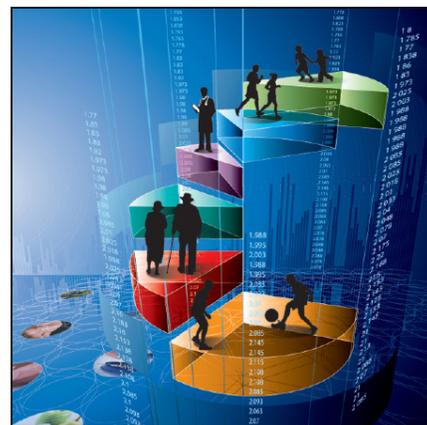


## Health Reports

# Housing and health among Inuit children

by Dafna E. Kohen, Evelyne Bougie and Anne Guèvremont

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- <sup>r</sup> revised
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# Housing and health among Inuit children

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## Abstract

**Background:** Housing conditions have been associated with child health. Inuit children are generally in poorer health than other Canadian children. They are also more likely to live in crowded households, in dwellings that need major repair, and to be exposed to second-hand smoke in the home.

**Data and methods:** This study uses the 2006 Aboriginal Children's Survey to examine associations between physical and psychosocial housing characteristics and physical and mental health outcomes of Inuit children aged 2 to 5.

**Results:** Physical and psychosocial housing characteristics were associated with selected indicators of Inuit children's health. The presence of a smoker in the home, homeownership, and parental housing satisfaction were associated with specific physical and/or mental health outcomes, even after adjusting for other housing factors and family and child sociodemographic characteristics.

**Interpretation:** Housing conditions were associated with the physical and mental health of young Inuit children, even when sociodemographic factors were taken into account. Homeownership and housing satisfaction appeared to be particularly important for young Inuit children's health.

**Keywords:** Affective symptoms, conduct disorder, environmental exposure, indoor air quality, respiratory conditions, tobacco smoke pollution

Inuit children are generally in poorer health than other children in Canada. This disparity has been associated with socioeconomic and household characteristics,<sup>1,2</sup> which include housing conditions.

The impact of the physical and psychosocial housing environment on children's health has long been recognized.<sup>3</sup> The physical environment involves safety issues (for example, fire hazards) and biological and chemical exposure (for example, to toxins such as tobacco smoke and mold). The psychosocial environment is related to feelings of security, control, and attachment such as home ownership and housing satisfaction.

Early childhood is particularly important for the study of associations between housing conditions and health. Young children spend much of their time indoors, and early exposures can have long-term health consequences.

According to the Canada Mortgage and Housing Corporation, "acceptable" housing should be *suitable* (not crowded), *adequate* (not in need of major repair), and *affordable* (cost less than 30% of before-tax household income).<sup>4</sup> According to results of the 2006 Census,<sup>5</sup> substantial numbers of Inuit lived in housing that did not meet one or more of these criteria.<sup>6,7</sup> For example, 31% lived in dwellings with more than one person per room, and 28% were in dwellings that needed major repair; the corresponding figures for non-Aboriginal people were 3% and 7%.

For young children, crowding and housing in need of repair have been related to conditions such as asthma, respiratory tract infections and influenza,<sup>8-16</sup> injuries,<sup>16,17</sup> and behaviour problems such as aggression, conflict, social withdrawal, psychological distress, poor school adjustment, and lower social competence.<sup>14,18-22</sup> Unaffordable housing has been associated with child behaviour problems.<sup>19,22</sup>

Environmental tobacco smoke has been linked to ear infections, respiratory infections, asthma, bronchitis, pneumonia, and influenza.<sup>9-11,15,23-27</sup> This is notable because the prevalence of daily smoking among Inuit is three times that of adults in Canada.<sup>28</sup> As a result, Inuit children are more likely than non-Aboriginal children to be exposed to second-hand smoke.<sup>29</sup>

Housing satisfaction has been related to better parental ratings of child health.<sup>1</sup> Finally, homeownership has been associated with fewer behaviour problems.<sup>30,31</sup>

However, many of the studies that reported associations between physical and psychosocial housing conditions and child health were based on small samples or on one community, focused on a single housing factor in relation to a single health outcome, or did not account for socioeconomic factors such as income and education. By contrast, the present study examines several physical and mental health outcomes in a population-based sample of Inuit children aged 2 to 5 in relation to a number of physical and psychosocial housing conditions, controlling for demographic and socioeconomic characteristics.

## Methods

### Data source

The data are from the 2006 Aboriginal Children's Survey (ACS), a national survey of Aboriginal children (First Nations off reserve, Métis, and Inuit) younger than age 6.<sup>32</sup> Because the frame for the ACS was obtained from the census roster, housing characteristics from the 2006 Census were included in the ACS dataset.

The study sample consisted of 1,233 children aged 2 to 5, who were identified by parents or guardians as Inuit (single

identity or in combination with another Aboriginal identity). Three-quarters of these children lived in Inuit Nunangat, the collective name for the aggregate of the four Inuit regions created through the signing of land claim agreements: 49% were in Nunavut; 20% in Nunavik; 3% in Nunatsiavut; and 4% in Inuvialuit. The remaining 24% lived outside Inuit Nunangat. For comparisons with non-Aboriginal children, data from the 2006 Census and the 2006/2007 National Longitudinal Survey of Children and Youth (NLSCY) were used.

