]. CA may have stronger associations with psychopathology if repeated or cumulative[3]. As many as one in four children may have suffered at least one severe CA in their lifetime[1,3]. Partial explanations of *why* some people go on to develop psychopathology and some do not, despite similar or even identical risk profiles have been proposed, in terms of underlying genetic differences, neurobiological changes and family processes, as well as sensitization to future adversity[4-6]. There is however, a particular need for research into mechanisms which may be altered through intervention[7]. Mediation analysis is particularly useful for establishing the nature of these mechanisms, as mediators can explain the relationship between adversity and psychopathology, rather than merely influencing that relationship or having a relationship with either adversity or psychopathology. Existing research has proposed some plausible candidates for such interventions, including family- and child-based mediators[5]. Research including multiple kinds of mediator can more clearly identify which factors are responsible for more of the relationship, allowing for more effective interventions[5]. Newer statistical methods such as that developed by Karlson, Holm and Breen (KHB) allow comparison of coefficients between these mediators in a logistical regression model[8]. This study aims to investigate a range of plausible candidate mediators of the relationship between CA and adolescent psychopathology, with a view to identifying candidates for intervention. We hypothesized that there are both child- and family-based mediators of the relationship between CA and psychopathology in adolescence. Our aim was to determine whether poor self-concept, lack of engagement with hobby participation and poor relationship with parents mediated the relationship between CA and internalising and externalising problems in childhood and adolescence.

Methods

Participants

The study population comprised the child cohort of the Growing Up in Ireland (GUI) study. This is the national longitudinal study of children and youth in Ireland[9,10]. The child cohort was recruited at age 9 and is comprised of 8658 children and their families. Participants were recruited from 910 primary schools (82% of those invited to participate), selected to accurately represent the school population of Ireland as a whole, with respect to location, disadvantage of pupils, gender mix, denominational status and number of 9 year old pupils[9]. A maximum of 40 students were recruited from each school, to minimize burden on school staff and to prevent larger schools from biasing the sample[9]. Multiple rounds of information and consent forms were given to families to minimize refusal. Between August 2007 and May 2008, 50% of the 17054 invited families consented to participate and provided useable data. A follow-up study (Wave two) was carried out at age 13 and 7423 (87.7%) were interviewed between August 2011 and March 2012. Interviews and questionnaires were undertaken with children, primary caregivers (PCG) and teachers at both ages 9 and 13, (Wave one and two). To account for the demographic differences between the baseline and follow-up caused by differential attrition, the data were 'reweighted' with respect to differential response characteristics[10] which gives rise to the reweighted sample size of 7,505 participants.

Ethics and Consent: The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. The quantitate aspects of the child cohort of Growing up in Ireland study was granted ethical approval from the research ethics committee of the Health Research Board. Written consent was obtained from all participants and their parents/guardians in the GUI study. Participants are not identifiable from the anonymized microdata file.

Exposures

Childhood Adversity

At age 9, the primary caregiver was asked about stressful life events to which the child might have been exposed (see supplementary Table 1). These were: death of a parent, death of a close family member, death of a close friend, parent in prison, drug taking/alcoholism in the immediate family, mental disorder in the immediate family, a stay in foster home/residential care, serious illness/injury, serious illness/injury of a family member, divorce/separation of parents, conflict between parents, moving house, moving country, and other disturbing event/unspecified.

This questionnaire does not include any items on sexual or physical abuse. The questionnaire includes both severe ('death of a parent') and mild events (e.g. 'moving house'). Determining the subjective impact of each of these events is not possible from this questionnaire. For this paper we defined Childhood Adversity as experiencing three or more events, or at least one of the seven most stressful life events which we defined a-priori as: death of a parent; death of a close friend; parent in prison; drug taking/alcoholism in the immediate family; mental disorder in the immediate family; serious illness/injury and a stay in foster home/residential care.

Outcomes

Adolescent and Persistent psychopathology

The Strengths and Difficulties Questionnaire (SDQ)[11] was administered to primary caregivers at ages 9 and 13. Sum scores for internalising and externalising problems were used separately, with a pre-defined threshold for each scale, in line with the definition of the measure (above 7 items endorsed for internalising and 9 for externalising).

