Personal and family predictors of children's medically attended injuries that occurred in the home

Joshua A Mott

Abstract

Objective—This study examined the independent contributions of demographic, behavioral, and environmental antecedents of pediatric medically attended injuries that occurred in the home.

Setting—Two thousand and thirty six American children aged 4–12 in 1988 were drawn from the National Longitudinal Survey of Youth.

Method—Multiple logistic regression was used to examine whether having a medically attended injury that occurred in the home in 1990 was related to environmental, behavioral, and demographic indicators measured in 1988. To account for individual differences in access to care, results were stratified within samples of children that had, and had not, demonstrated a prior ability to access the medical care system for injury treatment. **Results**—Among children who *did not* access the medical care system for injury treatment in 1988, measures of home environmental risk factors did not distinguish those injured at home from those not injured at home in 1990. However, among children who *did* access the medical care system for injury treatment in 1988, indicators of “dark” (relative risk 4.68, $p=0.019$) and “cluttered” (relative risk 4.31, $p=0.038$) home environments became significantly and independently associated with home injuries in 1990.

Conclusion—If not accounted for in data collection or analyses, individual differences in non-financial barriers to medical care may lead to an underestimation of the influences of important home environmental risk factors for medically attended injuries.

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Keywords: home injuries; medically attended injuries; access to care

Injuries in the home account for over 25% of all fatal injuries and over half of all medically attended injuries to children under 15 years of age in the United States.^{1,2} Despite the considerable impact of this problem on public health, the limited availability of home environmental measures for large samples of children,^{3–7} and a lack of controls for appropriately measuring individual differences in financial and non-financial access to medical care,^{8–11} has limited our understanding of important antecedents of

pediatric home injuries. This research addresses these issues using a national longitudinal sample of children.

Existing empirical work on children's injuries provides more insight into the determinants of all injuries than it does those specifically occurring in the home. Generally, an increased risk of injury in children has been associated with broad, and essentially impossible to change, demographic indicators such as gender and age,^{2,3,5,6,10–18} the absence of both parents in the home,^{2,3,5,7,9,13,17–20} higher birth order,^{2,10,13,14,21} lower social class,^{20,22} lower maternal education,^{23,24} and poor maternal health.^{7,13,20,25,26} Other research stemming from earlier work on childhood injury “proneness” has indicated that children with behavioral predispositions toward aggressiveness, impulsivity, hyperactivity, and headstrong behavior^{21,27–35} are also more likely than others to be injured.

The physical characteristics of the home environment have long been considered important risk factors for childhood injuries as well. Dark homes, broken stairways, and cluttered or hazardous home environments have been linked to an increased risk of injury in children.^{7,13,36} However, these physical attributes of the home have not commonly been operationalized in large national samples because of a lack of available data.^{3,4}

Our understanding of the risk factors for home injuries may also be confounded by individual differences in accessing medical care.^{8–11} While factors such as run down homes,^{7,13,36} home crowding,^{2,10,13,14,21} a lack of monitoring or attention,^{2,7,10,13,14,21,37} and single parenting^{2,3,5,7,9,13,17–20} can theoretically be related to an increased risk of injuries in children, these factors may also characterize families whom may be less likely to seek medical attention for an injury because of a lack of insurance coverage, or perhaps as importantly, for non-financial reasons.^{38–42} This non-financial component of access is less easily operationalized in injury analyses, and may include language barriers, a distrust of the medical system, provider shortages, legal restrictions, transportation difficulties, or the availability of child care. As large sample injury research has typically involved analyses of only those injuries that were severe enough to require medical attention, such differences in access to medical care could produce a mis-estimation of important home environmental and demographic risk factors for injury.⁴²

Health Policy and Research Centers, University of Illinois at Chicago

Correspondence to:
Dr Joshua Mott, c/o Dr Frank Mott, Center for Human Resources, Ohio State, 921 Chatham Lane, Suite 200, Columbus, OH 43221-2418, USA.

To address these issues, this research assesses the independent associations between home environmental, behavioral, and socio-demographic risk factors, and children's medically attended injuries that occurred in the home. Results are stratified between samples of children who have, and have not, previously accessed the medical care system for injury treatment.

Methods

Funded primarily by the US Department of Labor, the National Longitudinal Survey of Youth (NLSY) includes a sample of 12 686 young men and women who were between the ages of 14 and 22 in 1979. Ninety one per cent of the still eligible respondents were being followed up in 1990. NLSY surveys have repeatedly included questions on marital history, schooling, current labor force status, health limitations, fertility, income and assets, household composition, and geographic residence.⁴³ Beginning with the 1986 wave of the NLSY, the female respondents also answered an extensive set of questions that pertain to the health and wellbeing of their children. These assessments encompass cognitive, socioemotional, and physiological aspects of their children's health and development, as well as information about the social characteristics of their families. In the analyses to follow, measures of gender, age, race/ethnicity, maternal health and education, birth order, family structure, and economic situation are all taken from the 1988 NLSY main study questionnaire.