### Physical housing characteristics

Three housing characteristics were derived from the 2006 Census. *Crowding* was defined as more than one person per room (results of analyses using a 1.5-person-per-room cut-off were similar and are available by request). *Dwelling in need of major repair* was based on the question: “Is this dwelling in need of any repairs? (no, regular maintenance, minor repairs, major repairs).” *Unaffordable housing* was defined as reported housing costs greater than 30% of before-tax household income.<sup>4</sup> From the ACS, regular exposure to smoke in the home was determined based on responses to the question: “Including both household members and regular visitors, does anyone smoke inside your home every day or almost every day (yes/no)?”

### Psychosocial housing characteristics

Two psychosocial housing characteristics were considered: homeownership and satisfaction with housing. *Homeownership* (“Is this dwelling owned by you or a member of this household, even if it is still being paid for?”) was derived from the 2006 Census. *Parental satisfaction with housing conditions* (“How would you rate your feelings about your housing conditions?: very satisfied, satisfied, dissatisfied, very dissatisfied”) was derived from the ACS.

The analysis accounted for five socioeconomic and demographic variables: parent’s/guardian’s highest level of edu-

cation, household income (adjusted for household size), area of residence (in or outside Inuit Nunangat), and child sex and age.

*Physical child health outcomes* were: parent-/guardian-rated child health status (excellent/very good versus good/fair/poor); two or more ear infections in past year; activity limitation (yes/no); two or more chronic conditions (yes/no); and chronic respiratory conditions (allergies, asthma, and/or bronchitis).

*Mental/Behavioural outcomes* were measured by four subscales (prosocial behaviour, hyperactivity-inattention, emotional symptoms, and conduct problems) from the Strengths and Difficulties Questionnaire (SDQ),<sup>33</sup> which has been validated for the ACS sample.<sup>34</sup>

### Analyses

Descriptive analyses of housing, socioeconomic and demographic characteristics were examined. Separate regression analyses were conducted for each child health outcome. Two models were constructed. Model 1 included the physical housing indicators. Model 2 added psychosocial housing, socioeconomic and demographic characteristics. (Results of a model incorporating psychosocial housing characteristics prior to inclusion of socioeconomic and demographic controls are available by request.) Multicollinearity among the predictors was assessed via correlations. Analyses were based on survey data weighted to be representative of the 2006 Census counts of children younger than age 6. The bootstrap method was used to account for the complex sampling design of the survey.

**Table 1**  
**Housing and selected sociodemographic characteristics, Inuit and non-Aboriginal children aged 2 to 5, Canada, 2006**

| Housing and sociodemographic characteristics    | %      | Inuit<br>95% confidence interval |        | Non-Aboriginal |
|-------------------------------------------------|--------|----------------------------------|--------|----------------|
|                                                 |        | from                             | to     | %              |
| <b>Physical housing characteristics</b>         |        |                                  |        |                |
| Crowded (more than 1 person per room)           | 36.3   | 33.9                             | 38.8   | 6.7            |
| Crowded (more than 1.5 people per room)         | 9.7    | 8.4                              | 11.2   | 1.6            |
| Needs major repair                              | 29.3   | 26.8                             | 31.9   | 7.7            |
| Regular smoker in home                          | 20.3   | 18.1                             | 22.7   | ...            |
| Housing costs more than 30% of household income | 9.4    | 7.3                              | 11.6   | 24.6           |
| <b>Psychosocial housing characteristics</b>     |        |                                  |        |                |
| Homeownership                                   | 24.2   | 21.5                             | 27.1   | 73.7           |
| Parent satisfied/very satisfied with housing    | 69.0   | 66.5                             | 71.5   | ...            |
| <b>Sociodemographic characteristics</b>         |        |                                  |        |                |
| Parent/Guardian not secondary school graduate   | 57.9   | 54.8                             | 60.8   | 7.0            |
| Mean household income (\$)                      | 65,850 | 63,333                           | 68,367 | 79,949         |
| Single-parent family                            | 24.8   | 22.3                             | 27.5   | 14.9           |
| Area of residence                               |        |                                  |        |                |
| Nunatsiavut                                     | 2.8    | 2.7                              | 3.0    | ...            |
| Nunavik                                         | 19.9   | 18.9                             | 20.9   | ...            |
| Nunavut                                         | 49.2   | 46.9                             | 51.4   | ...            |
| Inuvialuit                                      | 4.0    | 3.4                              | 4.7    | ...            |
| Outside Inuit Nunangat                          | 24.1   | 21.0                             | 27.4   | ...            |
| Child sex                                       |        |                                  |        |                |
| Male                                            | 51.0   | 48.1                             | 53.9   | ...            |
| Female                                          | 49.0   | 46.1                             | 51.9   | ...            |
| Mean age of child (years)                       | 4.0    | 4.0                              | 4.1    | ...            |

... not applicable

**Note:** All coefficients of variation for Aboriginal Children’s Survey were less than 16.6%.

**Sources:** 2006 Aboriginal Children’s Survey; 2006 Census of Population; 2006/2007 National Longitudinal Survey of Children and Youth.