Internalising and externalising problems were examined separately in the interest of identifying mediators which might support one or the other, in the context of mixed evidence for specificity of CA leading to kinds of psychopathology[12].

A persistence measure was included in the analysis using the SDQ internalising and externalising scores from both time-points. Persistent internalising or externalising problems were defined as scoring above the threshold at both time-points (i.e. 9 and 13).

Mediators

Mediators were chosen in an attempt to cover both internal and external child factors (thoughts about themselves as well as behaviours) and family factors. Mediators were measured at age 9 in order to best identify those to be used targeted in interventions.

Self-concept

Our candidate 'internal child factor' was measured with the 60 item Piers Harris II scale[13] at ages 9 and 13. This is a 20 item self-report questionnaire designed for use with children aged 7-18. It includes domain subscales with items on behavioural adjustment (e.g. "I am well behaved in school"), intellectual and school status (e.g. "I am good in my schoolwork"), physical appearance and attributes, freedom from anxiety (e.g. "I am often afraid"), popularity ("I have many friends") and happiness and satisfaction (e.g. "I like being the way I am"). The total score (the sum of these subscales) was used in the analysis, reverse-scored and standardised via z-score, so as to be directly comparable to the other variables in the path decomposition.

Parent-child relationship

Measured by primary caregiver report with the Pianta parent-child relationship scale[14] at ages 9 and 13. The two longer subscales with items about conflict (e.g. "My child and I always seem to be struggling with each other") or positive items (e.g. "I share an affectionate, warm relationship with my child") were used as measures of positive and negative aspects of the relationship. The positive subscale was reverse-scored and both were standardised via z-score in order to be directly comparable to other variables in the path decomposition.

Hobby participation

Our candidate 'external child factor' was measured as a category variable of participation in either sports or 'cultural activities' at age 9.

Confounds

Gender and handedness were both included as confounds, as they have previously been associated with differences in the development of psychopathology[15,16]. Nationality was also included, measured

by proxy as whether or not the child was born in Ireland, as immigration from some countries or in some circumstances may be associated with increased risk of psychopathology.[17] Socio-economic status was also included as a confound, measured both as the highest level of education achieved by the primary caregiver and as the family's income quintile.

Childhood psychopathology, as measured by parent-report SDQ at age 9, was included as a confound as it is likely to be a predictor of psychopathology at age 13 and may relate to both CA and mediators.

Statistical analysis

Logistic regression was used to examine the demographic differences between children with and without CA (Table 1).

Mediation analysis was undertaken in line with Baron and Kenny's recommendations[18], proposing the model shown in Figure 1. Logistic regression was used to investigate whether CA (and confounds) predicted externalising and internalising behaviours at age 13 and persistence of psychopathology between ages 9 and 13 (Table 2). Second, linear regression was used to investigate whether CA predicted mediators (with the exception of hobby participation, the only categorical mediator, for which logistic regression was used). Third, non-significantly related mediators were then excluded, and logistic regression was used to investigate the association between mediators and psychopathology (Table 3).

The Karlson, Holm and Breen (KHB) method[8], which allows comparison of estimated coefficients of two nested non-linear probability models was used in STATA (version SE 15.1) to decompose the effects of the mediators in this logistic regression model (Table 3). The decomposed pathways are visually displayed in Figure 1. Finally, a small proportion of participant were missing data on some variables (primarily income quintile: 7.0% and self-concept: 6.7%). To ensure that this did not bias the results, we re-ran all analysis using multiple imputation with five imputed datasets (see supplementary 2). A comparison of the coefficients estimated from the observed findings and the imputed finding are reported in Supplementary 2.

Fig 1. Proposed models of the relationship between CA and psychopathology, with the total effects transmitting both directly and indirectly via proposed mediators: parent-child conflict and positive relationship, self-concept and hobby participation

[Insert Fig 1]

Note. Each mediator was investigated separately and multivariate path-decomposition was only conducted on variables that significantly mediated the relationship between Childhood Adversity (CA) and psychopathology.

