JAMA Network Open

Original Investigation | Pediatrics

Childhood Maltreatment and Adult Multimorbidity

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Abstract

IMPORTANCE Child maltreatment is a major global public health concern with well-documented psychological consequences, but its associations with long-term physical health conditions remain less well understood.

OBJECTIVE To examine the associations between childhood maltreatment and adult multimorbidity using electronic health records in Hong Kong.

DESIGN, SETTING, AND PARTICIPANTS This population-based cohort study used electronic health record data from Hong Kong, comprising 7473 individuals with a first recorded episode of maltreatment between ages 0 and 19 years from 2001 to 2010 and 26 834 matched individuals without documented maltreatment. Individuals who reached adulthood (ie, after age 19 years) by December 31, 2024, were included.

EXPOSURE History of childhood maltreatment vs none.

MAIN OUTCOMES AND MEASURES The primary outcome was the occurrence of multimorbidity during adulthood as documented in participants' diagnostic records through December 31, 2024. Cox proportional hazards models were used to estimate the risks of 16 disease categories and multimorbidity patterns diagnosed after age 19 years, both overall and stratified by preexisting physical, mental, or neurodevelopmental conditions in childhood.

RESULTS After exclusions, the final cohort comprised 32 674 individuals (16 986 female [52%]), including 7137 who were exposed to childhood maltreatment and 25 537 unexposed individuals. Their median (IQR) age was 9.0 (6.0-13.0) years at inclusion and 28.1 (24.2-31.6) years at the end of follow-up. The median (IQR) follow-up duration was 19.0 (16.6-21.3) years. Childhood maltreatment was associated with increased risks across 13 adult diagnostic categories. The highest risks were observed with mental and behavioral disorders (hazard ratio [HR], 2.78; 95% CI, 2.49-3.09), ear diseases (HR, 1.88; 95% CI, 1.27-2.78), injuries (HR, 1.81; 95% CI, 1.65-1.98), and blood diseases (HR, 1.67; 95% CI, 1.41-1.97). Maltreatment was also associated with a higher risk and earlier onset of complex multimorbidity (HR, 1.96; 95% CI, 1.68-2.27). The associations between childhood maltreatment and adult diagnoses were attenuated among individuals with mental health or neurodevelopmental conditions diagnosed in childhood.

CONCLUSIONS AND RELEVANCE In this 19-year cohort study of 32 674 individuals, childhood maltreatment was associated with elevated risks for multiple health conditions in adulthood. These findings underscore the need for early prevention and sustained, trauma-informed health care support to reduce the risk of lifelong multimorbidity among children who have experienced maltreatment.

Key Points

Question Is childhood maltreatment associated with increased risks of adult multimorbidity?

Findings In this population-based cohort study of 32 674 individuals identified between 2001 and 2010 in Hong Kong, childhood maltreatment was associated with increased risks across 13 diagnostic categories in adulthood. Childhood maltreatment was also associated with a higher risk and earlier onset of both simple and complex multimorbidity.

Meaning These findings suggest that childhood maltreatment is associated with broad and lasting adverse health consequences across the life course, highlighting the importance of prevention, early identification, trauma-informed care, and strengthened child protection policies.

+ Invited Commentary

+ Supplemental content

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JAMA Network Open. 2026;9(7):e2623051. doi:10.1001/jamanetworkopen.2026.23051

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Introduction

Child maltreatment, which includes all forms of abuse and neglect, is an important global public health issue with lasting impacts on the child's health and development across multiple domains.[1] Global meta-analyses estimate that, during the COVID-19 pandemic, the prevalence of physical and psychological child abuse was 18% and 39%, respectively.[2] Rates of physical abuse were generally similar among girls and boys, except in Europe, where the median (IQR) prevalence was 12.0% (6.9%-23.0%) among girls and 27.0% (7.0%-43.0%) among boys; in contrast, median rates of emotional abuse were higher among girls than boys in North America (28.4% vs 13.8%) and Europe (12.9% vs 6.2%), but were more comparable between sexes in other regions.[3] These estimates were based primarily on self-reported data and may, therefore, be vulnerable to recall bias, underreporting, and social desirability bias, particularly in retrospective studies.[4] Although electronic health records may underidentify milder cases of child maltreatment, they are generally seen as more reliable and less affected by reporting bias.[5]

Contrary to the relatively stable or declining trends in child maltreatment reported elsewhere,[6,7] a previous study in Hong Kong found that hospitalization rates for child maltreatment doubled between 2001 and 2010.[8] Child maltreatment incidents frequently result in severe injuries that necessitate emergency treatment or extended hospitalization, underscoring the serious nature of these consequences. Beyond their immediate physical and psychological effects, childhood maltreatment is also associated with a wide array of health issues that can affect individuals throughout their lifespan.[9,10] Prolonged maltreatment during childhood can disrupt emotional regulation, cognitive functioning, and physical health, leading to biological changes that elevate the risk of developing various diseases and disorders later in life.[11,12] Emerging evidence suggests that children who experience maltreatment are at increased risk of developing chronic physical health conditions, such as cardiovascular disease, diabetes, autoimmune disorders, and respiratory illnesses.[13-16] A previous study[17] using territory-wide hospital administrative data in Hong Kong found that substantiated child maltreatment was associated with a 4-fold risk of neurodivergent and psychiatric disorders, including conduct disorder/oppositional defiant disorder, attention-deficit/hyperactivity disorder, personality disorders, depression, anxiety, psychosis, and bipolar disorder. Importantly, these associations did not vary by history of childhood sexual abuse, age of onset, or gender.[17]