## Results

Inuit children aged 2 to 5 were more likely than non-Aboriginal children to live in crowded conditions and in dwellings that needed major repair. Specifically, 36% of Inuit children were in households with more than one person per room, and 29% lived in structures that needed major repair (Table 1). The corresponding figures for non-Aboriginal children were much lower: 7% (crowded) and 8% (need major repair). As well, 20% of Inuit children were in homes where they were regularly exposed to smoke.

However, in 2006, 9% of Inuit children were in homes where housing costs amounted to more than 30% of household income, well below the comparable percentage for non-Aboriginal children: 25%.

One-quarter (24%) of Inuit children lived in a dwelling owned by a member of the household, compared with three-quarters (74%) of non-Aboriginal children. A majority—69%—of parents/guardians of Inuit children were satisfied or very satisfied with their housing conditions.

More than half (58%) of Inuit children had parents/guardians with less than secondary school graduation, compared with 7% of non-Aboriginal children. A quarter (25%) of Inuit children were in single-parent families, versus 15% of non-Aboriginal children.

Descriptive analyses of housing characteristics by Inuit region are available in Appendix Table A.

### Physical housing characteristics

Compared with Inuit children in dwellings that were not crowded, those in crowded households had lower odds of being rated in excellent/very good health, higher odds of at least two ear infections in the past year, and higher emotional symptoms and conduct problem scores (Model 1 in Tables 2 and 3). Housing in need of major repair was associated with lower odds of excellent/very good health. Children in unaffordable housing had higher odds of two or more chronic conditions and chronic respiratory conditions. Regular exposure to smoke in the home was associated with conduct problems.

**Table 2**

**Odds ratios relating housing and sociodemographic characteristics to physical health outcomes, Inuit children aged 2 to 5, 2006**

| Physical health outcomes/Housing and sociodemographic characteristics | Model 1    |         | Model 2    |         |
|-----------------------------------------------------------------------|------------|---------|------------|---------|
|                                                                       | Odds ratio | p-value | Odds ratio | p-value |
| <b>Parent-rated child health excellent/very good</b>                  |            |         |            |         |
| Crowded                                                               | 0.58*      | 0.000   | 0.90       | 0.459   |
| Needs major repair                                                    | 0.72*      | 0.010   | 0.84       | 0.247   |
| Unaffordable                                                          | 1.00       | 0.991   | 0.93       | 0.827   |
| Regular smoker in home                                                | 1.18       | 0.304   | 1.48*      | 0.021   |
| Homeownership                                                         | ...        | ...     | 1.57*      | 0.041   |
| Parent satisfied with housing                                         | ...        | ...     | 1.42*      | 0.017   |
| Male                                                                  | ...        | ...     | 0.81       | 0.133   |
| Child age (months, divided by 12)                                     | ...        | ...     | 0.97       | 0.610   |
| Adjusted household income (in \$10,000s)                              | ...        | ...     | 1.04       | 0.352   |
| Parent/Guardian not secondary school graduate                         | ...        | ...     | 0.45*      | 0.000   |
| Single-parent family                                                  | ...        | ...     | 0.78       | 0.116   |
| Lives in Inuit Nunangat                                               | ...        | ...     | 0.60*      | 0.050   |
| <b>Two or more ear infections or otitis in past year</b>              |            |         |            |         |
| Crowded                                                               | 1.43*      | 0.013   | 1.11       | 0.500   |
| Needs major repair                                                    | 1.01       | 0.955   | 0.96       | 0.790   |
| Unaffordable                                                          | 1.32       | 0.410   | 1.63       | 0.186   |
| Regular smoker in home                                                | 0.93       | 0.673   | 0.94       | 0.704   |
| Homeownership                                                         | ...        | ...     | 0.88       | 0.584   |
| Parent satisfied with housing                                         | ...        | ...     | 0.72*      | 0.042   |
| Male                                                                  | ...        | ...     | 1.23       | 0.193   |
| Child age (months, divided by 12)                                     | ...        | ...     | 0.85*      | 0.009   |
| Adjusted household income (in \$10,000s)                              | ...        | ...     | 0.95       | 0.233   |
| Parent/Guardian not secondary school graduate                         | ...        | ...     | 0.71*      | 0.042   |
| Single-parent family                                                  | ...        | ...     | 0.94       | 0.742   |
| Lives in Inuit Nunangat                                               | ...        | ...     | 2.35*      | 0.001   |
| <b>Two or more chronic conditions</b>                                 |            |         |            |         |
| Crowded                                                               | 0.71       | 0.064   | 0.65*      | 0.029   |
| Needs major repair                                                    | 1.39       | 0.104   | 1.19       | 0.409   |
| Unaffordable                                                          | 2.42*      | 0.004   | 1.66       | 0.145   |
| Regular smoker in home                                                | 0.91       | 0.689   | 0.83       | 0.428   |
| Homeownership                                                         | ...        | ...     | 0.72       | 0.215   |
| Parent satisfied with housing                                         | ...        | ...     | 0.46*      | 0.000   |
| Male                                                                  | ...        | ...     | 0.75       | 0.105   |
| Child age (months, divided by 12)                                     | ...        | ...     | 1.05       | 0.505   |
| Adjusted household income (in \$10,000s)                              | ...        | ...     | 0.94       | 0.234   |
| Parent/Guardian not secondary school graduate                         | ...        | ...     | 0.93       | 0.727   |
| Single-parent family                                                  | ...        | ...     | 1.33       | 0.172   |
| Lives in Inuit Nunangat                                               | ...        | ...     | 0.65       | 0.122   |
| <b>Chronic respiratory allergies, asthma or bronchitis</b>            |            |         |            |         |
| Crowded                                                               | 0.70       | 0.085   | 0.76       | 0.223   |
| Needs major repair                                                    | 0.92       | 0.721   | 0.76       | 0.298   |
| Unaffordable                                                          | 2.35*      | 0.010   | 1.90       | 0.091   |
| Regular smoker in home                                                | 1.09       | 0.692   | 1.08       | 0.767   |
| Homeownership                                                         | ...        | ...     | 0.87       | 0.640   |
| Parent satisfied with housing                                         | ...        | ...     | 0.62*      | 0.040   |
| Male                                                                  | ...        | ...     | 1.00       | 1.000   |
| Child age (months, divided by 12)                                     | ...        | ...     | 0.93       | 0.475   |
| Adjusted household income (in \$10,000s)                              | ...        | ...     | 0.99       | 0.885   |
| Parent/Guardian not secondary school graduate                         | ...        | ...     | 0.97       | 0.892   |
| Single-parent family                                                  | ...        | ...     | 1.41       | 0.168   |
| Lives in Inuit Nunangat                                               | ...        | ...     | 0.54*      | 0.026   |