Results

Prevalence and demographics of childhood adversity

28.2% (2,114) of the participants met the definition for CA at age 9. These comprised both the 17.6% (1,323) of participants who reported at least one severe life event and the 15.5% (1,160) who reported three or more less severe life events. The prevalence of each stressful event is reported in supplementary Table 1. The demographics of those who did and did not report these are shown in table 1. Children who experienced CA were more likely to be female, born outside of Ireland, had primary caregivers who were educated at either only primary school, non-degree or postgraduate levels or were in the lowest two income quintiles. They were also more likely to have met the cut-off for both externalising and internalising problems at age 9.

Table 1. Demographic characteristic of participants who report childhood adversity (CA) and those who do not.

[Insert Table 1]

Childhood adversity and psychopathology

8.2% of the participants met the definition for externalising problems at age 13. 39.5% of these participants reported CA at age 9. CA at age 9 significantly predicted age 13 externalising problems (OR:1.56, 95% CI:1.28-1.91).

For internalising problems, 8.7% of the participants met the definition at age 13. 44.7% of these participants reported CA at age 9. CA at age 9 significantly predicted age 13 internalising problems (OR:1.83, 95% CI:1.52-2.21).

Similarly, 4.1% of the participants met the definition for persistent externalising problems. Of these participants, 39.8% reported CA. Age 9 CA was significantly associated with persistent externalising problems (OR:1.81, 95% CI:1.41-2.31).

4.0% of the participants met the cut-off for persistent internalising problems. 55.3% of these participants reported CA. Age 9 CA was significantly associated with persistent internalising problems (OR:3.12, 95% CI:2.45-3.99).

Mediation analysis (see Tables 2 and 3)

CA was positively associated with age 9 poor self-concept, parent-child conflict and negatively associated with hobby participation. CA was not associated with positive parent-child relationship. All mediators were associated with all psychopathology outcomes except positive parent-child relationship, which was not associated with age 13 externalising or internalising problems (see table 2).

Table 2. The association between mediators and both childhood adversity (CA) and adolescent psychopathology.

[Insert Table 2]

Path decomposition demonstrated that both parent-child conflict and self-concept explained a significant percentage of the relationship between CA and age 13 psychopathology and persistent psychopathology (Table 3). For example, parent-child conflict mediated over half of the relationship between CA and persistent externalising problems (Indirect OR: 1.30, 95% CI: 1.19-1.43). The direct relationship remained significant in all of the path decompositions, with the exception of the

mediation analysis for parent-child conflict with the age 13 and persistent externalising paths (table 3).

Multivariate path-decomposition demonstrated that only parent-child conflict significantly mediated the relationship between CA and age 13 externalising problems (self-concept OR: 1.02, 95% CI: 0.99-1.04, 4.2%; parent-child conflict OR: 1.10, 95% CI:1.05-1.15, 22.0%). Both self-concept and parent-child conflict mediated the relationship between CA and persistent externalising problems (self-concept OR: 1.03, 95% CI:1.00-1.06, 5.7%; parent-child conflict OR: 1.27, 95% CI:1.18-1.36, 45.6%) and persistent internalising problems (self-concept OR: 1.02, 95% CI:0.99-1.04, 2.6%; parent-child conflict OR: 1.21, 95% CI:1.14-1.29, 19.1%) with parent-child conflict accounting for a higher percentage of these relationships. In the multivariate path-decomposition, the direct pathway only remained significant for persistent internalising problems (OR: 2.21, 95% CI: 1.48-3.32).

Table 3. Pathway decomposition for mediators in the relationship between CA and psychopathology.

[Insert Table 3]

Discussion

From this large, longitudinal, nationally representative sample, we found that parent-child conflict and to a lesser extent self-concept mediates the relationship between CA and psychopathology reported at age 13 and persistently at both ages 9 and 13.

Parent-child conflict has previously been found to mediate the relationship between family-related negative life events and adolescent problem behaviours[19]. There is also strong evidence that parent-child conflict predicts a range of subsequent kinds of psychopathology[20,21]. This is particularly important in the context of evidence showing bidirectional relationships between parent-child conflict and externalising behaviours over time[22]. Additionally, parent-child conflict has been found to mediate the relationship between externalising and internalising problems in late childhood and early adolescence[23]. These findings suggest that CA can lead to a “downward spiral” of increased risk for

subsequent psychopathology, including conduct disorder in adolescence and depression in adulthood due to changes in the parent-child relationship[22,23].

