Traumatic Experiences in Childhood and the Risk of Arthritis

A Prospective Cohort Study

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ABSTRACT

Background: Recent data suggest that psychosocial factors, including childhood and adulthood stressors, may play a significant role in the development of chronic musculoskeletal pain and other symptoms. The purpose of this study was to determine if traumatic experiences in childhood are associated with an increased risk of self-reported arthritis later in life.

Methods: We used longitudinal data (N=9,159) from the first 3 cycles of the National Population Health Survey (NPHS) in Canada. New cases of arthritis were identified using an interviewer-administered questionnaire. Psychological trauma in childhood or adolescence was measured by a 7-item questionnaire asking about physical abuse, fearful experiences, hospitalization, being sent away from home, and 3 types of parental disturbance. The effects of trauma were examined in a multivariable discrete-time proportional hazards model.

Results: The incidence of self-reported arthritis was 27.1 per 1,000 person-years. We found a relative risk of 1.17 (95% CI=0.92, 1.48) for one traumatic event and 1.27 (95% CI=0.99, 1.62) for two or more traumatic events. Independent effects were observed for prolonged hospitalization (HR=1.33, 95% CI=1.05, 1.68) and being very scared (HR=1.29, 95% CI=1.02, 1.62). In subgroup analyses, no significant interactions were found between trauma and sex, socio-economic status, or baseline health.

Conclusions: In this large prospective study, we found a moderate increase in the risk of arthritis among persons reporting multiple traumatic experiences in childhood.

La traduction du résumé se trouve à la fin de l'article.

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Arthritis affects nearly 4 million Canadians aged 15 years and over and is one of the most commonly reported chronic conditions in population surveys.^{1,2} It has been estimated that between 1991 and 2031, the number of people with arthritis in Canada will increase by 124%.³ Arthritis has a strong impact on daily function, ability to work, participation in social activities, and overall quality of life.^{4,5} Despite its high prevalence and impact on population health, no studies of incident arthritis/rheumatism or risk factors for this condition have been published in Canada. Therefore, it is difficult to appreciate the overall burden of arthritis associated with modifiable risk factors or to ascertain the potential for primary prevention.

Clinical and epidemiological studies suggest that stressful experiences early in life may affect behaviour and coping skills in adult life and increase the risk of chronic illness.^{6,7} Epidemiological data also suggest that the prevalence of self-reported childhood trauma in Canada increased in the past two decades.⁸ Recently, a growing number of studies have looked at the role of psychosocial factors, including stress, in the etiology of musculoskeletal diseases.⁹ Even though different biological mechanisms are involved in different types of arthritis, psychosocial factors may play a role in a broad range of conditions. Traumatic events in childhood, such as abuse or loss of parents, have been associated with fibromyalgia,¹⁰⁻¹³ low-back pain,¹⁴⁻¹⁶ and other musculoskeletal symptoms.^{17,18} To our knowledge, no study has examined whether a history of childhood trauma increases the risk of arthritis.

The primary purpose of this study was to determine, in a large population cohort, if adverse experiences in childhood increase the risk of self-reported, clinically diagnosed arthritis or rheumatism. Our secondary objectives were to examine which specific experiences are associated with increased risk and whether gender, socio-economic status, and baseline health modify this relationship.

METHODS

Study design

We used longitudinal data from the first 3 cycles of the National Population Health Survey (NPHS) in Canada conducted in

1994/95, 1996/97, and 1998/99.^{19,20} The NPHS collects information about the health of the Canadian population every two years. It covers household and institutional residents in all provinces and territories, except persons living on Indian reserves, on Canadian Forces bases, and in some remote areas. For the longitudinal component, the NPHS drew a representative sample of approximately 19,600 households. One household member was randomly selected for participation. The survey was designed and implemented by Statistics Canada. A more detailed description of the NPHS design and interview procedures can be found in published reports.^{19,20} The inception cohort for our study was defined as NPHS participants who were 18 years of age or older and free of arthritis or rheumatism at baseline.

Measures

In all 3 cycles, NPHS respondents were asked the following question: Have you been diagnosed by a health professional with arthritis or rheumatism? Respondents were instructed to report only long-term problems, defined as those that lasted or were expected to last 6 months or longer. Childhood trauma was assessed at baseline by seven yes/no questions asking about negative experiences that happened when the respondent was a child or teenager, such as spending 2 weeks or more in a hospital, parents getting a divorce, long-term unemployment, being scared “so much you thought about it for years after”, being sent away from home, parental use of alcohol or drugs, and physical abuse. We created a 3-level summary index: 0 traumatic events, 1 traumatic event, and 2+ traumatic events.