Although research across diverse populations has consistently demonstrated associations between child maltreatment and mental health problems,[4,18] and accumulating evidence points to biological changes following maltreatment,[11,12] its links to long-term physical health conditions have received considerably less attention than its mental health consequences.[19,20] Given its potential to affect both physical and mental health, childhood maltreatment may also be associated with an increased risk of subsequent multimorbidity. Multimorbidity, which is defined as the coexistence of 2 or more health conditions, physical, mental, or both,[21] is a growing public health concern because of its associations with reduced quality of life, impaired functional outcomes, and increased health care utilization and costs.[22] Understanding multimorbidity in relation to child maltreatment is important for developing more effective prevention and intervention plans to improve health outcomes among affected individuals.

Therefore, this study used population-based electronic health records in Hong Kong to investigate whether child maltreatment was associated with an increased likelihood of developing physical and mental disorders in adulthood (ie, after age 19 years). In addition, we examined the association between childhood maltreatment and adult multimorbidity, as well as its associations with adult diagnoses stratified by childhood diagnoses of physical, mental, and neurodevelopmental conditions.

Methods

Study Design and Data Source

This study analyzed data from a previously reported electronic health record cohort.[17] Briefly, this was a longitudinal study that followed individuals with and without a confirmed history of childhood

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maltreatment, recorded between January 1, 2001, and December 31, 2010, from the date of their first maltreatment episode or matched hospital admission until December 31, 2024. Details of case identification, exposures, and outcomes are provided in the eMethods in Supplement 1. The study was conducted in compliance with the ethical standards of the relevant national and institutional committees on human research and the principles of the Declaration of Helsinki.[23] We followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines for cohort studies. Ethical approval was obtained from the institutional review board of the University of Hong Kong, Hospital Authority Hong Kong Western Cluster. Because all patient records were fully pseudonymized, the board waived the requirement for informed consent.

Statistical Analysis

Cox proportional hazards regression models were used to examine the associations between childhood maltreatment and 16 adult diagnostic categories adjusted for age at index date, gender, and Comprehensive Social Security Assistance status, an indicator for socioeconomic status. The cohort participants were followed-up from age 19 years until death, or December 31, 2024, whichever came first. Hence, the time scale of the Cox model started from age 19 years. The magnitude of association was expressed as a hazard ratio (HR) with a 95% CI. We also examined the association between childhood maltreatment and adult multimorbidity, excluding infections and injuries. Three types of multimorbidity were considered: simple multimorbidity, defined as having 2 or more long-term physical and mental health conditions during the follow-up period; complex multimorbidity, characterized by 3 or more long-term physical and mental health conditions involving different bodily systems; and mental health multimorbidity, which refers to the cooccurrence of 2 or more long-term mental health conditions.[24] Further analyses examined interactions between childhood maltreatment and childhood diagnoses across 3 domains: physical health (encompassing all physical disorders excluding mental disorders, neurodevelopmental disorders, and injuries), neurodevelopmental conditions (including attention-deficit/hyperactivity disorder, autism spectrum disorder, conduct disorders, and intellectual developmental disorder), and mental health (encompassing all mental disorders excluding neurodevelopmental disorders) in relation to adult diagnoses. A ratio of HR (RHR) was computed as the HR for the presence of childhood maltreatment divided by the HR for the absence of childhood maltreatment, with an RHR greater than 1 indicating that the association between childhood maltreatment and adult diagnoses was greater among individuals with the childhood condition (present) than the subgroup without (absent). Competing risks in Cox models were addressed using cause-specific HRs, with follow-up censored at the occurrence of deaths from alternative events. To visualize differences in absolute risks, marginal cumulative incidence functions were estimated using G-computation (standardization) based on a Fine-Gray subdistribution hazards model,[25] which handles competing risks in the estimation process.

Data were cleaned and analyzed using R statistical software version 4.0.2 (R Project for Statistical Computing).[26] Proportional hazard assumptions were inspected visually and with Schoenfeld residual tests showing no evidence for violation. A 2-sided $P < .05$ was deemed statistically significant. False discovery rate–adjusted P values (q values) were also reported to account for multiple testing.

Results

Data were collected for 7473 individuals with a first recorded episode of maltreatment between ages 0 and 19 years from 2001 to 2010 and 26 834 matched individuals without documented maltreatment. After exclusions, the final cohort included 32 674 individuals (16 986 female [52%]), including 7137 who experienced childhood maltreatment and 25 537 who did not. Their median (IQR) age was 9.0 (6.0-13.0) years at inclusion and 28.1 (24.2-31.6) years at the end of follow-up (**Table 1**). The median (IQR) follow-up duration was 19.0 (16.6-21.3) years.

