Long-term Cognitive, Psychological, and Health Outcomes Associated With Child Abuse and Neglect

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abstract

Potential long-lasting adverse effects of child maltreatment have been widely reported, although little is known about the distinctive long-term impact of differing types of maltreatment. Our objective for this special article is to integrate findings from the Mater-University of Queensland Study of Pregnancy, a longitudinal prenatal cohort study spanning 2 decades. We compare and contrast the associations of specific types of maltreatment with long-term cognitive, psychological, addiction, sexual health, and physical health outcomes assessed in up to 5200 offspring at 14 and/or 21 years of age. Overall, psychological maltreatment (emotional abuse and/or neglect) was associated with the greatest number of adverse outcomes in almost all areas of assessment. Sexual abuse was associated with early sexual debut and youth pregnancy, attention problems, posttraumatic stress disorder symptoms, and depression, although associations were not specific for sexual abuse. Physical abuse was associated with externalizing behavior problems, delinquency, and drug abuse. Neglect, but not emotional abuse, was associated with having multiple sexual partners, cannabis abuse and/or dependence, and experiencing visual hallucinations. Emotional abuse, but not neglect, revealed increased odds for psychosis, injecting-drug use, experiencing harassment later in life, pregnancy miscarriage, and reporting asthma symptoms. Significant cognitive delays and educational failure were seen for both abuse and neglect during adolescence and adulthood. In conclusion, child maltreatment, particularly emotional abuse and neglect, is associated with a wide range of long-term adverse health and developmental outcomes. A renewed focus on prevention and early intervention strategies, especially related to psychological maltreatment, will be required to address these challenges in the future.

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Dr Strathearn conceptualized and designed the original study linking the Mater-University of Queensland Study of Pregnancy data set with substantiated reports of child maltreatment, drafted the special article, and reviewed and revised the manuscript; Dr Giannotti assisted in drafting the manuscript and prepared all tables and figures; Drs Mills, Kisely, and Abajobir conceptualized and wrote the original research articles summarized in this article; Dr Najman was the original principal investigator of the Mater-University of Queensland Study of Pregnancy; and all authors critically reviewed the manuscript for important intellectual content and approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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Child maltreatment is a major public health issue worldwide, with serious and often debilitating long-term consequences for psychosocial development as well as physical and mental health.[1] In the United States alone, 3.5 million children are reported for suspected maltreatment each year, with an annual substantiated maltreatment rate of 9.1 per 1000 children.[2] Some of the long-term adverse outcomes associated with maltreatment include cognitive disability, anxiety and depression, psychosis, teen-aged pregnancy, addiction disorders, obesity, and cardiovascular disease.[3] Understanding the distinctive impact of differing types of maltreatment may help medical professionals provide more wholistic care and treatment recommendations as well as identify

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more specific public health targets for primary prevention.

Unfortunately, however, little is known about the long-term effects of differing types of child maltreatment, which include sexual abuse, physical abuse, emotional abuse, and neglect.[4] According to a meta-analysis review,[5] research on child maltreatment has predominantly been focused on sexual abuse, with far less attention paid to psychological maltreatment (emotional abuse and/or neglect) and the co-occurrence of different types of maltreatment. In addition, most of the current evidence is derived from cross-sectional studies, which may be subject to recall bias,[6–8] in which an outcome status (such as depression) may influence recall of the exposure (ie, previous maltreatment). Few previous studies have adequately controlled for confounding variables, such as perinatal risk, socioeconomic adversity, parental psychopathology, and impaired early childhood development, which may predispose to both child maltreatment and later adverse health outcomes.

Longitudinal studies offer evidence that is more robust, but these studies are relatively few in number and have generally been limited to certain sociodemographic groups[9] or to specific types of child maltreatment, such as sexual abuse.[1,10] Other longitudinal studies have relied on retrospective recall of maltreatment rather than prospectively collected agency-reported data.[11–13] In studies in which prospective data have been collected,[7,13–17] only a few have compared different types of child maltreatment.[7,16,17]

In this special article, we review findings from the Mater-University of Queensland Study of Pregnancy (MUSP), a now 40-year longitudinal prenatal cohort study from Brisbane, Australia, involving >7000 women and their children.[18] Unique features of the MUSP include its use of a population-based sample, its use of prospectively substantiated child maltreatment reports, and its consideration of different subtypes of maltreatment. In addition, the study design controlled for a wide range of confounders and covariates, including both maternal and child sociodemographic and mental health variables. This combined body of work, which includes numerous publications over the past decade, has documented a broad range of adverse outcomes associated with child maltreatment, including deficits in cognitive and educational outcomes[19–21]; mental health problems, such as anxiety, depression, posttraumatic stress disorder (PTSD), psychosis, delinquency, and intimate partner violence (IPV)[22–25]; substance abuse and addiction[26–30]; sexual health problems[31]; physical growth and health deficits[32–35]; and overall decreased quality of life.[36]

Our purpose for this special article is to compare the effects of 4 differing types of maltreatment on long-term cognitive, psychological, addiction, and health outcomes assessed in the offspring at ~14 and/or 21 years of age. Rather than providing a systematic review or meta-analysis of the current literature, which would include diverse study designs and purposes, we report and compare the findings of individual articles that used a common data set and standard methodology to study a broad array of outcomes. We particularly highlight the long-term impact of emotional abuse and neglect, which has received far less attention in the literature.

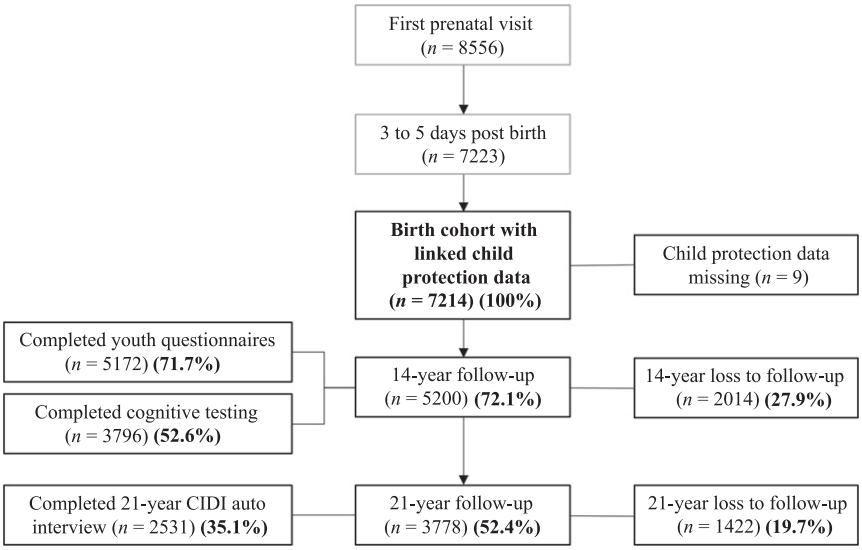

FIGURE 1
Overview of the MUSP enrollment and testing.