Potential confounding variables were classified into the following groups: 1) demographic and socio-economic (age, sex, education, income adequacy, living arrangements, marital status, race, working status); 2) anthropometrical (weight, height); 3) behavioural (alcohol, smoking, gardening/yard work, exercise/recreation, pattern of daily physical activity); 4) health status (self-rated health, restriction of activity); 5) psychological measures (depression, mental distress, chronic stress, personal stress, life events); 6) injury in the past 12 months; and 7) hormone replacement therapy. Most of these variables were time-

TABLE 1

Baseline Distribution of Demographic Variables, Self-rated Health, and Childhood Trauma Among NPHS Respondents 18 Years of Age or Older and Free of Arthritis (N=9,159)

Variable	N (%)
Age Group	
18-24	1220 (13.3)
25-44	4237 (46.3)
45-64	2391 (26.1)
65+	1311 (14.3)
Sex	
Male	4286 (46.8)
Female	4873 (53.2)
Education	
Less than high school diploma	2322 (25.4)
High school diploma with/without some trade school/college/university	3874 (42.3)
Diploma/certificate/degree from trade school/college/university	2947 (32.2)
Not stated	16 (0.2)
Income Adequacy	
Lowest income	606 (6.6)
Lower middle	1142 (12.5)
Middle	2621 (28.6)
Upper middle	3246 (35.4)
Highest income	1198 (13.1)
Not stated	346 (3.8)
Self-rated Health	
Poor/fair	743 (8.1)
Good	2208 (24.1)
Very good	3695 (40.3)
Excellent	2513 (27.4)
Childhood Trauma: Number of Traumatic Events	
0 traumatic events	4549 (49.7)
1 traumatic event	2280 (24.9)
2+ traumatic events	1893 (20.7)
Not stated	437 (4.8)
Childhood Trauma: 2 or More Weeks in Hospital	
No	7426 (81.1)
Yes	1334 (14.6)
Not stated	399 (4.4)
Childhood Trauma: Parents Abused Drugs or Alcohol	
No	7379 (80.6)
Yes	1386 (15.1)
Not stated	394 (4.3)
Childhood Trauma: Parents Divorced	
No	7842 (85.6)
Yes	925 (10.1)
Not stated	392 (4.3)
Childhood Trauma: Parents Unemployed for a Long Time	
No	7604 (83.0)
Yes	1144 (12.5)
Not stated	411 (4.5)
Childhood Trauma: Physically Abused	
No	8118 (88.6)
Yes	643 (7.0)
Not stated	398 (4.4)
Childhood Trauma: Sent Away from Home	
No	8591 (93.8)
Yes	177 (1.9)
Not stated	391 (4.3)
Childhood Trauma: Very Scared	
No	6957 (76.0)
Yes	1807 (19.7)
Not stated	395 (4.3)

NPHS=National Population Health Survey

dependent, i.e., were allowed to have different values in cycles 1 and 2. The variables are described in the Appendix. Further details and the wording of the questions can be found in the NPHS documentation.¹⁹⁻²¹

For the analysis of effect modification, we selected sex, socio-economic status (income and education), and baseline self-rated health as potential modifiers. These variables are important determinants of health in general, are known to affect sus-

ceptibility to chronic illness, and could be used to identify vulnerable groups for targeted interventions. The variables were dichotomized according to the median of their distributions in the study population.

Statistical methods

The analyses were weighted to represent the Canadian population at the time of the baseline survey. To account for the complex sampling design, confidence intervals and p-values were obtained using bootstrap

TABLE II**Incidence of Arthritis/Rheumatism Among NPHS Respondents 18 Years of Age and Older**

Population Group	Incidence per 1000 Person-years
All	27.05
Males	21.35
Females	32.97
Age	
18-24	5.35
25-44	14.21
45-64	46.25
65+	84.86

NPHS=National Population Health Survey
Incidence rates are weighted to represent the Canadian population.