The salient aspects of parent-child conflict to this relationship bear further investigation. Causes of parent-child conflict may include parent factors that in some cases are included in our CA measure (e.g. inter-parental conflict, parental mental illness and alcohol or drug use) and some that are not (e.g. genetic influences) as well as child factors, especially temperament [20,21,24,25]. It may be necessary to account for the various contributors to parent-child conflict in any attempt to design interventions in this pathway, and some of these contributors may themselves make targets for effective interventions.

Population-level interventions in parent-child conflict are a difficult proposition. While intervention in situations of abuse and neglect is widely accepted as necessary, identifying those in need of intervention and designing effective interventions has its own challenges[26]. Within the realm of parenting style or quality, interference in families may be politically unpopular, and require significant cross-spectrum support[27]. There have however been examples of success in home-visit interventions to reduce child abuse and neglect[26]. Targeted interventions providing parenting education and training have been shown to be effective in reducing children's antisocial behaviour, and this could be a plausible type of intervention to reduce parent-child conflict[28].

Of note, positive parent-child relationship was not significantly associated with CA in this sample, but was protective against persistent psychopathology in the logistic regression analysis. This suggests that while there does not appear to be an increase in positive parent-child relationship following CA to compensate for its negative effects in this pathway, it might still have a role to play in reducing the rates of persistent psychopathology.

Contrary to our hypothesis, only one of our child-based factors accounted for a significant part of the relationship between CA and psychopathology. Organised hobby participation has been previously found to be related to psychopathology in adolescence, and this relationship was shown in our results[29]. It does not, however, appear to have a protective role against psychopathology following

adversity. Further research including a more in-depth investigation of free time behaviours might find other external child-based factors which could mediate this pathway.

Self-concept significantly mediated a small proportions of the relationship between CA and psychopathology. Previous research has shown self-efficacy to be a mediator between CA and depressive symptoms in adults[30]. Self-concept may be a promising focus or intervention, particularly in older adolescents, when the role of family relationships may be less significant. Moreover, targeting specific aspects of self-concept, such as self-efficacy, or self-concept in a given domain, may be related to this pathway while others aspects of self-concept might not.

Strengths and limitations

The size and representative nature of the sample used and the validity of the outcome measures used strengthen the conclusions that can be drawn from the study and the applicability of the findings to the general population. Each analysis included confounds, and the findings were both robust to this and similar across both time-points.

The measure of childhood adversity in this study did not include measures of sexual or physical abuse or neglect, but that does not mean that they exercised no effect on the results. Both severe and moderate stressful events appear to cluster in time, and both may disproportionately affect children with other vulnerabilities[3]. For this reason, our measure of childhood adversity may mask a stronger underlying relationship. Additionally, the increased risk of subsequent stressful life events following the first event, compounded by the fact that psychopathology at age 9 may increase risk of subsequent stressful life events prior to age 13, means that there is no certainty that this effect is due solely to stressful life events experienced prior to age 9.[3,31]

The measure of hobby participation is also not independent of service provision and available facilities for children in schools, and therefore may act as a proxy for deprivation or cuts to services for children. All analyses controlled for the influence of income bracket, and hence real effects of hobby participation may not be visible in this study.

This study was reliant on parent-report measures, despite some evidence that child-report measures of psychopathology may differ from parent's, particularly in adolescence.[32] This may result in some level of underestimation of both externalising and internalising problems, or perhaps varied underestimation depending on family structure.[32] Finally, we have combined a range of stressful events into a 'childhood adversity' measure. It is possible that the heterogeneity in events reduces the generalisability of the findings. For example, the relationship between different stressful events and psychopathology may be mediated by different variables. However, conducting a series of specific stressor investigations would likely produce a number of false positive observations and would not speak to childhood adversity but rather the stressor-specific association with psychopathology. Further research would be required to investigate if the association between specific stressors and psychopathology are differentially mediated.