... not applicable

\* p < 0.05

Source: 2006 Aboriginal Children's Survey.

For physical activity limitations and serious injury in the past year, no housing characteristic demonstrated significant

associations, so results are not presented in Table 2, but are available by request.

## Psychosocial housing characteristics

When psychosocial housing, socioeconomic and demographic factors were taken into account (Model 2 in Tables 2 and 3), many of the relationships

between physical housing conditions and the health of Inuit children disappeared. Associations between crowding and excellent/very good health, ear infections, emotional symptoms, and conduct problems were no longer significant. In

fact, a significant *negative* association between crowding and chronic conditions emerged—crowding was associated with lower odds of having two or more chronic conditions.

The association between housing in need of repair and parental ratings of child health was not statistically significant in the full model. As well, a significant *negative* association with emotional symptoms was apparent—children in dwellings that needed major repair tended to have lower emotional symptoms scores.

In the full model, regular exposure to smoke in the home remained significantly associated with conduct problems. Unexpectedly, regular exposure to smoke was associated with higher odds of a child being rated in excellent/very good health.

Homeownership was associated with higher odds of excellent/very good health and lower scores of emotional symptoms and conduct problems.

Parental satisfaction with housing was associated with higher odds of excellent/very good health; lower odds of ear infections, chronic conditions, and respiratory conditions; and lower inattention-hyperactivity and emotional symptoms scores. However, additional analyses showed that parental housing satisfaction was closely tied to physical housing conditions (less crowding, not in need of major repair) and homeownership (Table 4).

## Discussion

This study reveals associations between physical and psychosocial aspects of housing and Inuit children's health. Consistent with the literature,<sup>6,7,35</sup> ACS data showed the housing situation of Inuit children to be less favourable than that of non-Aboriginal children in Canada. When crowding, need for repair, and housing affordability were considered alone, the analysis suggested that they were associated with negative physical and mental health outcomes for Inuit children.

Unaffordable housing may have an indirect link to child health, in that shelter costs may reduce resources available for health care, adequate nutrition, and home safety.<sup>19,22</sup> As well, chronic financial

**Table 3**  
**Regressions relating housing and sociodemographic characteristics to mental health outcomes, Inuit children aged 2 to 5, 2006**