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Outcome	Study Reference	Age, y	Adjustment for Co-occurrence of Maltreatment Subtypes[a]	*N*	$N_{(Mal)}$	Specific Maltreatment Subtypes Associated With Outcome, Adjusted Odds Ratio or Coefficient (95% CI)				
						Sexual Abuse	Physical Abuse	Emotional Abuse	Neglect	Any Maltreatment
Cognition and education										
Reading ability[b]	Mills et al[19]	14	Statistical adjustment	3788	298	-4.3 (-7.0 to -1.5)			-4.4 (-8.5 to -0.4)	-5.3 (-7.6 to -2.9)
Perceptual reasoning[b]				3794	298	-3.1 (-5.8 to -0.4)			-5.7 (-9.7 to -1.7)	-4.3 (-6.6 to -2.0)
Attention problems (parent report)[b,c]	Boyd et al[21]	14	Nonexclusive categories	5173	976	0.90 (0.28 to 1.52)	1.57 (1.19 to 1.95)			—
Attention problems (self-report)[b,c]		21		3778	299	0.23 (-0.27 to 0.73)	0.33 (0.01 to 0.65)			—
Receptive verbal intelligence[b]	Mills et al[20]	21	Nonexclusive categories	2150	87	-2.26 (-5.34 to -0.38)			-2.14 (-8.97 to -0.39)	-2.52 (-5.31 to -0.67)
Failing to complete high school				3750	168	3.64 (2.47 to 5.39)[d]			4.42 (2.51 to 7.80)[e]	3.59 (2.50 to 5.16)[d]
Failure to be in education or employment				3739	171	1.97 (1.28 to 3.03)			3.13 (1.74 to 5.61)[d]	2.22 (1.49 to 3.30)[d]
Psychological and mental health										
Internalizing behavior[b]	Mills et al[22]	14	Nonexclusive categories	4798	258	0.91 (-0.93 to 2.76)	2.25 (0.76 to 3.74)	3.38 (1.88 to 4.87)	3.88 (2.30 to 5.46)	2.13 (1.07 to 3.19)
Externalizing behavior[b]				4798	258	0.42 (-1.36 to 2.19)	2.90 (1.47 to 4.33)	2.88 (1.44 to 4.31)	3.17 (1.65 to 4.69)	2.28 (1.26 to 3.30)
Internalizing behavior[b]	Kisely et al[39]	21	Nonexclusive categories	3725	167	0.05 (-2.27 to 2.16)	1.58 (-0.29 to 3.46)	3.10 (1.35 to 4.85)	2.73 (0.77 to 4.69)	1.31 (0.18 to 2.61)
Externalizing behavior[b]				3725	167	0.25 (-1.56 to 2.07)	1.84 (0.30 to 3.39)	2.92 (1.48 to 4.35)	3.10 (1.49 to 4.71)	1.76 (0.70 to 2.82)
Anxiety disorder, lifetime (CIDI)				2508	171	1.80 (0.93 to 3.47)	1.50 (0.86 to 2.92)	2.68 (1.55 to 4.63)[d]	3.01 (1.63 to 5.58)[d]	1.95 (1.30 to 2.91)
Depressive disorder, lifetime (CIDI)				2508	171	2.15 (1.11 to 4.16)[d]	1.59 (0.56 to 2.12)	1.75 (1.00 to 3.10)	1.94 (1.04 to 3.64)	1.56 (1.03 to 2.36)
Depressive symptoms (CES-D)				3776	171	1.16 (0.64 to 2.10)	2.05 (1.26 to 3.31)[d]	2.10 (1.34 to 3.30)[d]	2.76 (1.03 to 2.89)[d]	1.53 (1.08 to 2.17)
PTSD, lifetime (CIDI)				2508	171	4.38 (2.06 to 9.29)[e]	2.54 (1.12 to 5.72)[d]	4.76 (2.45 to 8.16)[e]	2.78 (1.22 to 6.39)[d]	3.38 (2.00 to 5.70)[d]
Psychosis, lifetime (CIDI)	Abajobir et al[23]	21	Nonexclusive categories	2558	167	—	—	4.26 (1.17 to 15.54)[e]	3.26 (0.71 to 14.05)	3.12 (1.13 to 8.61)[d]
Delusional experience				3729	167	1.86 (0.90 to 3.82)	1.46 (0.78 to 2.73)	2.13 (1.23 to 3.67)[d]	2.72 (1.54 to 4.82)[d]	1.89 (1.24 to 2.89)
Visual hallucination				3737	167	0.86 (0.30 to 2.48)	1.32 (0.65 to 2.69)	1.57 (0.82 to 2.99)	2.28 (1.34 to 4.12)[d]	1.56 (0.96 to 2.55
Auditory hallucination				3752	167	0.98 (0.38 to 2.56)	1.05 (0.49 to 2.21)	1.83 (1.01 to 3.33)	2.14 (1.14 to 4.05)[d]	1.31 (0.79 to 2.17)
Delinquency (males)	Abajobir et al[24]	21	Statistical adjustment	1810	76	1.23 (0.14 to 11.12)	3.37 (1.37 to 8.33)[d]	3.28 (1.37 to 7.85)[d]	3.43 (1.43 to 8.24)[d]	2.95 (1.45 to 6.04)[d]
Delinquency (females)				2008	96	0.74 (0.09 to 5.80)	0.56 (0.07 to 4.25)	0.54 (0.07 to 4.04)	1.37 (0.31 to 6.11)	0.56 (0.13 to 2.41)
Experience of IPV (severe combined abuse)	Abajobir et al[25]	21	None	3322	156	2.15 (0.96 to 4.82)	1.69 (0.82 to 3.53)	3.97 (2.24 to 7.04)[d]	4.62 (2.51 to 8.52)[e]	2.12 (1.28 to 3.51)[d]
Emotional IPV				3322	156	1.48 (0.82 to 2.66)	1.84 (1.11 to 3.03)	3.19 (1.99 to 5.14)[d]	2.64 (1.58 to 4.42)[d]	1.84 (1.31 to 2.57)
Physical IPV				3322	156	2.31 (1.27 to 4.18)[d]	1.76 (1.06 to 2.92)	2.76 (1.72 to 4.43)[d]	2.74 (1.62 to 4.63)[d]	2.14 (1.51 to 2.99)[d]
Harassment				3322	156	1.27 (0.68 to 2.36)	1.15 (0.56 to 1.95)	1.63 (1.02 to 2.59)	1.44 (0.86 to 5.36)	1.28 (0.89 to 1.83)
Quality of life	Abajobir et al[36]	21	Nonexclusive categories	3730	176	1.49 (0.75 to 3.12)	1.49 (0.80 to 2.77)	2.49 (1.41 to 4.39)[d]	2.86 (1.53 to 5.36)[d]	2.08 (1.37 to 3.16)[d]
Addiction and substance use										
Heavy alcohol[c]	Mills et al[26]	14	Exclusive categories	5153	789	0.56 (0.12 to 2.69)	0.34 (0.04 to 2.80)	2.63 (1.31 to 5.26)[d]		1.36 (0.89 to 2.09)
Any alcohol[c]				5153	789	0.44 (0.16 to 1.21)	0.79 (0.30 to 2.12)	1.78 (1.06 to 2.97)		1.13 (0.85 to 1.50)
Heavy smoking[c]				5154	789	1.81 (0.52 to 6.27)	3.10 (0.94 to 10.27)	2.16 (1.09 to 4.31)[d]		2.36 (1.61 to 3.47)[d]
Any smoking[c]				5154	789	1.40 (0.58 to 3.36)	2.28 (0.95 to 5.51)	2.03 (1.20 to 3.42)[d]		1.76 (1.32 to 2.34)
Heavy alcohol	Kisely et al[30]	21	Nonexclusive categories	3762	169	1.69 (0.68 to 4.09)	1.34 (0.68 to 2.65)	1.86 (1.04 to 3.32)	1.31 (0.65 to 2.67	—
Alcohol use disorder, lifetime (CIDI)				2531	169	0.69 (0.29 to 1.62)	1.15 (0.62 to 2.16)	0.90 (0.42 to 1.66	1.95 (1.05 to 3.62)	—
Any cigarettes use	Kisely et al[40]	21	Nonexclusive categories	3373	167	1.85 (1.03 to 3.32)	2.01 (1.23 3.27)[d]	2.07 (1.39 to 3.84)[d]		1.88 (1.34 2.63)
Cannabis abuse	Abajobir et al[28]	21	Statistical adjustment	2526	121	0.97 (0.32 to 2.89)	1.85 (0.87 to 3.93)	1.98 (0.98 to 4.02)	2.62 (1.17 to 5.86)[d]	1.79 (1.08 to 2.96)
Early onset of cannabis abuse				2526	121	—	2.51 (0.84 to 7.44)	3.59 (1.43 to 9.01)[d]	3.48 (1.15 to 10.52)[d]	2.77 (1.35 to 5.68)[d]
Cannabis dependence				2526	121	1.30 (0.38 to 4.47)	2.81 (1.27 to 6.22)[d]	2.44 (1.12 to 5.33)[d]	2.68 (1.09 to 6.52)[d]	2.47 (1.43 to 4.29)[d]
Early onset of cannabis dependence				2526	121	—	5.09 (1.69 to 15.39)[e]	3.39 (0.99 to 11.68)	4.92 (1.40 to 17.25)[e]	3.72 (1.58 to 8.73)[d]
Injecting drug use (males)	Abajobir et al[27]	21	Exclusive categories	1769	72	1.45 (0.18 to 11.96)	2.56 (0.99 to 6.58)	2.51 (1.05 to 5.98)[d]	1.43 (0.48 to 4.23)	2.01 (0.98 to 4.11)
Injecting drug use (females)				1981	91	2.41 (0.96 to 6.07)	2.69 (1.06 to 6.87)[d]	3.02 (1.30 to 6.97)[d]	2.70 (1.05 to 6.93)[d]	2.36 (1.19 to 4.67)[d]
Sexual health										
Early sexual debut	Abajobir et al[31]	21	Statistical adjustment	3081	153	1.99 (1.01 to 3.90)	2.03 (1.14 to 3.62)[d]	2.15 (1.27 to 3.65)[d]	2.29 (1.30 to 4.03)[d]	2.07 (1.39 to 3.05)[d]
Multiple sexual partners				3081	153	1.82 (0.98 to 3.37)	1.41 (0.83 to 2.41)	1.45 (0.89 to 2.37)	2.16 (1.26 to 3.71)[d]	1.37 (0.97 to 1.95)
Youth pregnancy (girls)				1980	92	3.47 (1.67 to 7.19)[d]	5.90 (2.72 to 12.83)[e]	3.28 (1.60 to 6.72)[d]	7.17 (3.03 to 16.99)[e]	4.27 (2.56 to 7.11)[e]
Pregnancy miscarriage				1525	77	1.24 (0.47 to 3.24)	1.11 (0.63 to 1.96)	2.73 (1.07 to 6.92)[d]	2.09 (0.83 to 5.26)	1.45 (0.74 to 2.72)
Termination of pregnancy (female)				1980	79	0.91 (0.31 to 2.53)	0.97 (0.37 to 2.55)	0.66 (0.23 to 1.92)	0.75 (0.27 to 2.09)	0.86 (0.43 to 1.73)
Physical health										
Asthma	Abajobir et al[35]	21	Statistical adjustment	3762	130	1.46 (0.83 to 2.57)	1.31 (0.80 to 2.13)	1.61 (1.01 to 2.54)	1.65 (0.99 to 2.75)	1.32 (0.94 to 1.84)
High dietary fat intake	Abajobir et al[33]	21	None	3766	170	1.60 (0.67 to 3.84)	1.91 (1.04 to 3.49)	1.16 (0.61 to 2.23)	1.52 (0.78 to 2.95)	1.65 (1.06 to 2.57)
Poor sleep quality (males)	Abajobir et al[34]	21	Nonexclusive categories	3778	171	0.36 (0.08 to 1.60)	2.63 (1.04 to 6.64)[d]	1.80 (0.81 to 3.99)	0.99 (0.46 to 2.19)	1.29 (0.74 to 2.56)
Poor sleep quality (females)						0.85 (0.37 to 1.94)	0.66 (0.28 to 1.61)	0.72 (0.32 to 1.66)	1.13 (0.38 to 3.39)	0.71 (0.39 to 1.28)
Height deficit[b]	Abajobir et al[32]	21	Statistical adjustment	2661	171	-0.01 (-2.30 to 1.55)	-0.03 (-3.16 to -0.02)	-0.03 (-3.47 to -0.40)	-0.03 (-4.03 to -0.67)	-0.02 (-2.14 to 0.02)