Conclusion

We found that the association between childhood adversity and both adolescent psychopathology and persistent psychopathology, is mediated by parent-child conflict. This suggests that parent-child relationship quality is a key target for interventions in childhood to reduce the incidence of psychopathology in adolescents.

Required Statements and Author Information

Declaration of interest: None

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Author contribution: Niamh Dhondt formulated the research question, undertook the analysis and drafted the article. Colm Healy made suggestions about the research question, chose the statistical methods and revised the article drafts. Mary Clarke contributed to data analysis and interpretation and offered critical revisions of drafts of the article. Mary Cannon made suggestions about the research question, contributed to data analysis and interpretation and offered critical revisions to drafts of the article. All authors approved the final version to be published and agree to be accountable for all aspects of the work.

Data availability: Authors had access to the Anonymized Microdata File data in the Growing Up in Ireland study. This is ongoing for some of the authors who are undertaking continued work with this dataset. This data can be accessed through the Irish Social Science Data Archive.

Author Details: Niamh Dhondt: BA. Medical student at Royal College of Surgeons in Ireland, Dublin.

Colm Healy: BSc, MSc. PhD Candidate in the Department of Psychiatry at the Royal College of Surgeons in Ireland, Dublin.

Mary Clarke: PhD in Psychology. Lecture in the Departments of Psychiatry and Psychology at the Royal College of Surgeons in Ireland, Dublin.

Mary Cannon: M.D., PhD. Professor of Psychiatry at the Royal College of Surgeons in Ireland, Dublin and Beaumont Hospital, Dublin.

Correspondence Author: Colm Healy, Department of Psychiatry, Royal College of Surgeons in Ireland, 2nd Floor Ardilaun House, 111 Stephens Green, Dublin 2, D02 VN51.

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Table 1. Demographic characteristics of participants with or without childhood adversity.

Characteristic	Controls (n=5,391)	Childhood Adversity (n=2,114)	OR[a] (CI)
Gender (% male)	52.1	48.2	**1.17 (1.05-1.29)**
Handedness (% left-handed)	13.9	13.1	0.90 (0.79-1.03)
Nationality (% born in Ireland)	92.4	80.3	**2.81 (2.43-3.26)**
Primary carer's highest education (%)			
None/primary education only	5.6	8.2	**1.75 (1.43-2.15)**
Junior certificate or equivalent	22.8	25.3	**1.34 (1.17-1.53)**
Leaving certificate or equivalent	38.5	32.0	-
Post-secondary diploma/certificate	15.7	16.7	**1.28 (1.10-1.49)**
Primary degree	11.1	11.1	**1.20 (1.01-1.43)**
Postgraduate	6.3	6.7	**1.27 (1.03-1.57)**
Annual family income quintile (%)			
Lowest	17.9	23.8	**1.49 (1.26-1.75)**
Second	18.5	23.8	**1.44 (1.22-1.70)**
Third	20.4	18.3	-
Fourth	20.9	16.8	0.89 (0.75-1.06)
Highest	22.2	17.3	0.87 (0.73-1.03)
Age 9 externalising (%)	8.15	13.0	**1.69 (1,44-1.98)**
Age 9 internalising (%)	8.58	16.04	**2.03 (1.75-2.37)**

OR, odds ratio; CI, 95% confidence interval.
[a]Emboldened statistics are significant at the P<0.05 level.

Table 2. The association between the mediators and both childhood adversity (CA) and adolescent psychopathology.