| Mental health outcomes/Housing and sociodemographic characteristics | Model 1            |         | Model 2            |         |
|---------------------------------------------------------------------|--------------------|---------|--------------------|---------|
|                                                                     | Parameter estimate | p-value | Parameter estimate | p-value |
| <b>Prosocial behaviour</b>                                          |                    |         |                    |         |
| Crowded                                                             | -0.02              | 0.328   | -0.01              | 0.735   |
| Needs major repair                                                  | 0.00               | 0.940   | -0.01              | 0.526   |
| Unaffordable                                                        | 0.02               | 0.539   | 0.02               | 0.552   |
| Regular smoker in home                                              | -0.02              | 0.292   | -0.04              | 0.065   |
| Homeownership                                                       | ...                | ...     | -0.01              | 0.766   |
| Parent satisfied with housing                                       | ...                | ...     | -0.03              | 0.109   |
| Male                                                                | ...                | ...     | -0.06*             | 0.003   |
| Child age (months, divided by 12)                                   | ...                | ...     | 0.04*              | 0.000   |
| Adjusted household income (in \$10,000s)                            | ...                | ...     | 0.01               | 0.173   |
| Parent/Guardian not secondary school graduate                       | ...                | ...     | 0.01               | 0.521   |
| Single-parent family                                                | ...                | ...     | -0.01              | 0.648   |
| Lives in Inuit Nunangat                                             | ...                | ...     | -0.02              | 0.496   |
| <b>Inattention-hyperactivity</b>                                    |                    |         |                    |         |
| Crowded                                                             | 0.04               | 0.257   | 0.01               | 0.764   |
| Needs major repair                                                  | -0.02              | 0.576   | -0.05              | 0.224   |
| Unaffordable                                                        | -0.07              | 0.390   | -0.08              | 0.301   |
| Regular smoker in home                                              | 0.08               | 0.057   | 0.06               | 0.135   |
| Homeownership                                                       | ...                | ...     | -0.05              | 0.293   |
| Parent satisfied with housing                                       | ...                | ...     | -0.09*             | 0.016   |
| Male                                                                | ...                | ...     | 0.12*              | 0.001   |
| Child age (months, divided by 12)                                   | ...                | ...     | -0.03              | 0.118   |
| Adjusted household income (in \$10,000s)                            | ...                | ...     | -0.02*             | 0.016   |
| Parent/Guardian not secondary school graduate                       | ...                | ...     | -0.04              | 0.298   |
| Single-parent family                                                | ...                | ...     | 0.03               | 0.505   |
| Lives in Inuit Nunangat                                             | ...                | ...     | 0.01               | 0.907   |
| <b>Emotional symptoms</b>                                           |                    |         |                    |         |
| Crowded                                                             | 0.04*              | 0.038   | -0.01              | 0.658   |
| Needs major repair                                                  | -0.02              | 0.303   | -0.05*             | 0.020   |
| Unaffordable                                                        | 0.02               | 0.705   | -0.03              | 0.469   |
| Regular smoker in home                                              | 0.01               | 0.627   | -0.02              | 0.402   |
| Homeownership                                                       | ...                | ...     | -0.07*             | 0.002   |
| Parent satisfied with housing                                       | ...                | ...     | -0.08*             | 0.000   |
| Male                                                                | ...                | ...     | -0.05*             | 0.006   |
| Child age (months, divided by 12)                                   | ...                | ...     | 0.01               | 0.188   |
| Adjusted household income (in \$10,000s)                            | ...                | ...     | -0.02*             | 0.000   |
| Parent/Guardian not secondary school graduate                       | ...                | ...     | 0.02               | 0.452   |
| Single-parent family                                                | ...                | ...     | 0.06*              | 0.012   |
| Lives in Inuit Nunangat                                             | ...                | ...     | 0.04               | 0.134   |
| <b>Conduct problems</b>                                             |                    |         |                    |         |
| Crowded                                                             | 0.06*              | 0.049   | 0.02               | 0.513   |
| Needs major repair                                                  | 0.00               | 0.923   | -0.00              | 0.894   |
| Unaffordable                                                        | -0.02              | 0.684   | 0.01               | 0.882   |
| Regular smoker in home                                              | 0.10*              | 0.014   | 0.09*              | 0.026   |
| Homeownership                                                       | ...                | ...     | -0.08*             | 0.031   |
| Parent satisfied with housing                                       | ...                | ...     | -0.05              | 0.123   |
| Male                                                                | ...                | ...     | 0.06*              | 0.027   |
| Child age (months, divided by 12)                                   | ...                | ...     | -0.03*             | 0.043   |
| Adjusted household income (in \$10,000s)                            | ...                | ...     | -0.01              | 0.166   |
| Parent/Guardian not secondary school graduate                       | ...                | ...     | -0.10*             | 0.003   |
| Single-parent family                                                | ...                | ...     | 0.09*              | 0.012   |
| Lives in Inuit Nunangat                                             | ...                | ...     | 0.14*              | 0.000   |

... not applicable

\* p < 0.05

Source: 2006 Aboriginal Children's Survey.

pressure may affect parenting behaviours and parental stress, and ultimately, influence child outcomes.<sup>19,22,36</sup> In fact, when the psychosocial housing, socioeconomic, and demographic factors were taken into account, associations between affordability and chronic conditions were no longer significant.

Similarly, when homeownership and housing satisfaction were considered, crowding was no longer significantly associated with less favourable health ratings, ear infections, and emotional and conduct problems; and housing in need of major repair was no longer associated with less favourable health ratings.

Relationships between parental housing satisfaction and health conditions persisted over and above socioeconomic and demographic characteristics. Parental housing satisfaction was related to higher odds of excellent/very good health and lower odds of ear infections and respiratory conditions. Homeownership remained significantly associated with positive health ratings.

The lower odds of chronic conditions among children in crowded households could indicate limited access to health care services,<sup>35</sup> and therefore, undiagnosed disease,<sup>23</sup> in northern areas where crowding is most prevalent. However,

the pattern was similar outside Inuit Nunangat (results not shown). More nuanced definitions of concepts might assist in the interpretation of these findings. For instance, a multi-generational household might be described as “crowded,” but such living arrangements can offer advantages.<sup>37,38</sup>

The relatively low rate of exposure to indoor smoke (given the prevalence of daily smoking) in this study is similar to results of other research<sup>39</sup> and may indicate successful education and prevention programs.<sup>40,41</sup> Moreover, regular exposure to indoor smoke was linked to favourable ratings of child health. Although unexpected, such findings have been reported previously.<sup>10,39</sup> Kovesi et al.<sup>10</sup> attributed the absence of associations between indoor smoking and respiratory tract infections among Inuit children to a lack of variability in smoking behaviour, since smokers were present in most homes. Egeland et al.<sup>39</sup> suggested that despite the high prevalence of smoking among Inuit, public health messages aimed at reducing indoor smoking may have resulted in less exposure, and thus, fewer links with child health. Indeed, the ACS specifically asked about *indoor* smoking. It is also possible that diagnosis of respiratory problems is less common among Inuit, and so may have been underreported. Nonetheless, for children exposed to smoke indoors, an association with conduct problems remained statistically significant even when the psychosocial housing and sociodemographic factors were taken into account.