	$P < .05$
	$P < .01$
	$P < .001$
	$P < .0001$

FIGURE 2

Published studies from the Mater-University of Queensland Study of Pregnancy, linking long-term outcomes with specific maltreatment subtypes (adjusted coefficients or odds ratios ± 95% confidence intervals). CES-D, Center for Epidemiologic Studies–Depression Scale; CI, confidence interval; *N*, number of offspring in sample; $N_{(Mal)}$, number of offspring who experienced maltreatment. [a]In different articles adjusting for co-occurrence of maltreatment subtypes was handled in different ways: (1) statistical adjustment: each maltreatment subtype predictor was statistically adjusted for the other maltreatment subtypes (eg, neglect was adjusted for the occurrence of physical, sexual, and emotional abuse) and is reflected in the table's odds ratios and coefficients; (2) exclusive categories: different combinations of maltreatment types are included in mutually exclusive groups (eg, physical abuse only, physical abuse and emotional

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METHODS

Description of the MUSP Cohort

Between 1981 and 1983, 8556 consecutive pregnant women who attended their first prenatal clinic visit at the Mater Mothers' Hospital in Brisbane, Australia, agreed to participate (Fig 1). After excluding mothers who did not deliver a singleton infant at the Mater Mothers' Hospital or withdrew consent, the MUSP birth cohort consisted of 7223 mother-infant dyads, who were followed over 2 decades: at 3 to 5 days, 6 months, 5 years, 14 years and 21 years. Midway through the study, this rich data set was anonymously linked to state reports of child abuse and neglect, which identified some form of suspected maltreatment in >10% of cases.[37] Notified cases, which had been referred from the community or by general medical practitioners, were investigated by the Queensland government child protection agency. Substantiated maltreatment was determined after a formal investigation when there was "reasonable cause to believe that the child had been, was being, or was likely to be abused or neglected."[38] Substantiated maltreatment occurred when a notified case was confirmed for (1) sexual abuse, "exposing a child to or involving a child in inappropriate sexual activities"; (2) physical abuse, "any non-accidental physical injury inflicted by a person who had care of the child"; (3) emotional abuse, "any act resulting in a child suffering any kind of emotional deprivation or trauma"; or (4) neglect, "failure to provide conditions that were essential for the healthy physical and emotional development of a child," which encompassed physical, emotional and medical neglect.[37]

Inclusion Criteria for Original Research Publications

We searched PubMed from inception to April 2020 for published MUSP articles in which agency-reported child maltreatment was evaluated as the predictor of a range of outcomes. Studies needed to meet the following criteria for inclusion in the review: (1) notified or substantiated abuse and neglect was listed as a main predictor variable and (2) outcomes included standardized measurements of cognitive, psychological, behavioral, or health functioning. From ~340 published MUSP studies, we identified 24 articles dealing with child maltreatment, of which 21 included state-reported maltreatment versus self-reported maltreatment data (n = 3). Nineteen of the 21 articles met all inclusion criteria and were evaluated in this review (Fig 2). One study was excluded because it only examined outcomes associated with sexual abuse.[8] Another article was excluded because its outcome measures were similar to another included study.[29]

Quality of Supporting Literature

Each of the reviewed articles followed Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for the conduct of cohort studies.[41] The quality of the studies was also evaluated by using a modified version of the Newcastle-Ottawa Scale, which is used to assess the following domains: sample representativeness and size, comparability between respondents and nonrespondents, ascertainment of outcomes, and statistical quality.[42] On the basis of this assessment, all of the MUSP studies were determined to be of low risk of bias, with a score of 4 out of 5 points (Supplemental Information).

Predictors: Maltreatment Types

In all but 2 studies (which used notified maltreatment[21,26]) events were dichotomized and coded as substantiated maltreatment versus no substantiated maltreatment. According to a validated classification of maltreatment types,[43] specific categories and co-occurring forms of childhood maltreatment[44] were used to predict outcomes. In 2 studies,[19,20] all types of abuse were combined into 1 category and compared to neglect, whereas in another study, sexual abuse was compared to any combination of nonsexual maltreatment.[21] In 2 other studies,[26,40] emotional abuse and neglect (examples of psychological maltreatment) were combined, partly because of overlapping definitional constructs from the government child protection agency (emotional abuse included "emotional deprivation," and neglect included the failure to provide for "healthy…emotional development"). In all but 2 of the included articles,[25,33] co-occurrence of different types of maltreatment was considered, either by examining specific combinations of maltreatment types (in exclusive or nonexclusive overlapping categories) or by statistically adjusting for all remaining types of maltreatment (Fig 2).