The NLSY also contains maternal reports of their children's medical coverage and behaviors, as well as interviewer observations of the home environment. Insurance coverage is represented by dichotomous variables; children who are uninsured or on Medicaid are separately referenced against children who are privately insured. Variables reflecting headstrong and hyperactive behaviors (in standard score form) are subscales of the child behavior checklist (CBCL),⁴⁴ and are normed against a national population.⁴³ While in the homes in 1988, the interviewers also observed whether or not the surroundings were "dark or perceptually monotonous", or "minimally cluttered". These observations were each coded to indi-

cate (1 v 0) whether the homes were characterized as "dark" or "cluttered".

In 1988 and 1990 the mothers were asked how many accidents or injuries requiring medical attention their children suffered during the preceding 12 months. As a result, medically attended injuries reported at either interview date reflect injuries incurred over the period preceding the interview. The NLSY also contains information on the place of injury. As the etiological influences of home environmental variables are central to this investigation, the dependent variable in all analyses was limited to medically attended injuries that occurred in the children's homes. This variable was dichotomized and reflects whether or not (1 v 0) the children had a medically attended injury that occurred in the home during the 12 months preceding the 1990 interview date. Thus, the multivariate results reflect the regression of maternal reports of their children's home injuries in 1990 on independent variables measured in 1988 (one exception to this is that information on insurance coverage is taken from 1990 and not 1988 as this best reflected the children's coverage status at the time of injury). All results are fully adjusted for all of the risk and sociodemographic variables.

Analyses were conducted using the logistic regression procedure in SPSS-PC version 8.0. Findings are based on a sample of 2036 children between 4 and 12 years of age in 1988, who have a complete database timeline from 1987 to 1990 on all of the variables of interest. As the mothers were between 14 and 21 years of age on 1 January 1979, the findings of this research may be considered representative of a cross section of children born to a national sample of women who were between the ages of 25 and 32 as of 1 January 1990.

Results

Table 1 presents descriptive characteristics of the sample. Two thirds of the children were covered by private health insurance and white respondents were more likely than non-white respondents to have private insurance coverage. Uninsured children and those on Medicaid were more likely than privately insured children to have been living below the poverty level in 1988, to come from single parent

Table 1 Per cent distributions of sample characteristics by race and 1990 medical coverage status

	Total (n=2036)	White (n=835)	Non-white (n=1201)	Privately insured (n=1332)	Not privately insured (n=704)
Male	49.7	49.7	49.6	49.6	49.7
White	41.0	—	—	49.1	25.7
Privately insured	65.4	78.3	56.5	—	—
Medicaid	19.9	8.5	27.9	—	—
Uninsured	14.7	13.2	15.7	—	—
Mean age of child (in years)	6.78	6.58	6.93	6.74	6.86
Income below poverty level, 1988	30.4	17.1	39.6	16.6	43.6
Spouse of mother is absent from home	33.9	18.0	45.0	23.7	53.1
Child has no older biological siblings	58.4	62.0	55.9	62.2	51.1
Mother has completed 12 or more years of school, 1988	65.3	72.0	60.6	76.4	55.7
Mother has a work limiting health condition	6.8	6.5	7.0	7.1	6.3
Home is "cluttered"	15.4	17.8	13.7	14.6	16.9
Home is "dark or perceptually monotonous"	10.3	6.2	13.2	6.7	25.7
Home is "dark or cluttered"	21.8	20.0	23.1	18.5	28.0
Child had a medically attended injury that occurred at home in 1990	5.5	8.3	3.6	6.5	3.6

Table 2 Predictors of medically attended injuries that occurred in the home in 1990, among children who did not have any reported medically attended injuries in 1988 (n=1814)