In the full model, homeownership and housing satisfaction were important for both the physical and mental health of Inuit children. However, as in other studies,<sup>42,43</sup> housing satisfaction was linked to physical housing conditions. Consequently, the condition of housing may indirectly influence child health through associations with psychosocial factors.

Consistent with earlier research,<sup>44</sup> the positive effects of homeownership remained for parent-rated child health, emotional symptoms, and conduct problems. Homeownership, in turn, was

### *What is already known on this subject?*

- Inuit children are generally in poorer health than other children in Canada.
- Housing conditions are associated with children's physical and mental health.
- Inuit are more likely than other people in Canada to live in crowded conditions and in dwellings that need major repair.
- The prevalence of daily smoking is higher among Inuit than among other people in Canada.

### *What does this study add?*

- Housing conditions were related to the physical and mental health of Inuit children aged 2 to 5.
- Crowding, housing in need of major repair, and unaffordable housing were no longer associated with Inuit child health when psychosocial housing factors and demographic and socioeconomic characteristics were taken into account.
- Exposure to smoke in the home, homeownership, and parental housing satisfaction were associated with Inuit child health, even when the other factors were considered.

**Table 4**  
**Odds ratios relating housing and sociodemographic characteristics to parental satisfaction with housing, Inuit children aged 2 to 5, 2006**

| Housing and sociodemographic characteristics  | Odds ratio | p-value |
|-----------------------------------------------|------------|---------|
| <b>Housing characteristics</b>                |            |         |
| Crowded                                       | 0.67*      | 0.003   |
| Needs major repair                            | 0.44*      | 0.000   |
| Unaffordable                                  | 0.81       | 0.474   |
| Regular smoker in home                        | 0.77       | 0.094   |
| Homeownership                                 | 1.81*      | 0.002   |
| <b>Sociodemographic characteristics</b>       |            |         |
| Adjusted household income (in \$10,000s)      | 1.04       | 0.364   |
| Parent/Guardian not secondary school graduate | 0.73       | 0.065   |
| Single-parent family                          | 0.87       | 0.362   |
| Lives in Inuit Nunangat                       | 0.31*      | 0.000   |

\* p < 0.05

Source: 2006 Aboriginal Children's Survey.

related to housing quality—homeowners were less likely than tenants to live in crowded conditions or in dwellings that needed major repair (data not shown). Homeownership has also been associated with higher-quality, stimulating, and safe environments, more parental supervision, parental self-esteem, emotional support in the home,<sup>31,42</sup> community investments, and geographic and school stability.<sup>42</sup> These factors could contribute to associations between homeownership and positive child outcomes.

## Limitations

The results of this analysis should be interpreted in the context of several limitations. The associations between housing characteristics and reported child outcomes are correlational; causality cannot be inferred. Data from the 2006 Aboriginal Children's Survey reflect conditions 10 years ago and not necessarily the most recent housing and sociodemographic conditions.

The limitations also include shared method variance—variance attributable to the measurement method (the survey) rather than to the constructs (housing conditions) the measures are assumed to represent. This is a concern when self-reported data are collected at the same time from the same participants, particularly when the variables are perceptual measures. For this analysis, all child outcomes were based on parental reports. However, three of the physical

housing characteristics (crowding, affordability, need for repair) were from the Census, and the others were from the Aboriginal Children's Survey. All were self-reported, but not at the same time or necessarily by the same person. Although this does not rule out the possibility of reporting bias or other confounding influences, correlations of housing characteristics, socioeconomic characteristics, and child outcomes were low to moderate.

The findings warrant replication and point to the need for longitudinal data to examine associations over time and for objective data such as direct measures of indoor air quality to be considered.

## Conclusions

This study reveals associations between physical and psychosocial housing characteristics and Inuit children's health outcomes. Future research would benefit

from an understanding of the processes through which housing conditions affect child health. For example, do satisfaction and homeownership affect children via their associations with parental mental health, parental stress, and/or parenting behaviours?<sup>45</sup> Inclusion of additional measures, such as objective assessments of housing conditions and standardized or non-parent reported outcomes for children, would benefit future analyses. ■