	Exposure[a,b]	**Outcomes[a]**			
	Age 9 CA[c]	**Age 13 Psychopathology[d]**		**Persistent Psychopathology[c]**	
Mediators[e]	Childhood Adversity, beta (CI)	Externalising problems, OR (CI)	Internalising problems, OR (CI)	Externalising problems, OR (CI)	Internalising problems, OR (CI)
Self-concept *(n = 6,516)*	**0.12 (0.06-0.18)**	**1.27 (1.16-1.38)**	**1.17 (1.08-1.28)**	**1.52 (1.37-1.69)**	**1.46 (1.32-1.62)**
Parent-child conflict *(n = 6,963)*	**0.27 (0.22-0.32)**	**1.63 (1.50-1.78)**	**1.56 (1.44-1.69)**	**2.69 (2.43-2.98)**	**2.32 (2.10-2.56)**
Parent-child positive *(n = 6,964)*	0.02 (-0.03-0.07)	1.08 (0.99-1.18)	1.06 (0.97-1.15)	**1.41 (1.27-1.54)**	**1.34 (1.22-1.48)**
Hobby participation *(n = 6,967)*	**0.74 (0.64-0.86)**	**0.68 (0.54-0.87)**	**0.70 (0.56-0.87)**	**0.44 (0.33-0.57)**	**0.46 (0.35-0.60)**

OR, odds ratio; CI, 95% confidence interval.

a: Emboldened statistics are significant at the P<0.05 level.

b. The relationship between CA and hobby participation was investigated using logistic regression. The relationship between CA and the other mediators variables was investigated using linear regression. The relationship between the mediators and the outcome variables were investigated using logistic regression.

c. Adjustment 1: Gender, Nationality, Maternal Education, Income Quintile,

d. Adjustment 2: Gender, Nationality, Maternal Education, Income Quintile, Age 9 Psychopathology.

e. Number of observations used in each analysis varies due to missing data. To account for this the data was re-analysed using multiple imputations. Minimal differences were found between the observed and imputed results (see Supplementary File 2).

Table 3. Pathway decomposition for mediators in the relationship between childhood adversity and psychopathology[a]

	Age 13 Psychopathology[a]						**Persistent Psychopathology[b]**					
Mediators[c]	Externalising indirect* OR (CI)	Externalising direct OR (CI)	% Mediation	Internalising indirect OR (CI)	Internalising direct OR (CI)	% Mediation	Externalising indirect OR (CI)	Externalising direct OR (CI)	% Mediation	Internalising indirect OR (CI)	Internalising direct OR (CI)	% Mediation
Self-concept (n = 6,490)	**1.02 (1.00-1.05)**	**1.55 (1.11-2.16)**	**5.14**	1.02 (0.99-1.03)	**1.71 (1.29-2.27)**	2.75	**1.05 (1.01-1.09)**	**1.73 (1.10-2.72)**	**8.39**	**1.04 (1.01-1.08)**	**2.65 (1.79-3.92)**	4.32
Parent-child conflict (n = 6,934)	**1.10 (1.05-1.15)**	1.37 (1.00-1.89)	**23.88**	**1.09 (1.00-1.19)**	**1.71 (1.30-2.24)**	**14.03**	**1.30 (1.19-1.43)**	1.27 (0.82-1.97)	**52.39**	**1.24 (1.15-1.34)**	**2.48 (1.71-3.63)**	**19.21**
Parent-child Positive (n = 6,935)	1.00 (0.99-1.00)	**1.55 (1.14-2.12)**	-0.06	1.00 (0.99-1.01)	**1.83 (1.40-2.39)**	-0.12	1.01 (0.98-1.04)	**1.82 (1.20-2.73)**	1.19	1.01 (0.98-1.03)	**3.11 (2.16-4.48)**	0.52
Hobby participation (n = 6,938)	1.01 (0.99-1.03)	**1.53 (1.12-2.09)**	2.59	1.01 (0.99-1.02)	**1.80 (1.38-2.36)**	1.46	1.03 (0.99-1.06)	**1.73 (1.16-2.60)**	5.07	1.03 (0.99-1.05)	**3.03 (2.11-4.35)**	2.25