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Table 2 shows the results of regression models of the associations between childhood maltreatment and adult diagnoses. Child maltreatment was significantly associated with increased risks of a wide range of physical and mental health diagnoses in adulthood. Compared with the unexposed group, individuals exposed to childhood maltreatment exhibited higher hazards for all-cause mortality (HR, 1.98; 95% CI, 1.42-2.76) and multimorbidity, including both simple (HR, 1.88; 95% CI, 1.72-2.05) and complex (HR, 1.96; 95% CI, 1.68-2.27) forms. Furthermore, child maltreatment was highly associated with an increased likelihood of mental health multimorbidity in adulthood (HR, 3.62; 95% CI, 3.01-4.35).

Regarding individual physical health outcomes, childhood maltreatment was associated with adult infectious diseases (HR, 1.30; 95% CI, 1.16-1.46), particularly bacterial infections (HR, 1.32; 95% CI, 1.17-1.49). It was also associated with diabetes (HR, 1.54; 95% CI, 1.01-2.35). Blood diseases (HR, 1.67; 95% CI, 1.41-1.97), such as anemia (HR, 1.74; 95% CI, 1.39-2.18), were more common among individuals exposed to childhood maltreatment. Elevated risks were also observed for mental and behavioral disorders (HR, 2.78; 95% CI, 2.49-3.09), neurological disorders (HR, 1.62; 95% CI, 1.28-2.06), eye diseases (HR, 1.54; 95% CI, 1.11-2.14), ear diseases (HR, 1.88; 95% CI, 1.27-2.78), circulatory diseases (HR, 1.26; 95% CI, 1.04-1.53), respiratory diseases (HR, 1.20; 95% CI, 1.07-1.35), digestive system diseases (HR, 1.29; 95% CI, 1.16-1.42), and genitourinary conditions (HR, 1.43; 95% CI, 1.29-1.59). Skin diseases (HR, 1.38; 95% CI, 1.19-1.60) and musculoskeletal conditions (HR, 1.32; 95% CI, 1.13-1.53) also showed significant associations. Child maltreatment was further associated with markedly increased risks of injury in adulthood (HR, 1.81; 95% CI, 1.65-1.98), including accidents (HR, 1.68; 95% CI, 1.48-1.90), self-harm (HR, 2.75; 95% CI, 2.23-3.38), and assaults (HR, 3.96; 95% CI, 2.90-5.40).

Table 3 shows the results of interactions between childhood maltreatment and childhood preexisting physical health, mental health, or neurodevelopmental conditions, in association with adult diagnoses. Childhood physical health conditions had minimal interaction with maltreatment, and the only significant finding was with bacterial infection (RHR, 1.30; 95% CI, 1.01-1.68; $P = .04$). In contrast, the associations of maltreatment with simple multimorbidity (RHR, 0.69; 95% CI, 0.52-0.93; $P = .02$), complex multimorbidity (RHR, 0.45; 95% CI, 0.28-0.72; $P < .001$), and mental health multimorbidity (RHR, 0.47; 95% CI, 0.30-0.75; $P = .001$) were all significantly attenuated among individuals with mental health conditions diagnosed in childhood compared with those without such conditions. They also exhibited attenuated associations across 4 disease categories, including digestive system diseases (RHR, 0.56; 95% CI, 0.36-0.87; $P = .01$), genitourinary diseases (RHR, 0.54; 95% CI, 0.35-0.85; $P = .007$), injuries (RHR, 0.65; 95% CI, 0.44-0.95; $P = .03$), and mental and behavioral disorders (RHR, 0.40; 95% CI, 0.30-0.55; $P < .001$). Similar interactions were observed for childhood neurodevelopmental comorbidities, but with greater attenuation. For

Table 1. Participant Characteristics

Characteristic	Participants, No. (%)		
	Overall (N = 32 674)	Unexposed (n = 25 537)	Exposed (n = 7137)
Age, median (IQR), y			
At inclusion	9.0 (6.0-13.0)	9.0 (6.0-13.0)	9.0 (6.0-13.0)
At end of follow-up	28.1 (24.2-31.6)	28.1 (24.1-31.6)	28.1 (24.2-31.5)
Sex			
Female	16 986 (52)	13 220 (52)	3766 (53)
Male	15 688 (48)	12 317 (48)	3371 (47)
Receiving Comprehensive Social Security Assistance	6519 (20)	4981 (20)	1538 (22)
Childhood comorbidity[a]			
Physical health conditions	18 391 (56)	14 644 (57)	3747 (53)
Mental health conditions	605 (2)	309 (1)	296 (4)
Neurodevelopmental conditions[b]	878 (3)	361 (1)	517 (7)

[a] Refers to any diagnosis occurred from ages 0 to 18 years.