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## References

- Findlay LC, Janz TA. The health of Inuit children under age 6 in Canada. *The International Journal of Circumpolar Health* 2012; 71: 18580.
- Guevremont A, Kohen D. *Inuit Children's Health: A Report Using the 2001 Aboriginal Peoples Survey (Children and Youth Component)* Ottawa: Statistics Canada, 2007.
- World Health Organization. *Environmental Burden of Disease Associated with Inadequate Housing*. Copenhagen: World Health Organization, 2011.
- Canada Mortgage and Housing Corporation. *2006 Census Housing Series: Issue 9 – Inuit Households in Canada*. Ottawa: Canada Mortgage and Housing Corporation, 2010.
- Statistics Canada. *Aboriginal Peoples in Canada in 2006: Inuit, Métis and First Nations, 2006 Census (Catalogue 95-588-XIE2006001)* Ottawa: Statistics Canada, 2008.
- Tester F. Iglutaasaavut (Our new homes): Neither "New" nor "Ours" housing challenges of the Nunavut Territorial Government. *Journal of Canadian Studies* 2009; 43(2): 137-58.
- Belanger YD, Head W, Awosoga O. Housing and Aboriginal people in urban centres: A quantitative evaluation. *Aboriginal Policy Studies* 2012; 2(1): 4-25.
- Emond GM, Howat P, Evans JA, Hunt L. The effects of housing on the health of preterm infants. *Paediatric and Perinatal Epidemiology* 1997; 11: 228-39.
- Vadheim CM, Greenberg DP, Bordenave N, et al. Risk factors for invasive *Haemophilus influenzae* Type b in Los Angeles County children 18-60 months of age. *American Journal of Epidemiology* 1992; 136(2): 221-35.
- Kovesi T, Gilbert NL, Stocco C, et al. Indoor air quality and the risk of lower respiratory tract infections in young Canadian Inuit children. *Canadian Medical Association Journal* 2007; 177(2): 155-60.
- Koch A, Molbak K, Homoe P, et al. Risk factors for acute respiratory tract infections in young Greenlandic children. *American Journal of Epidemiology* 2003; 158(4): 374-84.
- Banerji A, Bell A, Mills EL, et al. Lower respiratory tract infections in Inuit infants on Baffin Island. *Canadian Medical Association Journal* 2001; 164(13): 1847-50.
- Bulkow LR, Singleton RJ, Karron RA, et al. Risk factors for severe respiratory syncytial virus infection among Alaska Native children. *Pediatrics* 2002; 109(2): 210-6.
- Sharfstein J, Sandel M, Kahn R, Bauchner H. Is child health at risk while families wait for housing vouchers? *American Journal of Public Health* 2001; 91(8): 1191-3.
- Gao Z, Rowe B, Majaesic C, et al. Prevalence of asthma and risk factors for asthma-like symptoms in Aboriginal children in the northern territories of Canada. *Canadian Respiratory Journal* 2008; 15(3): 139-45.
- Shenassa ED, Stubbendick A, Brown MJ. Social disparities in housing and related pediatric injury: A multilevel study. *American Journal of Public Health* 2004; 94(4): 633-9.
- Delgado J, Ramirez-Cardich ME, Gilman RH, et al. Risk factors for burns in children: crowding, poverty, and poor maternal education. *Injury Prevention* 2002; 8(1): 38-41.
- Evans GW, Saltzman H, Cooperman JL. Housing quality and children's socioemotional health. *Environment and Behavior* 2001; 33: 389-99.
- Moloughney B. *Housing and Population Health – The State of Current Research Knowledge*. Ottawa: Canadian Institute for Health Information, 2004.
- Canada Mortgage and Housing Corporation. *Housing Quality and Children's Socioemotional Health. Research Highlights*. Ottawa: Canada Mortgage and Housing Corporation, 2003.
- Evans GW. Child development and the physical environment. *Annual Review of Psychology* 2006; 57: 401-24.

22. Hwang S, Fuller-Thomson E, Hulchanski JD, et al. *Housing and Population Health: A Review of Literature*. Ottawa: Canada Mortgage and Housing Corporation, 1999.

23. Kovesi TA, Cao Z, Osborne O, Egeland GM. Severe early lower respiratory tract infection is associated with subsequent respiratory morbidity in preschool Inuit children in Nunavut, Canada. *Journal of Asthma* 2011; 48: 241-7.

24. Bowd AD. Otitis media: health and social consequences for aboriginal youth in Canada's north. *International Journal of Circumpolar Health* 2005; 64(1): 5-15.

25. Gessner BD, Ussery XT, Parkinson AJ, Breiman RF. Risk factors for invasive disease caused by *Streptococcus pneumoniae* among Alaska native children younger than two years of age. *The Pediatric Infectious Diseases Journal* 1995; 14(2): 123-8.

26. Li JS, Peat JK, Xuan W, Berry G. Meta-analysis on the association between environmental tobacco smoke (ETS) exposure and the prevalence of lower respiratory tract infection in early childhood. *Pediatric Pulmonology* 1999; 27: 5-13.

27. Lindfors A, Wickman M, Hedlin G, et al. Indoor environmental risk factors in young asthmatics: a case-control study. *Archives of Disease in Childhood* 1995; 73: 408-12.

28. Tait H. *Aboriginal Peoples Survey, 2006: Inuit Health and Social Conditions*. Ottawa: Statistics Canada, 2008.

29. Gionet L, Roshanafshar S. Select health indicators of First Nations people living off reserve, Métis and Inuit. *Health at a Glance* (Catalogue 82-624-X) Ottawa: Statistics Canada, 2013.

30. Boyle MH. Home ownership and the emotional and behavioral problems of children and youth. *Child Development* 2002; 73(3): 883-92.

31. Haurin DR, Parcel TL, Haurin RJ. Does homeownership affect child outcomes? *Real Estate Economics* 2002; 30(4): 632-66.