TABLE III**Effect of the Number of Childhood Traumatic Events and Confounding Variables on the Incidence of Arthritis/Rheumatism Among NPHS Respondents 18 years of Age and Older**

Variable	Hazard Rate Ratio	95% Confidence Interval
Childhood Trauma		
1 traumatic event	1.17	0.92, 1.48
2+ traumatic events	1.27	0.99, 1.62
Other Variables in the Model		
Age		
25-44	2.50	1.60, 3.92
45-64	8.90	5.73, 13.83
65+	15.76	9.90, 25.09
Female	1.55	1.28, 1.88
Restriction of activity	1.66	1.30, 2.13
Sprain or strain in the past 12 months	1.10	0.70, 1.72
Dislocation or broken bone in the past 12 months	1.62	0.98, 2.66
Other injury in the past 12 months	1.59	1.02, 2.46
Chronic stress index	1.26	1.00, 1.59

NPHS=National Population Health Survey
The hazard rate ratios were obtained from a discrete-time proportional hazards model adjusted for age, sex, baseline restriction of activity, injury in the past 12 months, and chronic stress index. Each traumatic event is assessed by a yes/no question. Reference categories are no trauma, age 18 to 24 years, male, no restriction of activity, and no injury in the past 12 months. The hazard ratio for chronic stress index is calculated for a change of 50 points, e.g., from 25 to 75 on the 0-100 index.

TABLE IV**Effects of Specific Childhood Traumatic Events and Confounding Variables on the Incidence of Arthritis/Rheumatism Among NPHS Respondents 18 Years of Age and Older**

Variable	Hazard Rate Ratio	95% Confidence Interval
Specific Types of Trauma		
Two or more weeks in hospital	1.33	1.05, 1.68
Parents abused drugs/alcohol	1.22	0.91, 1.62
Parents divorced	0.81	0.57, 1.16
Parents unemployed long time	0.90	0.67, 1.21
Physically abused	1.14	0.79, 1.66
Sent away from home	1.05	0.56, 1.99
Very scared	1.29	1.02, 1.62
Other Variables in the Model		
Age		
25-44	2.34	1.49, 3.65
45-64	7.97	5.15, 12.31
65+	13.90	8.83, 21.89
Female	1.53	1.26, 1.86
Restriction of activity	1.68	1.32, 2.13

NPHS=National Population Health Survey
The hazard rate ratios were obtained from a discrete-time proportional hazards model adjusted for age, sex, and baseline restriction of activity. Each traumatic event is assessed by a yes/no question. Reference categories are no trauma (for each type of trauma), age 18 to 24 years, male, and no restriction of activity.

methodology.²² Multivariable analyses were performed using a discrete-time proportional hazards model.²³ Under the assumption of constant hazards within each 2-year cycle, we fitted the complementary log-log transform of the probabili-

ty of incident arthritis as a linear function of the covariates using maximum likelihood methods for binary outcomes. The expected time of an event was assumed to be the mid point of the interval. This method facilitated the use of time-

dependent covariates, that is, an independent variable in the model having different values in different cycles. To adjust for confounding variables, we applied a method based on the magnitude of change in the coefficient of interest.²⁴ Variables were dropped one at a time, using the relative change in the coefficient for the effect of trauma as a criterion, until no single additional variable could be dropped without changing the relative risk by more than 5%.

RESULTS

In 1994/95, 14,117 people aged 18+ participated in the NPHS longitudinal panel (85% response rate). Non-respondents tended to be slightly younger and to have lower socio-economic status. At baseline, 2,044 reported arthritis/rheumatism and 615 reported activity limitations attributed to arthritis or other musculoskeletal problems. These subjects, plus those with missing values, were excluded from the cohort. Thus, the inception cohort consisted of 9,159 subjects free of arthritis. Demographic information for this cohort and the prevalence of childhood trauma at baseline are shown in Table I. About 25% of respondents reported one traumatic event in childhood and 21% reported two or more events.

The response rate was 98.4% in 1996/97 and 96.6% in 1998/99. Overall, 1,006 new cases of arthritis were reported during the four-year follow-up period. The incidence rate was 27.1 per 1,000 person-years, 21.4 among males and 33.0 among females (Table II). The incidence ranged from 5.4 per 1,000 person-years in the age group 18-24 to 84.9 per 1000 person-years in those 65 and older.

The effect of the number of traumatic events on the risk of arthritis was estimated in a model controlling for age, sex, restriction in activity, injury in the past 12 months, and chronic stress index. Persons reporting two or more traumatic events were more likely to develop arthritis than persons who did not experience any trauma (RR=1.27, 95% CI=0.99, 1.62), although the p-value was of borderline significance (Table III). The relative risk was 1.17 (95% CI = 0.92, 1.48) among those reporting only one traumatic event. In subgroup analyses, no significant interactions

were found between trauma and sex, socio-economic status, or baseline health (data not shown).