[b] Refers to attention-deficit/hyperactivity disorder, autism spectrum disorder, conduct disorders, and intellectual developmental disorder.

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Table 2. Associations of Childhood Maltreatment With Adult Health Conditions

Variable	No. of events	HR (95% CI)	*P* value	*q*
All-cause mortality	152	1.98 (1.42-2.76)	<.001	<.001
Simple multimorbidity[a]	2138	1.88 (1.72-2.05)	<.001	<.001
Complex multimorbidity[b]	750	1.96 (1.68-2.27)	<.001	<.001
Mental health multimorbidity[c]	449	3.62 (3.01-4.35)	<.001	<.001
Infectious diseases	1512	1.30 (1.16-1.46)	<.001	<.001
Bacterial infections	1271	1.32 (1.17-1.49)	<.001	<.001
Viral infections	277	1.24 (0.95-1.63)	.11	.15
Cancers	386	1.05 (0.83-1.33)	.69	.74
Endocrine diseases	334	1.13 (0.88-1.45)	.35	.41
Diabetes	103	1.54 (1.01-2.35)	.04	.06
Blood diseases	636	1.67 (1.41-1.97)	<.001	<.001
Anemia	344	1.74 (1.39-2.18)	<.001	<.001
Mental and behavioral disorders	1363	2.78 (2.49-3.09)	<.001	<.001
Substance misuse	179	2.57 (1.91-3.46)	<.001	<.001
Psychotic disorders	230	3.43 (2.65-4.44)	<.001	<.001
Depressive disorders	259	2.31 (1.80-2.96)	<.001	<.001
Bipolar disorders	78	2.58 (1.65-4.05)	<.001	<.001
Anxiety disorders	407	3.38 (2.79-4.11)	<.001	<.001
Personality disorders	114	4.86 (3.35-7.04)	<.001	<.001
Neurological disorders	320	1.62 (1.28-2.06)	<.001	<.001
Headache	139	2.00 (1.42-2.83)	<.001	<.001
Epilepsy	84	1.26 (0.77-2.05)	.36	.41
Eye diseases	169	1.54 (1.11-2.14)	.01	.02
Ear diseases	110	1.88 (1.27-2.78)	.002	.003
Circulatory diseases	529	1.26 (1.04-1.53)	.02	.03
Hypertension	78	1.42 (0.87-2.32)	.17	.21
Atherosclerotic cardiovascular diseases	51	2.53 (1.45-4.41)	.001	.002
Arrhythmias	51	1.22 (0.65-2.30)	.53	.58
Heart failure	108	1.26 (0.82-1.94)	.29	.36
Arterial and venous diseases	190	1.55 (1.13-2.11)	.006	.01
Respiratory diseases	1573	1.20 (1.07-1.35)	.002	.003
Respiratory tract infections	1264	1.20 (1.06-1.37)	.004	.01
Chronic obstructive pulmonary disease and asthma	273	1.29 (0.99-1.69)	.06	.08
Digestive system diseases	1950	1.29 (1.16-1.42)	<.001	<.001
Appendicitis	143	1.07 (0.72-1.58)	.74	.77
Inflammatory bowel disease	24	0.92 (0.34-2.46)	.87	.89
Liver diseases	123	0.97 (0.63-1.50)	.89	.89
Genitourinary diseases	1669	1.43 (1.29-1.59)	<.001	<.001
Renal failure	78	0.78 (0.44-1.39)	.40	.45
Skin diseases	853	1.38 (1.19-1.60)	<.001	<.001
Skin infections	430	1.69 (1.38-2.07)	<.001	<.001
Eczema and dermatitis	128	1.35 (0.91-1.98)	.13	.17
Musculoskeletal diseases	889	1.32 (1.13-1.53)	<.001	.001
Congenital malformations	234	1.17 (0.87-1.58)	.30	.36
Injuries	2170	1.81 (1.65-1.98)	<.001	<.001
Accidents	1175	1.68 (1.48-1.90)	<.001	<.001
Self-harm	366	2.75 (2.23-3.38)	<.001	<.001
Assaults	159	3.96 (2.90-5.40)	<.001	<.001

Abbreviations: HR, hazard ratio; *q*, false discovery rate–adjusted *P* value.

[a] Refers to cooccurrence of 2 or more long-term physical and mental health conditions (ie, excluding infections and injuries).

[b] Refers to cooccurrence of 3 or more long-term physical and mental health conditions involving different bodily systems (ie, excluding infections and injuries).

[c] Refers to cooccurrence of 2 or more long-term mental health conditions.