32. Statistics Canada. Family, community and child care. *Aboriginal Children's Survey, 2006* (Catalogue 89-634-X) Ottawa: Statistics Canada, 2008.

33. Goodman R. The strengths and difficulties questionnaire: A research note. *Journal of Child Psychology and Psychiatry* 1997; 38 (5): 581-6.

34. Oliver L, Findlay L, McIntosh C, Kohen D. Evaluation of the Strengths and Difficulties Questionnaire. *Aboriginal Children's Survey, 2006* (Catalogue 89-634-X) Ottawa: Statistics Canada, 2006.

35. O'Donnell, V. Selected findings of the Aboriginal Children's Survey 2006: Family and community. *Canadian Social Trends* (Statistics Canada, Catalogue 11-008) 2008; 86: 65-72.

36. Kohen D, Leventhal T, Dahinten VS, McIntosh CN. Neighborhood disadvantage: Pathways of effects for young children. *Child Development* 2008; 79(1): 156-69.

37. Daniewicz SC. When parents can't live alone. *Journal of Gerontological Social Work* 1995; 23 (3-4): 47-64.

38. Che-Alford J, Hamm B. Under one roof: Three generations living together. *Canadian Social Trends* (Statistics Canada, Catalogue 11-008) 1999; Summer: 6-9.

39. Egeland GM, Faraj N, Osborne G. Cultural, socioeconomic, and health indicators among Inuit preschoolers: Nunavut Inuit Child Health Survey, 2007-2008. *Rural Remote Health* 2010; 10(2): 1365.

40. Department of Health and Social Services. *Nunavut Tobacco Reduction Framework for Action 2011-2016*. Iqaluit: Government of Nunavut (no date).

41. Pauktuutit Inuit Women of Canada. *Client's Handbook to Reduce Second Hand Smoke*. Ottawa: Pauktuutit Inuit Women of Canada, 2012.

42. Rohe WM, Zandt SV, McCarthy G. Home ownership and access to opportunity. *Housing Studies* 2002; 17(1): 51-61.

43. Elsinga, M. and Hoekstra, J. Homeownership and housing satisfaction. *Journal of Housing and the Built Environment* 2005; 11: 228-39.

44. MacIntyre S, Ellaway A, Der G, et al. Do housing tenure and car access predict health because they are simply markers of income or self esteem? A Scottish study. *Journal of Epidemiology and Community Health* 1998; 52(10): 657-64.

45. Evans GW, Wells HM, Moch A. Housing and mental health: a review of the evidence and a methodological and conceptual critique. *Journal of Social Issues* 2003; 59(3): 475-500.

## Appendix

**Table A**  
**Housing and selected sociodemographic characteristics, by region, Inuit children aged 2 to 5, Canada, 2006**

| Housing and sociodemographic characteristics    | Inuit Nunangat    |                      |                   |                   |                     | Outside Inuit Nunangat |
|-------------------------------------------------|-------------------|----------------------|-------------------|-------------------|---------------------|------------------------|
|                                                 | Total (N = 1,074) | Nunatsiavut (N = 91) | Nunavik (N = 390) | Nunavut (N = 502) | Inuvialuit (N = 91) | Nunangat (N = 159)     |
| <b>Physical housing characteristics</b>         |                   |                      |                   |                   |                     |                        |
| Crowded (more than 1 person per room)           | 45.3              | 16.4*                | 58.1*             | 42.9              | 32.2*               | 8.0 <sup>FE</sup>      |
| Crowded (more than 1.5 people per room)         | 12.6              | 3.4 <sup>E*</sup>    | 19.8*             | 10.8              | 5.5 <sup>E*</sup>   | F                      |
| Needs major repair                              | 32.4              | 35.5*                | 45.0*             | 27.2              | 31.5                | 19.5 <sup>FE</sup>     |
| Regular smoker in home                          | 22.7              | 27.6*                | 25.2*             | 20.5              | 34.6*               | 12.5 <sup>FE</sup>     |
| Housing costs more than 30% of household income | 4.4               | F                    | 0*                | 5.7               | 13.3 <sup>E*</sup>  | 25.4*                  |
| <b>Psychosocial housing characteristics</b>     |                   |                      |                   |                   |                     |                        |
| Homeownership                                   | 18.0              | 42.8*                | 2.4 <sup>E*</sup> | 21.4              | 35.6*               | 43.8*                  |
| Parent satisfied/very satisfied with housing    | 62.3              | 68.7                 | 55.2*             | 64.3              | 67.9                | 89.6                   |
| <b>Sociodemographic characteristics</b>         |                   |                      |                   |                   |                     |                        |
| Parent/Guardian not secondary school graduate   | 67.4              | 32.6                 | 66.6              | 70.3              | 60.3                | 28.4                   |
| Mean household income (\$)                      | 67,112            | 56,547*              | 81,061*           | 62,214            | 65,463              | 61,854                 |
| Single-parent family                            | 23.9              | 22.5                 | 29.8              | 21.1              | 29.8                | 27.7                   |

\* significantly different from Nunavut (p < 0.05)

<sup>E</sup> use with caution

F too unreliable to be published

Source: 2006 Aboriginal Children's Survey.