The relative risks associated with specific types of trauma were obtained from a model controlling for age, sex, and restrictions in activity (Table IV). Two types of trauma, prolonged hospitalization (RR=1.33, 95% CI=1.05, 1.68) and being very scared (RR=1.29, 95% CI=1.02, 1.62) showed independent, significant effects.

DISCUSSION

This is the first study to examine the role of adverse childhood experiences in the development of self-reported, medically diagnosed arthritis. The study shows a 27%, borderline significant increase in the risk for those reporting two or more traumatic events. The effect of trauma was not significantly different between males and females, and between groups defined by socio-economic status or baseline health.

Because the sample was large, the estimates of relative risk are precise. Unlike most previous studies, our analysis controlled for a large number of potential confounders including measures of stress and emotional function. Selection, reverse causality, and recall bias are unlikely, thanks to prospective design and high response rate. The results are generalizable to the Canadian household population.

Several limitations inherent in survey data should be considered when interpreting these results. Since new cases of arthritis were ascertained through self-report, some degree of misclassification would be expected. Also, errors in the reporting of traumatic experiences are a potential source of bias. Both types of errors are likely non-differential in a prospective study and would tend to reduce the relative risk.²⁵ Furthermore, arthritis can be considered a generic term encompassing a number of diseases. In a validation study linking the 1994/95 NPHS to provincial administrative data, we found that the most common ICD-coded diagnoses among persons reporting arthritis/rheumatism were "symptoms involving nervous and musculoskeletal systems", "osteoarthritis", "other and unspecified disorders of back", and "other disorders of synovium, tendon and bursa". If some of these condi-

Appendix

Description of potential confounding variables included in the analysis

Age was categorized into four groups: 18-24, 25-44, 45-64, 65+. Race was classified as white or other. Education was grouped into 3 levels: less than high school diploma, high school diploma with/without some trade school/college/university, diploma/certificate/degree from trade school/college/university. Income adequacy was a five-level variable derived by Statistics Canada from information on total household income and household size (lowest income, lower middle, middle, upper middle, highest income). Marital status was grouped into three categories: married/common law/partner, single, widowed/divorced/separated. We classified living arrangements into four types: living alone; living with others and no dependants; living with dependants and possibly others; other. To measure working status we used the following categories: currently working; not currently working but had a job in the past 12 months; did not work in the past 12 months. Weight was measured in kilograms and height was measured in centimetres. Alcohol consumption was categorized as none in the past 12 months; less than once per month; one to three times per month; one or more times per week. Smoking was a four-level derived variable: never smoked; former smoker; current occasional smoker; current daily smoker. The amount of gardening and yard work was based on the estimated number of minutes the person gardened or did yard work in the past 3 months: none; less than or equal to the median number of minutes; greater than the median number of minutes. The physical activity index (active, moderate, inactive) was a variable derived from detailed questions about participation in a variety of recreational activities. Daily activities in the past 3 months were assessed by a four-level question: usually sit and don't walk much; stand/walk lots during the day; usually lift/carry light loads; do heavy work or carry very heavy loads. Self-rated health was measured by a standard five-level question (poor, fair, good, very good, excellent) but the two lowest categories were combined. Restriction of activity flag was a yes/no variable based on questions about activity limitations at home, work, school, travel, and leisure. Injury in the past 12 months limiting normal activities was a four-category variable: none; sprain/strain; dislocation/fracture; and other. Hormone replacement therapy was a yes/no variable. Psychological measures were treated as continuous variables. Chronic stress index was composed of 15 true/false items measuring activity overload, financial difficulties, child-related stress, and problems with relationships in day-to-day encounters, and the score was adjusted for the number of questions applicable. Personal stress index consisted of 5 true/false items (trying to do too many things at once; too much is expected; too much pressure to be like other people; work at home not appreciated; people too critical). Recent life events index included questions about negative events in the past 12 months, such as physical abuse, unwanted pregnancy, abortion or miscarriage, major financial difficulties, and serious problems at work or in school. Finally, mental health distress score and depression scale were both based on a subset of items from the Composite International Diagnostic Interview.

tions are not associated with childhood trauma, the overall relative risk will be further reduced.

The analyses pertaining to specific types of trauma as well as subgroup comparisons should be regarded as exploratory. The study had relatively low power to detect small to moderate effects for rare types of trauma or small between-group differences. Sexual abuse was not assessed in the NPHS. Finally, multiple testing increases the possibility of chance findings.