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Table 3. Comparison of the Associations Between Childhood Maltreatment and Adult Diagnoses According to Preexisting Physical Health, Mental Health, or Neurodevelopmental Conditions in Childhood (Defined as Any Diagnosis Recorded Between Ages 0 and 18 Years)

	Physical health conditions			Mental health conditions			Neurodevelopmental conditions[a]		
Variable	RHR (95% CI)[b]	*P* value	*q*	RHR (95% CI)[b]	*P* value	*q*	RHR (95% CI)[b]	*P* value	*q*
All-cause mortality	1.07 (0.52-2.22)	.86	.93	0.79 (0.24-2.56)	.70	.82	0.34 (0.16-0.73)	.006	.02
Simple multimorbidity[c]	1.08 (0.89-1.30)	.43	.90	0.69 (0.52-0.93)	.02	.08	0.48 (0.37-0.62)	<.001	<.001
Complex multimorbidity[d]	0.96 (0.70-1.33)	.82	.93	0.45 (0.28-0.72)	<.001	.01	0.34 (0.23-0.50)	<.001	<.001
Mental health multimorbidity[e]	1.18 (0.80-1.75)	.40	.90	0.47 (0.30-0.75)	.001	.01	0.40 (0.26-0.60)	<.001	<.001
Infectious diseases	1.26 (1.00-1.59)	.05	.42	0.78 (0.49-1.26)	.31	.54	0.57 (0.39-0.84)	.005	.02
Bacterial infections	1.30 (1.01-1.68)	.04	.42	0.64 (0.38-1.08)	.10	.26	0.52 (0.34-0.80)	.003	.01
Viral infections	0.94 (0.55-1.62)	.83	.93	1.48 (0.43-5.08)	.53	.74	0.94 (0.40-2.20)	.88	.88
Cancers	NE	NE	NE	1.08 (0.36-3.21)	.89	.89	0.67 (0.27-1.67)	.39	.55
Endocrine diseases	0.63 (0.38-1.05)	.08	.48	0.75 (0.27-2.06)	.57	.75	0.55 (0.25-1.22)	.14	.25
Diabetes	1.32 (0.53-3.32)	.55	.90	1.25 (0.22-7.22)	.81	.85	0.37 (0.10-1.31)	.12	.23
Blood diseases	1.23 (0.87-1.72)	.24	.67	1.15 (0.58-2.29)	.69	.82	0.73 (0.39-1.37)	.33	.48
Anemia	1.04 (0.66-1.65)	.85	.93	2.06 (0.67-6.36)	.21	.42	1.10 (0.44-2.72)	.84	.86
Mental and behavioral disorders	1.13 (0.91-1.40)	.28	.74	0.40 (0.30-0.55)	<.001	.004	0.52 (0.39-0.70)	<.001	<.001
Substance misuse	1.19 (0.65-2.16)	.58	.90	0.63 (0.26-1.53)	.31	.54	0.67 (0.23-2.00)	.48	.59
Psychotic disorders	1.08 (0.64-1.84)	.77	.93	0.39 (0.22-0.70)	.002	.01	0.61 (0.33-1.14)	.12	.23
Depressive disorders	1.03 (0.62-1.72)	.90	.94	0.32 (0.16-0.62)	<.001	.01	0.34 (0.16-0.76)	.008	.02
Anxiety disorders	0.83 (0.33-2.09)	.70	.93	0.52 (0.20-1.34)	.18	.38	1.54 (0.45-5.30)	.49	.59
Conduct disorders	1.40 (0.93-2.11)	.10	.50	0.39 (0.23-0.67)	<.001	.01	0.52 (0.30-0.92)	.02	.05
Neurological disorders	0.71 (0.41-1.22)	.21	.67	0.54 (0.27-1.07)	.08	.22	0.31 (0.19-0.50)	<.001	<.001
Headache	0.44 (0.18-1.05)	.06	.42	0.41 (0.16-1.04)	.06	.19	0.20 (0.10-0.40)	<.001	<.001
Epilepsy	0.46 (0.13-1.66)	.24	.67	0.78 (0.24-2.50)	.68	.82	0.65 (0.22-1.88)	.42	.57
Eye diseases	1.20 (0.59-2.46)	.62	.91	1.23 (0.39-3.90)	.72	.82	0.46 (0.16-1.31)	.15	.25
Ear diseases	1.16 (0.50-2.66)	.73	.93	1.23 (0.23-6.70)	.81	.85	1.16 (0.29-4.66)	.84	.86
Circulatory diseases	1.06 (0.71-1.60)	.77	.93	0.49 (0.23-1.06)	.07	.21	0.67 (0.36-1.27)	.22	.34
Hypertension	0.68 (0.25-1.90)	.46	.90	0.31 (0.03-3.60)	.35	.59	0.68 (0.14-3.32)	.63	.70
Heart failure	2.82 (0.96-8.23)	.06	.42	0.36 (0.08-1.53)	.16	.35	0.37 (0.10-1.43)	.15	.25
Arterial and venous diseases	1.07 (0.56-2.03)	.84	.93	0.84 (0.25-2.76)	.77	.85	1.66 (0.44-6.29)	.46	.59
Respiratory diseases	0.98 (0.77-1.24)	.85	.93	0.70 (0.44-1.12)	.13	.30	0.47 (0.34-0.67)	<.001	<.001
Respiratory tract infections	1.00 (0.76-1.31)	.99	.99	0.67 (0.40-1.10)	.11	.27	0.39 (0.27-0.57)	<.001	<.001
Chronic obstructive pulmonary disease	1.24 (0.63-2.44)	.52	.90	0.72 (0.24-2.14)	.56	.75	1.84 (0.64-5.27)	.26	.39
Digestive system diseases	1.06 (0.86-1.31)	.56	.90	0.56 (0.36-0.87)	.01	.05	0.52 (0.36-0.74)	<.001	.00
Appendicitis	1.93 (0.86-4.31)	.11	.50	2.67 (0.27-26.59)	.40	.60	NE	NE	NE
Liver diseases	0.77 (0.31-1.90)	.57	.90	0.47 (0.08-2.71)	.40	.60	0.35 (0.08-1.52)	.16	.26
Genitourinary diseases	1.24 (1.00-1.54)	.05	.42	0.54 (0.35-0.85)	.007	.04	0.56 (0.37-0.83)	.005	.02
Renal diseases	2.23 (0.45-11.04)	.33	.82	0.27 (0.03-2.59)	.26	.50	0.59 (0.09-3.93)	.59	.67
Skin diseases	1.11 (0.82-1.50)	.50	.90	1.39 (0.68-2.83)	.37	.60	0.82 (0.49-1.40)	.47	.59
Skin infections	1.02 (0.68-1.54)	.92	.94	0.72 (0.31-1.68)	.45	.65	0.52 (0.28-0.96)	.04	.08
Eczema and dermatitis	1.22 (0.54-2.76)	.63	.91	NE	NE	NE	2.13 (0.23-19.79)	.51	.60
Musculoskeletal diseases	1.27 (0.93-1.73)	.13	.50	1.16 (0.61-2.21)	.65	.82	0.55 (0.32-0.95)	.03	.07
Injuries	1.12 (0.93-1.34)	.24	.67	0.65 (0.44-0.95)	.03	.11	0.57 (0.41-0.79)	<.001	.00
Accidents	1.22 (0.95-1.56)	.12	.50	0.55 (0.32-0.94)	.03	.11	0.45 (0.29-0.71)	<.001	.00
Self-harms	1.49 (0.98-2.27)	.06	.42	0.44 (0.23-0.85)	.01	.047	0.44 (0.22-0.89)	.02	.05
Assaults	1.31 (0.69-2.47)	.41	.90	1.13 (0.31-4.14)	.85	.87	1.18 (0.33-4.19)	.80	.86