FIGURE 2 Continued

abuse only, physical and emotional abuse and neglect [without sexual abuse], etc; see Table 1); (3) nonexclusive categories: maltreatment categories may overlap with other categories (eg, any substantiated abuse [sexual, physical, or emotional] versus any substantiated neglect); and (4) none: no statistical adjustments or combined categories were presented for co-occurring maltreatment subtypes. [b]Adjusted coefficients (95% CI) were reported as statistical association measures rather than adjusted odds ratios. [c]Cases of notified (rather than substantiated) maltreatment. In the study by Mills et al,[26] a sensitivity analysis was performed after exclusion of unsubstantiated cases of maltreatment. The associations between any maltreatment and substance use were similar to those seen in the original analysis after full adjustment. [d]Medium effect size, based on magnitude of the adjusted odds ratio (2 ≤ odds ratio ≤ 4). [e]Large effect size, based on magnitude of the adjusted odds ratio (odds ratio > 4).

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Outcome Measured	Study Reference	Age, y	Covariates and Respective Categories																																	
				Sociodemographic												Perinatal and Childhood							Psychological and Mental Health							Addiction				Physical Health		
			Other maltreatment subtypes	Child sex	Race[a]	Child age[b]	Youth income level, receiving benefits at 21 y	Youth education level at 14 or 21 y	Youth marital status at 21 y	High residential problem area at 21 y	Maternal age[c]	Maternal education[d]	Family income[e]	Maternal marital status and social support[f]	Maternal unemployment	Previous pregnancies	Gestational age	Birth weight z score	NICU admission	Breastfeeding	Infant medical symptoms	Parental supervision at 5 y	ADHD at 5 y	Aggressive behaviors at 14 y	Youth internalizing, externalizing problems at 14, 21 y	Youth depressive symptoms at 21 y	Maternal depression[g]	Chronic maternal stress over the first 6 mo	Maternal adverse life events (eg, arrest, IPV)	Youth alcohol use at 14 and 21 y	Youth cigarette use at 14 and 21 y	Maternal alcohol use (pregnancy, infancy, 14 y, 21 y)[h]	Maternal cigarette use (pregnancy, infancy, 14 y, 21 y)[i]	BMI, physical activity	Skin problem	Maternal and paternal height
Cognition and education																																				
Reading ability	Mills et al[20]	14																																		
Perceptual reasoning																																				
Attention problems (parent report)	Boyd et al[21]	14																																		
Attention problems (self-report)		21																																		
Receptive verbal intelligence	Mills et al[20]	21																																		
Failing to complete high school																																				
Failure to be in education or employment																																				

FIGURE 3

Covariates used in published articles from the MUSP to adjust for possible confounding. [a] Race: child's race, parental race, and maternal or paternal racial origin at pregnancy. [b] Child age: child age and gestational age. [c] Maternal age: maternal age at the first visit clinic or at pregnancy. [d] Maternal education: maternal education (prenatal or at birth). [e] Family income: annual family income, familial income over the first 5 years or family poverty before birth or over the first 5 years of life, family income before birth, and annual family income. [f] Maternal marital status and social support: same partner at birth and 14 years and social support at 5 years. [g] Maternal depression: maternal depression during pregnancy, 3- to 6-month follow-up, or 21-year follow-up; chronic maternal depression. [h] Maternal alcohol use: maternal alcohol use at 3- to 6-month or 14-year follow-up and binge drinking. [i] Maternal cigarette use: cigarette use during pregnancy, 6 months postpartum, or at 14-year follow-up. ADHD, attention-deficit/hyperactivity disorder; CES-D, Center for Epidemiologic Studies–Depression Scale; IPV, intimate partner violence.

Covariates

All of the odds ratios, mean differences, or coefficients were adjusted for potential confounding variables (Fig 3). All articles adjusted for a variety of sociodemographic variables, such as age, race, education, income, and marital status. Perinatal and/or childhood factors, such as birth weight, gestational age, and breastfeeding status, were used as covariates, particularly in articles in which cognitive and educational outcomes were examined. Psychological and mental health variables (such as internalizing and externalizing behavior problems, maternal depression, chronic stress, or exposure to violence) were primarily included as covariates in mental health outcome studies, especially for psychosis. Addiction studies adjusted for youth and maternal alcohol or tobacco use, among other covariates, and physical health outcome studies adjusted for relevant covariates (such as BMI in a study of dietary fat intake and parental height when studying offspring height). In selected articles, maltreatment subtypes were also statistically adjusted for the other types of maltreatment to determine independent effects.

Outcomes

A total of 46 outcomes were assessed at 14 years (n = 5200) and/or 21 years (n = 3778) (Fig 1) and were grouped into 5 domains (Fig 2):

1. Cognition and education outcomes included reading ability and perceptual reasoning measured in adolescence, and, at age 21, receptive verbal intelligence and failure to complete high school or be either enrolled in school or employed; attention problems were measured at both time points.
2. Psychological and mental health outcomes at 21 years included internalizing and externalizing behavior problems (which were also assessed at 14 years), lifetime anxiety disorder, depressive disorder and symptoms, PTSD, lifetime psychosis diagnosis, psychotic symptoms (such as delusional experience or visual and/or auditory hallucinations), delinquency, experience of IPV or harassment, and overall quality of life.
3. Addiction and substance use, measured at both time points, included alcohol and cigarette use at 14 and 21 years, and cannabis abuse and/or dependence (including early onset) and injecting-drug use at the 21-year follow-up.
4. Sexual health was investigated at age 21 in terms of early initiation of sexual experience, having

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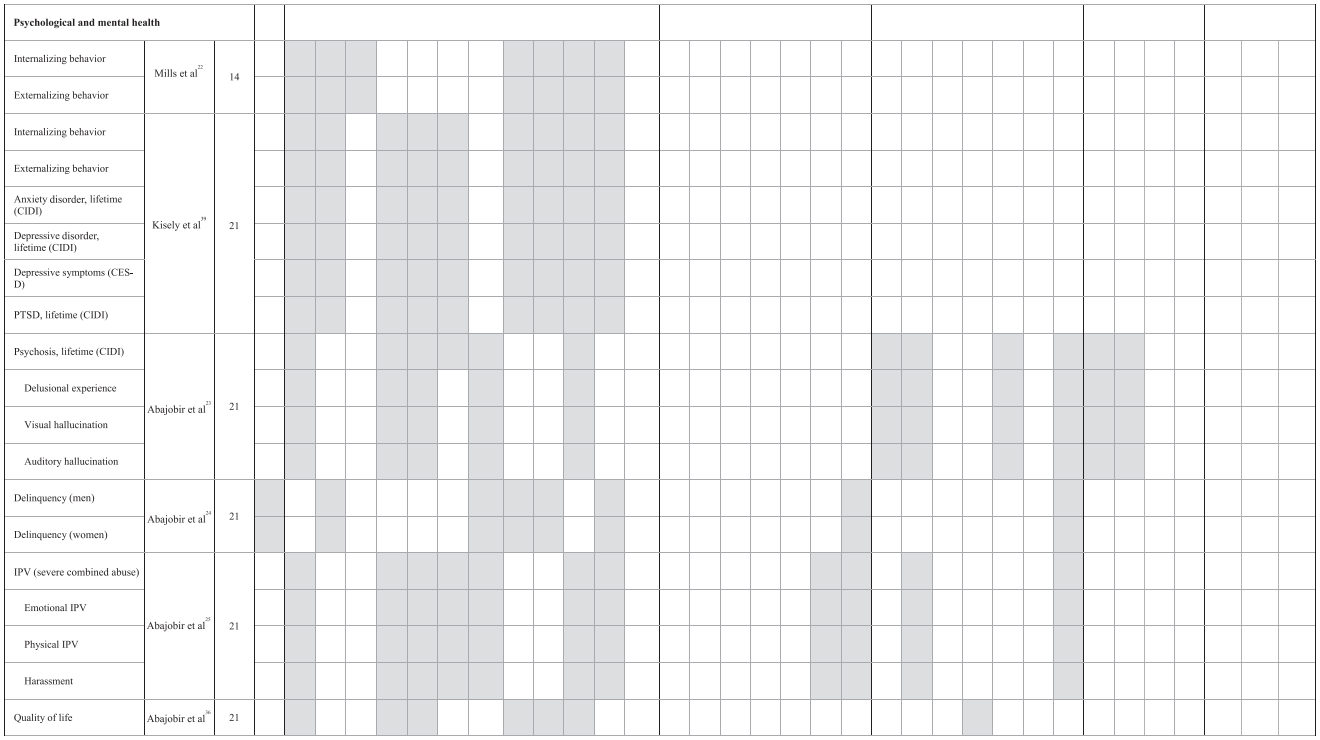

FIGURE 3 Continued
Covariates used in published articles from the MUSP to adjust for possible confounding.

multiple sexual partners, youth pregnancy, and miscarriage or termination.