Our results are plausible from an epidemiological point of view. Previous studies suggested an association between childhood trauma and fibromyalgia, chronic back pain, and other symptoms.¹⁰⁻¹⁸ Goldberg et al. examined the relationships between traumatic events in childhood, such as sexual and physical abuse, alcoholism, and drug addiction, and three types of chronic pain: facial pain, myofascial pain, and fibromyalgia.¹⁷ All pain groups had a history of abuse exceeding 48%, suggesting that childhood traumatic events are very common in these patients. In a study by McBeth et al., subjects with high tender point counts were substantially more likely to report adverse childhood experiences, including loss of parents and

abuse.¹⁰ Linton found an association between physical abuse in childhood and chronic back pain.^{15,16} The risk of common symptoms reported by women in a Swedish community survey was significantly related to childhood violence and abuse.¹⁸

There is emerging evidence that psychosocial factors affect the musculoskeletal system through hormonal pathways.⁹ Traumatic experiences may heighten the individual's responsiveness to adulthood stressors,²⁶ resulting in increased susceptibility to pain and other symptoms. Another possible mechanism involves changes in posture or muscle tone in response to repeated stress throughout the lifespan.⁹ Thus, childhood trauma may interact with other physical and psychosocial factors in precipitating biological changes and/or exacerbating the symptoms associated with pre-existing disease.

Our results are important from a public health perspective. No previous studies of arthritis incidence in Canada have been reported. Even though a relative risk of 1.27 associated with childhood trauma can be considered small to moderate by epidemiological standards, this estimate applies to a heterogeneous group of condi-

tions and may have been attenuated by measurement errors unavoidable in survey-based research. If the association is causal, about 6% of new cases of arthritis/rheumatism in Canada could be attributed to this exposure. Because arthritis is a very common and serious health problem, this implies a large number of cases and considerable economic impact. Furthermore, psychosocial determinants of health may be amenable to modification through social and health policies. This, however, will require the involvement of the education and social service sectors, in addition to health. Such a broad effort will not be possible until our knowledge base is sufficient to support evidence-based interventions. Development of this knowledge base has only begun and more studies, using a variety of methodological approaches, are needed.

In conclusion, our study shows that persons reporting multiple stressful events in childhood experience a moderate increase in the risk of developing arthritis or rheumatism later in life. Because of the paucity of previous research in this area and limitations of survey data, the results should be considered preliminary and need to be confirmed in future studies.

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RÉSUMÉ

Contexte : Des données récentes donnent à penser que des facteurs psychosociaux, en particulier les agents stressants durant l'enfance et à l'âge adulte, pourraient jouer un rôle important dans le fait d'être atteint de douleurs musculo-squelettiques chroniques et d'autres symptômes. Nous avons cherché à déterminer si les expériences traumatisantes durant l'enfance sont associées à un risque accru d'arthrite (selon les déclarations des intéressés) plus tard au cours de la vie.

Méthode : Nous avons utilisé les données longitudinales (N=9 159) des trois premiers cycles de l'Enquête nationale sur la santé de la population (ENSP) au Canada. Les nouveaux cas d'arthrite ont été répertoriés à l'aide d'un questionnaire administré par un intervieweur. Nous avons mesuré les traumatismes psychologiques vécus durant l'enfance ou l'adolescence au moyen d'un questionnaire en sept éléments, portant sur la violence physique, les expériences effrayantes, les hospitalisations, le fait d'avoir été envoyé hors de la maison et trois types de perturbations parentales. Les effets des traumatismes ont été examinés à l'aide d'un modèle multivariable des dangers proportionnels en temps discret.

Résultats : Établi selon les déclarations des intéressés, le taux d'arthrite était de 27,1 pour 1 000 personnes par année. Nous avons observé un risque relatif de 1,17 (IC de 95 % = 0,92-1,48) lorsqu'il n'y avait eu qu'un seul événement traumatisant, et de 1,27 (IC de 95 % = 0,99-1,62) lorsqu'il y en avait eu deux ou plus. Des effets indépendants ont été observés en ce qui a trait aux séjours prolongés à l'hôpital (HR [ratio de danger] = 1,33, IC de 95 % = 1,05-1,68) et aux grandes frayeurs (HR = 1,29, IC de 95 % = 1,02-1,62). Dans les analyses par sous-groupe, aucune interaction significative n'a été observée entre les traumatismes et le sexe, le statut socio-économique ou l'état de santé de référence.

Conclusions : Dans cette vaste étude prospective, nous avons constaté une hausse modérée du risque d'arthrite chez les personnes ayant vécu plusieurs expériences traumatisantes durant l'enfance.