Abbreviations: NE, nonestimable; RHR, ratio of hazard ratio; *q*, false discovery rate–adjusted *P* value.

[a] Refers to attention deficit hyperactivity disorder, autism spectrum disorder, conduct disorders and intellectual disability.

[b] An RHR greater than 1 indicates that the association between child maltreatment and adulthood diagnoses was greater among individuals with the childhood condition (present) than the subgroup without (absent).

[c] Refers to cooccurrence of 2 or more long-term physical and mental health conditions (ie, excluding infections and injuries).

[d] Refers to cooccurrence of 3 or more long-term physical and mental health conditions involving different bodily systems (ie, excluding infections and injuries).

[e] Refers to cooccurrence of 2 or more long-term mental health conditions.

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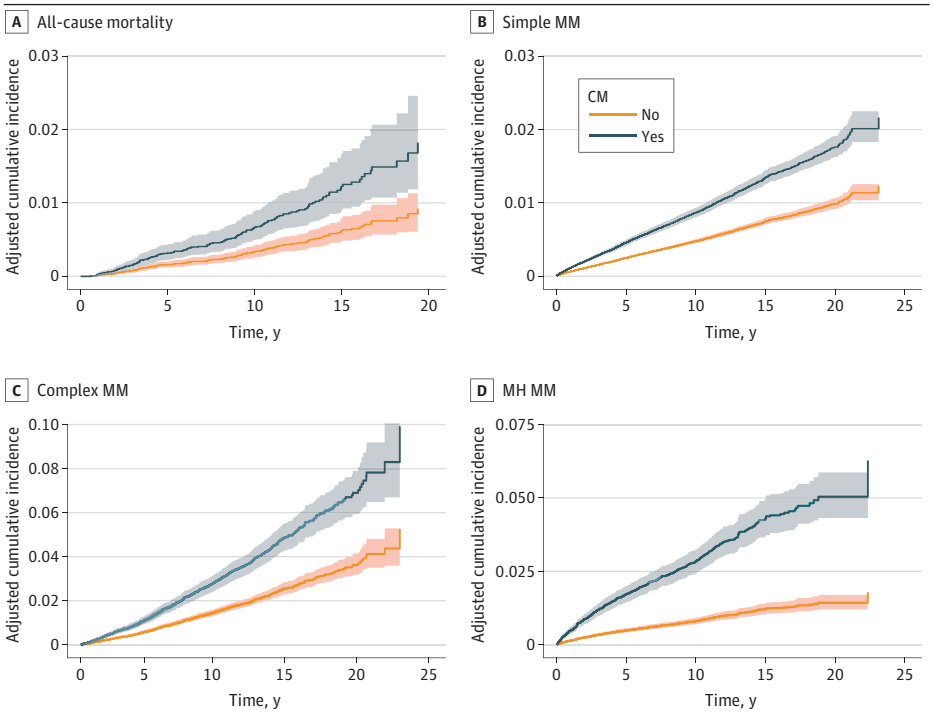
example, the RHRs were 0.48 (95% CI, 0.37-0.62; *P* < .001) and 0.34 (95% CI, 0.23-0.50; *P* < .001) for simple and complex multimorbidity, respectively, compared with 0.69 (95% CI, 0.52-0.93; *P* = .02) and 0.45 (95% CI, 0.28-0.72; *P* < .001) among individuals with mental health conditions diagnosed in childhood.