5. Physical health outcomes measured at 21 years included symptoms of asthma, high dietary fat intake, poor sleep quality, and height deficits.

The 14-year assessments included a youth questionnaire (n = 5172) and in-person cognitive testing (n = 3796). The 21-year visit included an in-person assessment of mental health diagnoses in a subset of the cohort (n = 2531) with the World Health Organization Composite International Diagnostic Interview (CIDI), which is based on *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* criteria[45] (Fig 1). All of the questionnaire and interview measures were validated, except for reported frequencies of specific events (ie, pregnancy, number of cigarettes, etc).

Associations were described by using either adjusted odds ratios or mean differences and coefficients, along with the corresponding 95% confidence intervals, and were plotted to visualize and compare the statistical significance of each association across specific outcome categories and types of maltreatment (Figs 4–8).

Ethical Approval

The MUSP was approved by the Human Ethics Review Committee of The University of Queensland and the Mater Misericordiae Children's Hospital. Ethical approval was obtained separately from the Human Ethics Review Committee of The University of Queensland for linking substantiated child maltreatment data to the 21-year follow-up data.

RESULTS

Prevalence and Co-occurrence of Maltreatment Subtypes

In this cohort of 7214 children (Fig 1), 7.1% (n = 511 children) experienced at least 1 episode of substantiated maltreatment. Substantiated sexual abuse was reported in 2.0% (n = 147), physical abuse in 4.0% (n = 287), emotional abuse in 3.7% (n = 267), and neglect in 3.7% of cases (n = 269) (Table 1). Almost 60% of the children with substantiated maltreatment had multiple substantiated episodes (293 children; range: 2–14 episodes per child; median: 3 episodes per child[37]). Of the 3778 young adults included in the 21-year follow-up, 4.5% (n = 171) had a history of substantiated maltreatment,[39] including sexual abuse (n = 53), physical abuse (n = 60), emotional abuse (n = 71), and neglect (n = 89).

More than half of the children who experienced substantiated maltreatment were reported for ≥2 co-occurring maltreatment types (Table 1). Of the substantiated sexual abuse cases, 57.1% of the children experienced ≥1 additional maltreatment types (84 of 147); for

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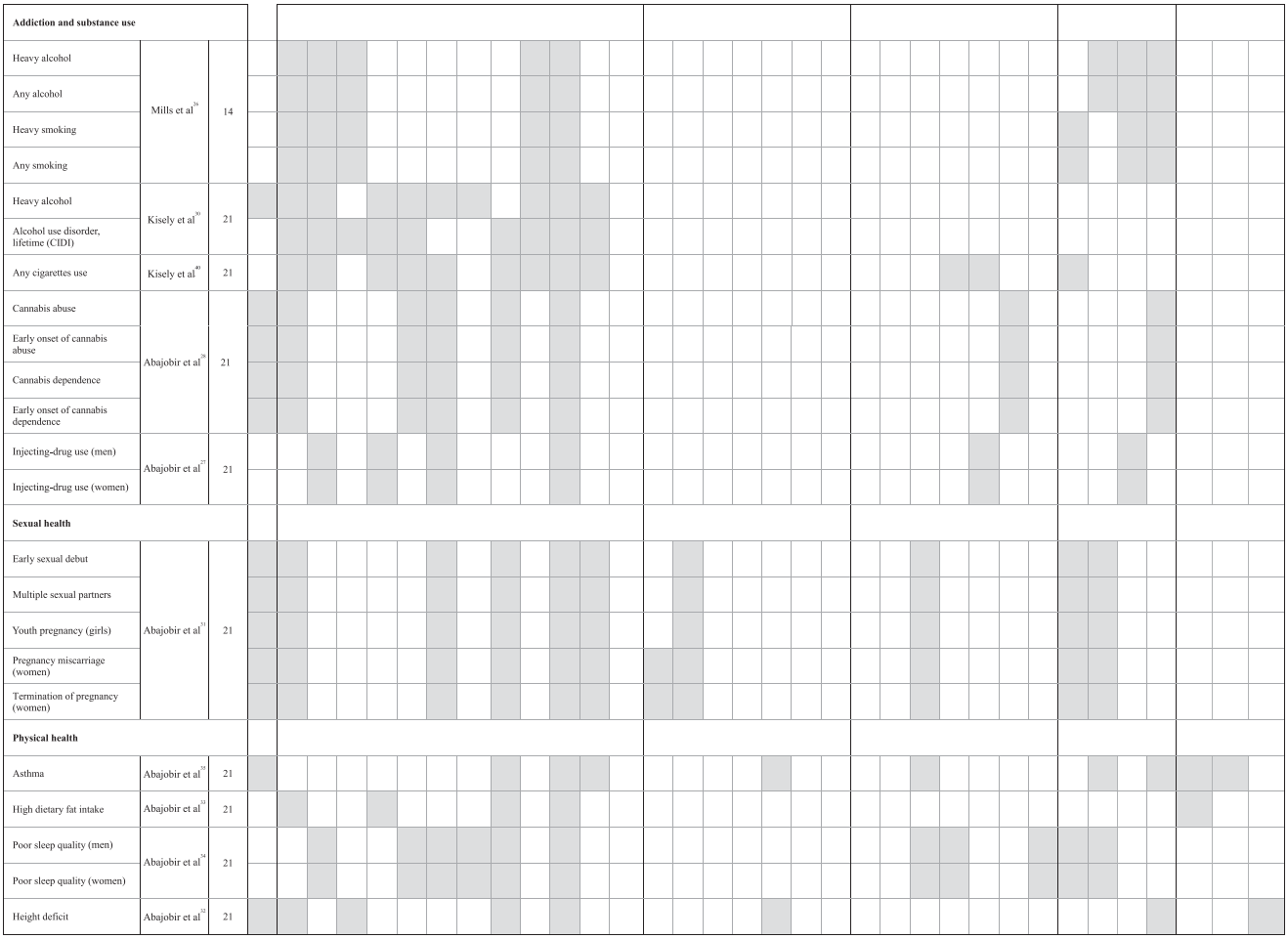

FIGURE 3 Continued
Covariates used in published articles from the MUSP to adjust for possible confounding.

physical abuse, this proportion was 79.1% (227 of 287); for emotional abuse, 83.5% (223 of 267); and for neglect, 73.6% (198 of 269). In particular, emotional abuse and neglect co-occurred, with or without other types of maltreatment, in ~59% of cases.[46]

Cognition and Education Outcomes

Abuse (a combined category) and neglect were both associated with significantly lower cognitive scores at both 14 and 21 years, as well as with negative long-term educational and employment outcomes in young adulthood.[19,20] This was after adjusting for factors such as the child's race, sex, birth weight, breastfeeding exposure, and age; family income; and maternal education and alcohol and/or tobacco use (Fig 3). Specifically, proxy measures of IQ, such as reading ability and perceptual reasoning, at age 14 years were adversely associated with both substantiated abuse and neglect.[19] Sexual abuse was associated with attention problems in adolescence, whereas nonsexual maltreatment was associated with attention problems at both time points.[21] Young adults who experienced substantiated child maltreatment had reduced scores on the Peabody Vocabulary Test at 21 years. In terms of educational outcomes in young adulthood, both abuse and neglect manifested a threefold to fourfold increase in odds of failing to complete high school and a twofold to threefold increase in the likelihood of being unemployed at age 21 years[20] (Figs 2 and 4).