OR: Odds ratio; CI: confidence interval.
a. Emboldened statistics are significant at the P<0.05level.
b. Adjustment1: Gender, Nationality, Maternal Education, Income Quintile, Age 9 Psychopathology.
c. Adjustment2: Gender, Nationality, Maternal Education, Income Quintile.
d. Indirect relationship is the part of the relationship accounted for by the mediator. Direct relationship is the part of the relationship which is not.
e. Number of observations in each analysis vary due to missing data. To account for this the data was reanalysed using multiple imputations. Minimal differences were found between the observed and imputed results (see Supplementary File 2).
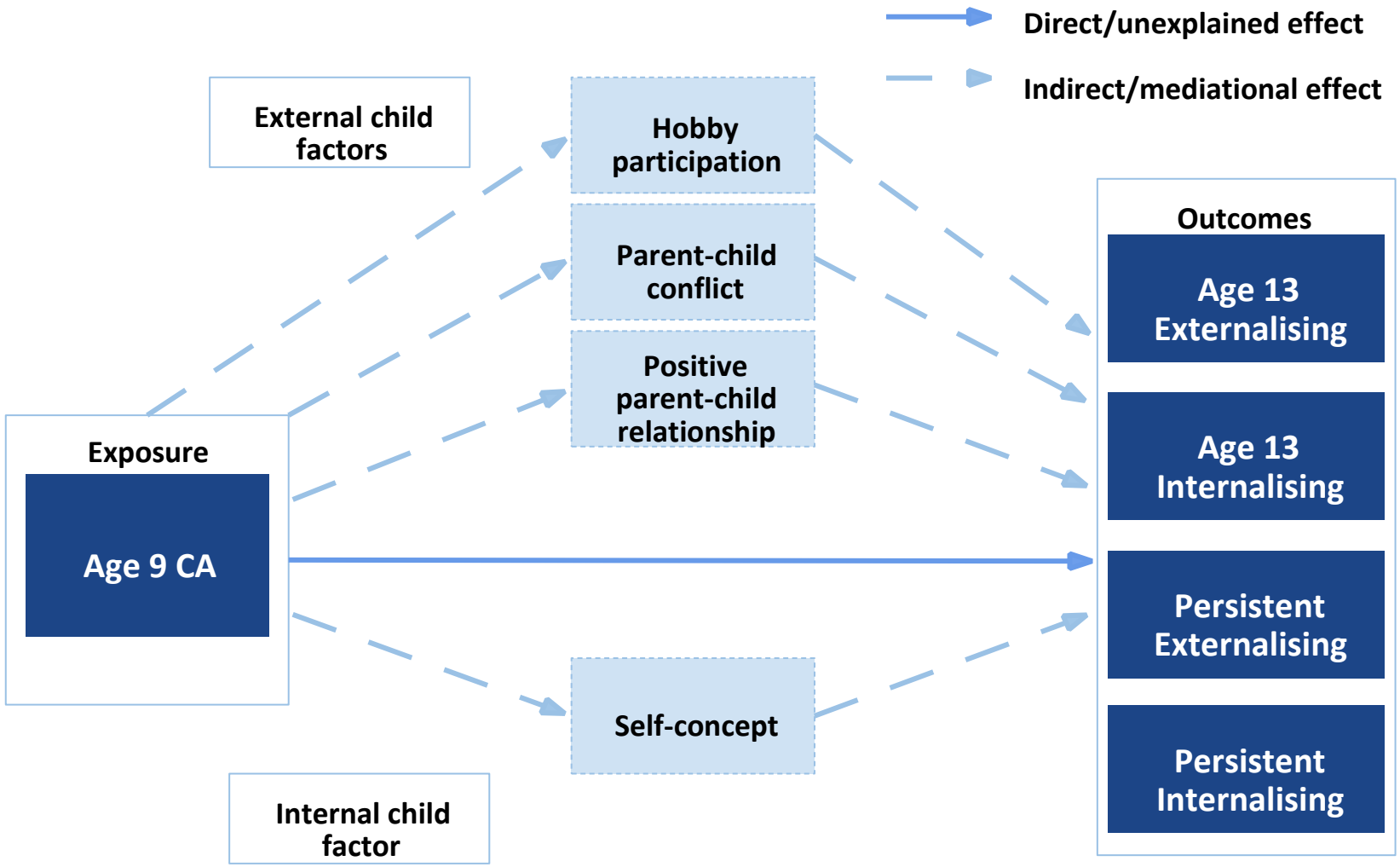
Fig 1. Proposed models of the relationship between CA and psychopathology, with the total effects transmitting both directly and indirectly via proposed mediators: parent-child conflict and positive relationship, self-concept and hobby participation