We also compared the cumulative incidence of multimorbidity and all-cause mortality between individuals with and without exposure to childhood maltreatment. As shown in the **Figure**, individuals exposed to childhood maltreatment had a higher cumulative incidence of multimorbidity and mortality throughout follow-up from age 19 years onward. They reached an approximately 8.7% risk of simple multimorbidity after 10 years of follow-up (at age 29 years), while the same absolute risk was not reached until 8 years later (at age 37 years) among those without documented childhood maltreatment. For complex multimorbidity, individuals exposed to childhood maltreatment reached a 2.9% risk after 10 years of follow-up (at age 29 years), whereas the same risk was not reached until 7 years later (at age 36 years) among individuals without documented maltreatment. The between-group difference was even more pronounced for mental health multimorbidity. After 4 years of follow-up, individuals exposed to childhood maltreatment had reached a 1.4% risk, a level not observed among nonmaltreated individuals until 20 years of follow-up. Details on the cumulative incidence of multimorbidity and all-cause mortality in the exposed and unexposed groups over the 20-year follow-up are provided in the eTable in Supplement 1.

Discussion

This large population-based cohort study used longitudinal electronic health records from hospitals in Hong Kong to compare the incidence of adult diseases in 7137 individuals who experienced maltreatment between ages 0 and 19 years during 2001 to 2010 with that in 25 537 matched individuals with no documented history of childhood maltreatment. We found that childhood maltreatment was associated with an increased risk of a broad range of adult diseases across 13 health domains. Individuals exposed to childhood maltreatment had a significantly higher likelihood

Figure. Line Graphs of Cumulative Incidence All-Cause Mortality and Simple, Complex, and Mental Health (MH) Multimorbidity (MM) in Individuals With and Without Exposure to Childhood Maltreatment (CM)



Graph x-axes indicate the time from the start of follow-up at age 19 years. Shaded areas indicate 95% CIs.

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of simple, complex, and mental health multimorbidity. However, the magnitude of these associations depended on preexisting childhood health conditions across physical, mental, and neurodevelopmental domains. In particular, childhood mental health or neurodevelopmental diagnoses appeared to attenuate the association between childhood maltreatment and several adult diagnoses.

Rather than taking a social science perspective, this study used a public health approach to examine the association between childhood maltreatment and adult diagnoses. Although previous research has explored related associations,[13-16] many studies were based on smaller samples or focused on a single disease outcome, which may have limited statistical power and contributed to inconsistent or nonsignificant findings. In contrast, by examining multiple disease outcomes in a large sample, our study provides more robust evidence that childhood maltreatment is associated with adverse health outcomes in adulthood. Extending prior research demonstrating an association between childhood maltreatment and adult multimorbidity,[27] our findings indicate that individuals exposed to childhood maltreatment are not only more likely to experience multimorbidity, but also to develop it at a younger age. By age 29 years, more than 2.9% had developed complex multimorbidity, representing an onset approximately 7 years earlier than among individuals without such a history of childhood maltreatment. Furthermore, exposure to childhood maltreatment was associated with an 88% increased risk of simple multimorbidity, a 96% increased risk of complex multimorbidity, and a 262% increased risk of mental health multimorbidity compared with no such exposure. These statistics underscore the profound and multifaceted impact of childhood maltreatment on both physical and mental health, challenging the prevailing view that its consequences are primarily psychological.

The observed associations between early maltreatment experiences and long-term physical health outcomes were consistent with prior reports. For instance, the Adverse Childhood Experiences study[28] involving 9508 participants reported that the odds of developing various health problems, such as circulatory diseases and musculoskeletal diseases, increased with the number of maltreatment types experienced. In line with this, a large US cross-sectional survey of 53 998 adults found that the likelihood of diabetes, myocardial infarction, and stroke increased proportionally with the number of adverse childhood experiences reported.[29] One possible mechanism linking childhood maltreatment to the increased risk of these diseases is stress-induced biological dysregulation. Exposure to severe stress during childhood may overactivate the hypothalamic-pituitary-adrenal axis and disrupt cortisol secretion, leading to impaired immune function, greater susceptibility to infections, and increased risk of metabolic and cardiovascular conditions.[30,31] In addition, childhood maltreatment has been associated with chronic inflammatory dysregulation, including elevated proinflammatory cytokine activity and oxidative stress.[32] Together, these alterations may contribute to the pathogenesis of cancers, cardiovascular diseases, and various metabolic disorders.[33,34]