Psychological and Mental Health Outcomes

During adolescence, physical abuse, emotional abuse, and neglect were all significantly associated with both internalizing and externalizing behavior problems, although this was not the case for physical abuse notifications without co-occurring emotional abuse or neglect.[22] After adjustment for relevant sociodemographic variables, the associations with emotional abuse and neglect remained significant at 21 years.[39] No statistically significant association was found between sexual

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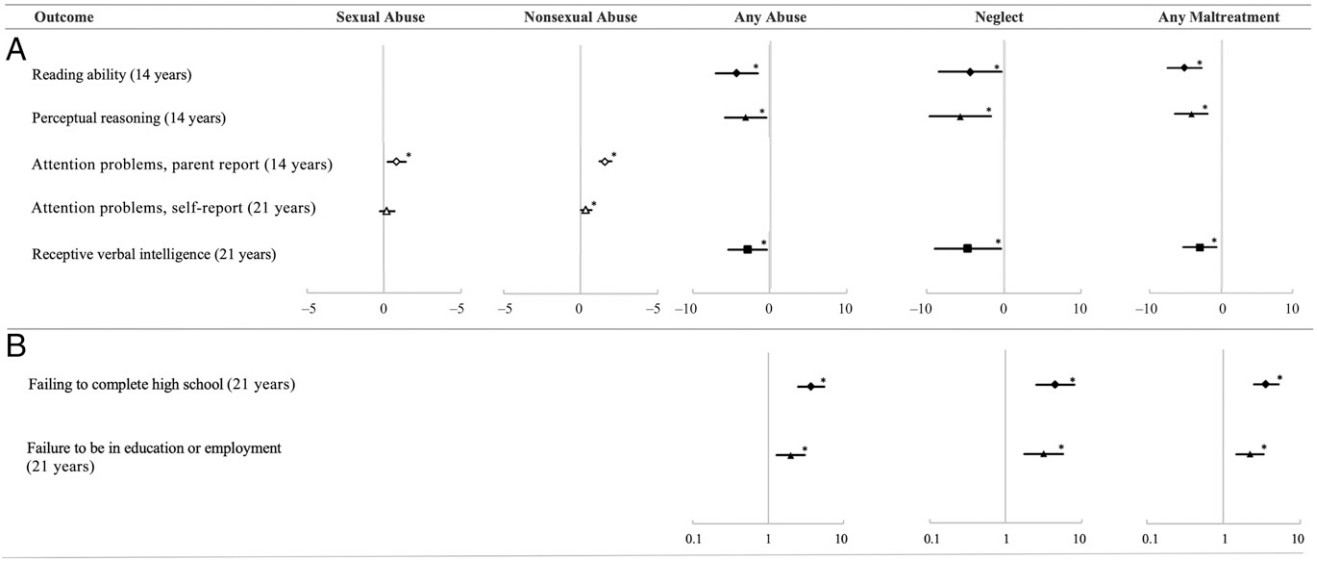

FIGURE 4
Child maltreatment and cognition and educational outcomes at 14 and 21 years. A, Adjusted coefficients ± 95% confidence intervals. B, Odds ratios ± 95% confidence intervals. * $P < .05$.

abuse and these behavior problems at either time point.

Psychological maltreatment in childhood was associated with all of the other 15 psychological and mental health outcomes in young adulthood, except for delinquency in women. This was true after adjustment for sociodemographic variables and psychological and mental health problems (such as attention-deficit/hyperactivity disorder, aggressive behavior problems, and maternal depression or adverse life events, in the case of psychosis and/or IPV exposure outcomes) (Fig 3). Specifically, both emotional abuse and neglect were significantly associated at 21 years with all of the following outcomes: anxiety, depression, PTSD, psychosis (with some exceptions), delinquency in men, and experiencing IPV and harassment (except for neglect).[22–25,39] Emotional abuse and neglect were the only maltreatment subtypes associated with a significant decrease in quality-of-life scores.[36]

The only mental health outcomes associated with sexual abuse were clinical depression, lifetime PTSD, and experiencing physical IPV.[8,25,39] Physical abuse was associated with externalizing behavior problems and delinquency (in men), internalizing behavior problems and depressive symptoms, experience of IPV, and PTSD[22,24,25,39] (Figs 2 and 5).

Addiction and Substance Use Outcomes

Overall, emotional abuse and/or neglect were associated with all categories of substance use and addiction at both 14 and 21 years, whereas physical and sexual abuse were associated with surprisingly few substance abuse outcomes. Specifically, childhood emotional abuse and neglect were associated with adolescent substance use at age 14, including alcohol use and smoking.[26] This was after adjustment for sociodemographic factors and youth and maternal drug use. The association with cigarette and alcohol use persisted from adolescence to adulthood. The category of "any cigarette use" was the only addiction outcome associated with all 4 types of maltreatment.[40] At 21 years, emotional abuse and neglect were both associated with the early onset of cannabis abuse after adjustment for maternal stress and cigarette use. Additionally, physical abuse, emotional abuse, and neglect all revealed increased odds of cannabis dependence at age 21, with early onset associated with physical abuse and neglect.[28] In contrast, only emotional abuse significantly predicted injecting-drug use in young adult men, after adjustment for maternal alcohol use and depression, whereas all types of substantiated childhood maltreatment were associated with injecting-drug use in women.[27] Sexual abuse was not associated with any addiction or substance use outcome except for cigarette use at 21 years (Figs 2 and 6).

Sexual Health Outcomes

All forms of maltreatment were significantly associated, at 21 years, with early onset of sexual activity and subsequent youth pregnancy. This was after adjustment for factors such as gestational age, youth psychopathology, and drug use. Neglect was the only type of maltreatment associated with having multiple sexual partners and was the maltreatment type most strongly associated with most other sexual health outcomes, especially youth pregnancy. Pregnancy miscarriage

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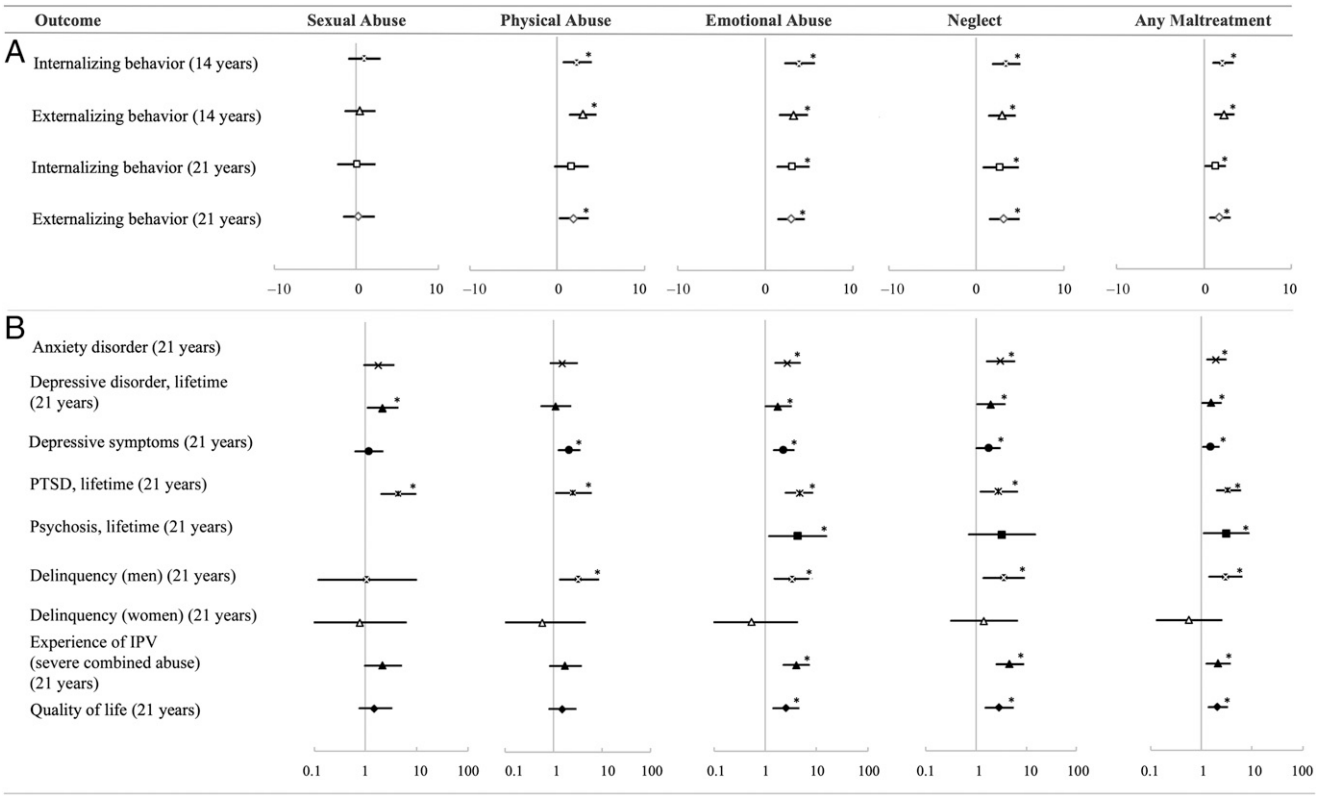

FIGURE 5
Child maltreatment and psychological and mental health outcomes at 14 and 21 years. A, Adjusted coefficients ± 95% confidence intervals. B, Odds ratios ± 95% confidence intervals. * $P < .05$.

was modestly associated with emotional abuse, whereas termination of pregnancy was not associated with any maltreatment subtype[31] (Figs 2 and 7).

Physical Health

Reduced adult height at 21 years, adjusted for parental height, was associated with all maltreatment subtypes except sexual abuse (which was not associated with any of the physical health outcomes). At 21 years, physical abuse was also associated with high dietary fat

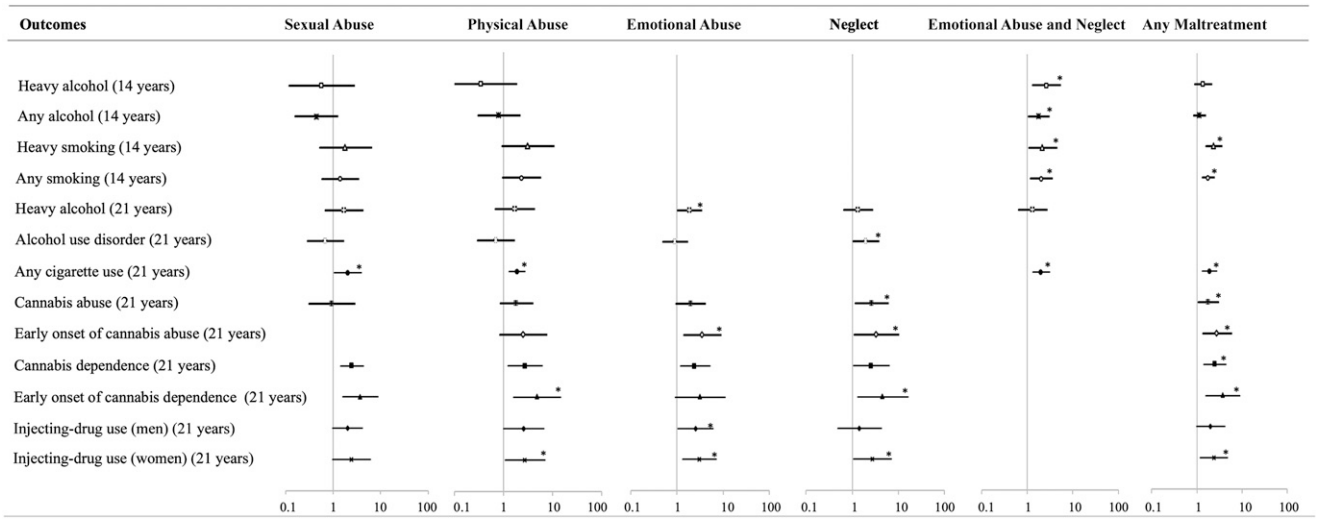

FIGURE 6
Child maltreatment and addiction and substance use outcomes at 14 and 21 years (adjusted odds ratio ± 95% confidence interval). * $P < .05$.

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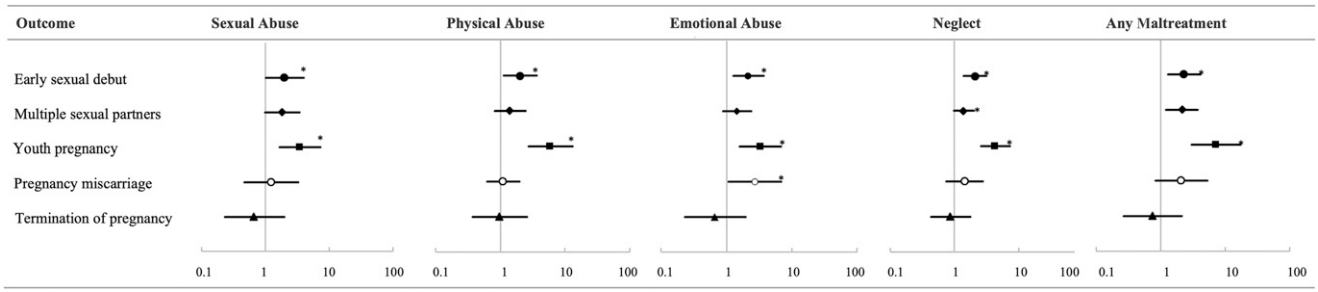

FIGURE 7
Child maltreatment and sexual health outcomes at 21 years (adjusted odds ratio ± 95% confidence interval). * $P < .05$.

intake, a risk factor for obesity (adjusted for BMI), and poor sleep quality in men (adjusted for psychopathology and drug use). Asthma at 21 years revealed a modest association with emotional abuse. The combined category of any maltreatment was also associated with high dietary fat intake (Figs 2 and 8).

Magnitude of Effects

To estimate the magnitude of potential effects of child maltreatment on long-term outcomes, other studies have used a number of statistical techniques. In one Australian study that used the MUSP and other data sets, the population attributable risk of child maltreatment causing anxiety disorders in men and women, was estimated to be 21% and 31%, respectively, and 16% and 23% for depressive disorders.[46] Similarly, in the MUSP study on cognitive and educational outcomes of maltreated youth, the population attributable risk of child maltreatment leading to "failure to complete high school" was 13%, and 14% for "failure to be in either education or employment at 21 years."[20]

Based on one published metric of effect size using the magnitude of the adjusted odds ratio,[47] 77% of the statistically significant associations in this review were considered to have a medium to large effect size (odds ratio ≥2), including 10% with a large effect size (odds ratio >4) (Fig 2).

DISCUSSION

In summary, over the past decade, the MUSP has revealed that child maltreatment is associated with a broad array of adverse outcomes during adolescence and young adulthood, including the following:

1. deficits in cognitive development, attention, educational attainment, and employment;
2. serious mental health problems, including anxiety, depression, PTSD, and psychosis, as well as delinquency and the experience of IPV;
3. substance use and addiction problems;
4. sexual health problems; and
5. physical health limitations and risk.

These results were seen after adjustment for a broad range of relevant sociodemographic, perinatal, psychological, and other risk factors (Fig 3). Many of the studies also adjusted for the other subtypes of child maltreatment and demonstrated that specific maltreatment types were closely associated with particular outcomes.

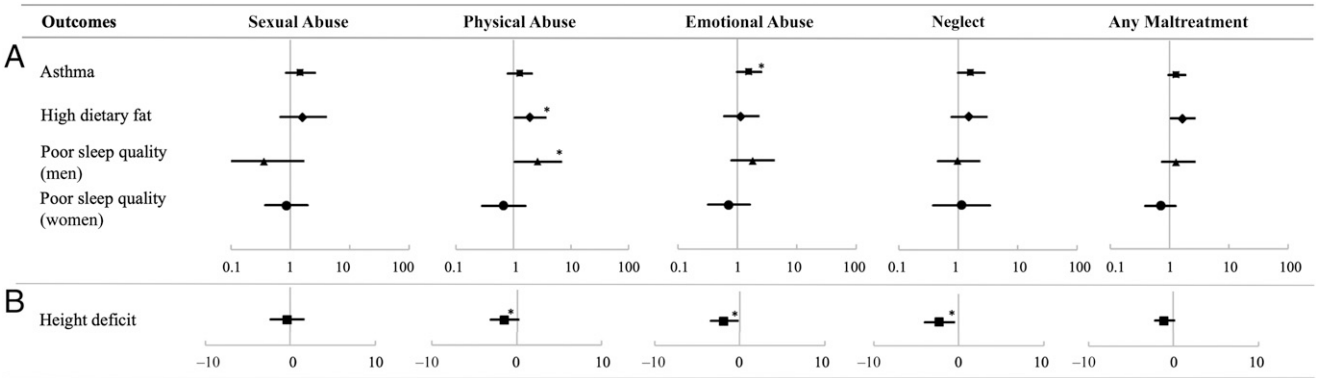

FIGURE 8
Child maltreatment and physical health outcomes at 21 years. A, Adjusted odds ratio ± 95% confidence interval. B, Adjusted coefficients ± 95% confidence interval. * $P < .05$.