In addition to analyzing individual diseases, we examined childhood comorbidities to better understand the longer-term risk of developing new health conditions following childhood maltreatment. Although unmeasured factors, such as symptom severity and genetic vulnerability, may have confounded these associations and should be considered in future research, our findings revealed distinct patterns according to the type of childhood comorbidity. Among individuals exposed to maltreatment, those with cooccurring physical health conditions in childhood were 30% more likely to develop bacterial infections in adulthood than those exposed to maltreatment alone. Notably, bacterial infection was the only adult condition significantly associated with childhood physical health conditions. By contrast, childhood mental health and neurodevelopmental conditions were associated with multiple significant reductions in the risk of later adult conditions. One possible explanation is that earlier identification of these conditions may lead to more timely intervention, closer monitoring, and greater support, thereby improving long-term health outcomes. Specifically, neurodevelopmental conditions, such as autism, are chronic conditions that are typically identified early in life, which may facilitate access to early intervention and support services aimed at

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optimizing functioning.[35,36] Conversely, some physical health conditions, such as skin infections, are generally acute and often resolve without requiring continued surveillance or intervention. Mental health conditions, such as depression, are likewise chronic; however, they often onset during adolescence,[37] potentially delaying access to support services. Consequently, individuals with these conditions may benefit less from ongoing care than those with neurodevelopmental conditions. In the context of global population aging, many countries have shifted health care resources toward adult and older-age care, often at the expense of child health services. Our findings, however, highlight the importance of maintaining, and potentially increasing, investment in pediatric care. This is particularly relevant because multimorbidity is associated with poorer functional status, lower quality of life, greater health care use, and higher mortality.[21,22] Its consequences may be especially profound in younger adults, for whom multimorbidity can disrupt education, employment, and social relationships.[22] Taken together, these findings suggest that individuals who experienced childhood maltreatment may benefit from more intensive, targeted support during the transition into adulthood to address both the lasting effects of early adversity and the current challenges associated with multimorbidity.

Limitations

This study had several strengths, including its large and representative sample, long follow-up period, and use of territory-wide electronic health records. Although our findings are representative of the Hong Kong context, the impacts of child maltreatment tend to be culturally specific and may not be generalizable to other populations.[38] Several other limitations should also be noted. First, hospital records typically capture only more severe cases; therefore, these findings likely reflect the consequences of more serious incidents. Further research is needed to determine whether the same health outcomes also occur in milder cases of child maltreatment. Such evidence would have important implications for resource allocation. Second, even though our analyses were adjusted for the Comprehensive Social Security Assistance status, a robust indicator of socioeconomic status in Hong Kong, residual confounding may remain due to unmeasured socioeconomic and familial factors that were not available in the electronic health records. Third, because of the large number of health outcomes included and the overlap among some outcomes, we were unable to derive simultaneous confidence intervals based on multivariate modeling. Fourth, the electronic health records lacked information on the types and severity of child maltreatment, which limited subgroup analyses of how different forms of maltreatment may influence long-term health outcomes.

Conclusions

In this large, population-based cohort study of 32 674 individuals followed-up for 19 years, childhood maltreatment was associated with adverse physical health outcomes in later life, extending beyond its well-established links to mental illness. Individuals exposed to childhood maltreatment had a significantly higher risk of developing a wide range of chronic diseases and multimorbidity in adulthood, often with earlier onset and greater disease burden, than those without such exposure. The consistent associations observed across multiple organ systems highlight the interconnected nature of maltreatment-related health outcomes and suggest the involvement of shared biological and psychosocial pathways. The attenuation of some of these associations after accounting for childhood mental health and neurodevelopmental comorbidities underscores the potential benefits of early detection and intervention for childhood health conditions. Future research should investigate the biological and behavioral pathways linking childhood maltreatment to multimorbidity, as well as how individuals with a history of maltreatment cope with cumulative burdens over time.

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ARTICLE INFORMATION

Accepted for Publication: May 6, 2026.

Published: July 14, 2026. doi:10.1001/jamanetworkopen.2026.23051

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Conflict of Interest Disclosures: Dr Chan reported receiving grants from the Health and Medical Research Fund and the General Research Fund outside the submitted work. Dr Mair reported receiving grants from the Wellcome Trust, National Institute for Health and Care Research, Engineering and Physical Sciences Research Council, Chief Scientist Office Scotland, and Medical Research Council paid to their institution outside the submitted work. No other disclosures were reported.

Data Sharing Statement: See Supplement 2.

Additional Contributions: The authors would like to thank all children and families for their support and participation in this cohort study.

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SUPPLEMENT 1.

eMethods. Case identification, exposures and outcomes

eTable. Cumulative incidence of multimorbidity and all-cause mortality in the exposed and unexposed groups over the 20-year follow-up

eReferences

SUPPLEMENT 2.

Data Sharing Statement

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