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TABLE 1 Nonexclusive and Exclusive Categorization of Child Maltreatment Subtypes (Single and in Combination) Within the MUSP Cohort

Combinations of Substantiated Maltreatment	*n*	% of Cohort (*N* = 7214)
Nonexclusive categories of maltreatment		
Any sexual abuse	147	2.0
Any physical abuse	287	4.0
Any emotional abuse	267	3.7
Any neglect	269	3.7
Exclusive categories of maltreatment		
None	6703	92.9
Sexual abuse only	63	0.87
Physical abuse only	60	0.83
Emotional abuse only	24	0.33
Neglect only	71	0.98
Sexual and physical abuse only	10	0.14
Sexual and emotional abuse only	6	0.08
Sexual abuse and neglect only	12	0.17
Physical and emotional abuse only	74	1.03
Physical abuse and neglect only	23	0.32
Emotional abuse and neglect only	37	0.51
Sexual, physical, and emotional abuse only	5	0.07
Sexual and physical abuse and neglect only	5	0.07
Sexual and emotional abuse and neglect only	11	0.15
Physical and emotional abuse and neglect only	75	1.04
Sexual, physical, and emotional abuse and neglect	35	0.49
Total with any substantiated maltreatment	511	7.1

Abuse, Neglect, and Cognitive Development

Significant cognitive delays and educational failure were seen for both abuse and neglect across adolescence and adulthood. In another study, the authors concluded that preexisting cognitive impairments at 3 or 5 years may explain this association, rather than maltreatment per se.[16] However, other research has revealed that children neglected over the first 4 years of life show a progressive decline in cognitive functioning, which is associated with a significantly reduced head circumference at 2 and 4 years of age.[48] In rodent models, contingent maternal behavior is linked with infant cognitive development, and possible mechanisms include increases in synaptic connections within the hippocampus[49] and reduced apoptotic cell loss.[50] Prolonged maternal separation, in contrast, is associated with impaired cognitive development in rodent and primate models.[51,52]

Psychological Maltreatment: Emotional Abuse and/or Neglect

One of the most striking conclusions from this review was the broad association between emotional abuse and/or neglect and adverse outcomes in almost all areas of assessment (Fig 2). In stark contrast, physical abuse and sexual abuse were associated with far fewer adverse outcomes. Overall, quality of life was lower for those who had experienced emotional abuse and neglect but not for those who had experienced physical or sexual abuse. Although emotional abuse and neglect often co-occur with other types of maltreatment,[46] the associated outcomes were generally robust even after statistical adjustment or separation into differing maltreatment categories (Fig 2).

Emotional abuse and neglect in early childhood may lead to psychopathology via insecure attachment,[53,54] which has been associated with externalizing behavior problems[55] and impaired social competence.[56,57] Emotional neglect, in particular, may lead to deficits in emotion recognition and regulation, as well as insensitivity to reward,[3] potentially influencing social and emotional development. Neglected children are less able to discriminate facial expressions and emotions,[58] whereas youth who have been emotionally neglected show blunted development of the brain's reward area, the ventral striatum.[59] Reduced reward activation may predict risk for depression,[59] addiction,[60] and other psychopathologies.[61]

Neglect was also associated with the early onset of sexual activity, multiple sexual partners, and youth pregnancy, even after adjustment for other maltreatment subtypes. This suggests that neglect may result in compensatory efforts to obtain sexual intimacy, consistent with other studies revealing higher rates of unprotected sex[62] and adolescent pregnancy in neglected children.[63] In the animal literature, female rodents that experience maternal deprivation tend to have an earlier onset of puberty and increased sexual receptivity, leading to elevated reproductive activity to help offset an environment of higher offspring risk.[64,65]

Sexual Abuse

As observed elsewhere,[66] sexual abuse was associated with early sexual experimentation and youth pregnancy as well as symptoms of PTSD and depression. Risky sexual behaviors were independent of other types of maltreatment but were not specific for sexual abuse. An additional MUSP study comparing self-reported and agency-notified child sexual abuse revealed consistent associations with major depressive disorder, anxiety disorders, and PTSD.[8] The absence of associations with other adverse outcomes, however, may be, in part, due to the lower prevalence of

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substantiated sexual abuse, especially at the 21-year follow-up.

Physical Abuse

Outcomes associated with physical abuse differed from those associated with sexual abuse, with increased odds of externalizing behavior problems, and delinquency in men. Jaffee[3] suggests that physical abuse, in particular, may lead to a hypervigilance response to threat, including negative attentional bias, disproportionate to relatively mild threat cues. Studies have revealed that physically abused children show selective attention to anger cues,[67] have difficulty disengaging from them,[58,68] and are more likely to misinterpret facial cues as being angry or fearful.[69]

Limitations

Although these studies demonstrated significant associations between maltreatment and a range of long-term outcomes, association does not equal causality. The causal mechanisms proposed above are tentative and may relate to multiple types of maltreatment.

Other limitations should also be considered. Firstly, selective attrition of socioeconomically disadvantaged and maltreated young people was evident in the MUSP cohort (Supplemental Information). However, based on multiple imputation calculations and inverse probability weighting of MUSP data,[18,70] differences in the rate of loss to follow-up, for both dependent and independent variables, made little difference to either the estimates or their precision, mirroring findings from other longitudinal studies.[71] In addition, the findings were mostly unchanged when using propensity analysis, which is used to assess the effects of nonrandom sampling variation by analyzing the probability of assignment to a particular category within an observational study given the observed covariates.[72] Specifically, the sample was weighted so that it better resembled sociodemographic characteristics at baseline to minimize bias from differential attrition in those with greater socioeconomic disadvantage.

Secondly, differences in the prevalence of specific maltreatment subtypes might have influenced the statistical power to detect true effects, particularly regarding sexual abuse (Table 1).

Finally, the co-occurrence of different types of maltreatment may have impacted the ability to accurately predict the associations between specific types of maltreatment and outcomes. Other studies have revealed that emotional abuse and neglect, in particular, are more likely to co-occur with each other and with other types of maltreatment.[73] However, even in those articles that statistically adjusted for other co-occurring maltreatment subtypes, the associated outcomes linked with emotional abuse and/or neglect were generally robust. In articles that did not adjust for these co-occurrences, some of the strongest associations were still observed for emotional abuse and/or neglect.

CONCLUSIONS

Child maltreatment, particularly psychological maltreatment, is associated with a broad range of negative long-term health and developmental outcomes extending into adolescence and young adulthood. Although these data do not establish causality, neurodevelopmental pathways are likely influenced by stress and early social experience through epigenetic mechanisms, which may affect gene expression and regulation and, ultimately, behavior and development.[3,74]

Understanding the developmental roots of these adverse outcomes may motivate physicians to more systematically inquire about early-life trauma and refer patients to more appropriate treatment services.[75,76] Even more importantly, early intervention and prevention programs, such as prenatal and infancy nurse home visiting,[77] have demonstrated, in randomized clinical trials, diminished rates of child abuse and neglect.[78,79] Long-term benefits to the offspring include decreased childhood internalizing problems,[80] reduced antisocial behavior and substance abuse in adolescence,[81] and improved cognitive skills extending into young adulthood.[80,82] Supporting at-risk parents and young children should thus be an urgent priority.

ABBREVIATIONS

CIDI: Composite International Diagnostic Interview
IPV: intimate partner violence
MUSP: Mater-University of Queensland Study of Pregnancy
PTSD: posttraumatic stress disorder

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