Risk or sociodemographic factor	Parameter estimate (β)	Standard error	Exponentiation of β (Exp)	95% Confidence interval for Exp	p Value
Child age in years, 1988	-0.04	0.06	0.96	0.86 to 1.07	0.481
Mother has a work limiting health condition, 1988	0.60	0.36	1.82	0.90 to 3.66	0.094
Mother has completed 12 or more years of school	-0.07	0.26	0.93	0.56 to 1.54	0.774
Birth order of child	0.13	0.14	1.14	0.87 to 1.49	0.348
Ratio of family income to the federally stated poverty level, 1988	-0.003	0.04	1.00	0.92 to 1.08	0.930
Child is white, non-Hispanic	0.71	0.24	2.04	1.28 to 3.25	0.003
Spouse of mother is absent from home, 1988	0.02	0.27	1.02	0.60 to 1.73	0.954
Sex of child (1=male, 2=female)	-0.45	0.27	0.64	0.41 to 0.99	0.045
Child insurance costs covered by Medicaid, 1990	-0.69	0.39	0.50	0.23 to 1.07	0.076
Child uninsured, 1990	-0.86	0.41	0.42	0.19 to 0.95	0.037
Child's standardized score on CBCL hyperactive subscale, 1988	0.001	0.01	1.00	0.99 to 1.02	0.882
Child's standardized score on CBCL headstrong subscale, 1988	0.004	0.01	1.00	0.99 to 1.02	0.607
Interviewer classified child's home as "dark", 1988	-0.10	0.43	0.90	0.39 to 2.10	0.811
Interviewer classified child's home as "cluttered", 1988	0.091	0.30	1.09	0.61 to 1.96	0.761
Interviewer classified child's home as "dark or cluttered", 1988*	-0.010	0.27	0.99	0.58 to 1.69	0.971

*The effects of this variable on the 1990 injury outcome were tested in a model that did not include the separate influences of "dark" and "cluttered". The variables representing dark and cluttered homes were correlated with each other at $r=0.2$.

families, and to have mothers that did not graduate from high school. In addition, they were more likely than privately insured children to come from homes characterized as dark or cluttered.

Table 2 presents the results of logistic regression analyses linking the 1990 injury outcome to demographic and risk factor variables measured in 1988, among children who did not have any reported medically attended injuries in 1988. White, non-Hispanic children were significantly more likely than other children to have had one or more reported medically attended home injuries in 1990 ($p = 0.003$). Boys were more likely than girls to have had a reported home injury ($p = 0.045$). In addition, children who were uninsured in 1990 were significantly less likely than those who were privately insured to have had one or more reported medically attended injuries in the home ($p = 0.037$). Children on Medicaid also had fewer reported home injuries than the privately insured, but this difference was also only marginally significant ($p = 0.076$).

Table 3 presents the predictors of home injuries in 1990 among a sample of children who

had previously accessed the medical care system for an injury in 1988. In table 3, white, non-Hispanic children remained significantly more likely than children of other racial/ethnic groups to have had a reported home injury ($p = 0.027$). However, after the adjustment for access to care that occurs in table 3, children who were uninsured or on Medicaid in 1990 were no longer less likely to have a reported home injury in 1990! The most noticeable changes from table 2 to table 3 involved the measures of the home physical environment. Table 3 shows that children who came from homes labeled by independent observers as "dark" ($p = 0.019$), "cluttered" ($p = 0.037$), and "dark or cluttered" ($p = 0.008$) were significantly more likely than others to have had a medically attended injury that occurred in the home. Interaction variables (not presented in the tables) were used to test whether the dark and cluttered parameter estimates changed significantly from table 2 to table 3. Results indicated that the effects of "dark" ($p = 0.004$), "cluttered" ($p = 0.017$), and "dark or cluttered" homes ($p = 0.001$) were significantly different between the samples and not likely to be due to

Table 3 Predictors of medically attended injuries that occurred in the home in 1990, among children who reported having at least one medically attended injury in 1988 (n=222)

Risk or sociodemographic factor	Parameter estimate (β)	Standard error	Exponentiation of β (Exp)	95% Confidence interval for Exp	p Value
Child age in years, 1988	-0.14	0.13	0.87	0.67 to 1.13	0.288
Mother has a work limiting health condition, 1988	-0.88	1.32	0.42	0.03 to 5.48	0.505
Mother has completed 12 or more years of school	-0.62	0.56	0.54	0.18 to 1.60	0.264
Birth order of child	0.33	0.27	1.39	0.83 to 2.35	0.214
Ratio of family income to the federally stated poverty level, 1988	0.03	0.09	1.03	0.87 to 1.23	0.711
Child is white, non-Hispanic	1.34	0.61	3.81	1.16 to 12.48	0.027
Spouse of mother is absent from home, 1988	-0.23	0.65	0.80	0.23 to 2.84	0.728
Sex of child (1=male, 2=female)	-0.94	0.56	0.39	0.13 to 1.19	0.098
Child insurance costs covered by Medicaid, 1990	0.89	0.71	2.43	0.60 to 9.78	0.213
Child uninsured, 1990	-0.66	0.93	0.52	0.08 to 3.22	0.480
Child's standardized score on CBCL hyperactive subscale, 1988	-0.001	0.02	1.00	0.97 to 1.03	0.977
Child's standardized score on CBCL headstrong subscale, 1988	-0.002	0.02	1.00	0.97 to 1.03	0.884
Interviewer classified child's home as "dark", 1988	1.54	0.66	4.68	1.28 to 17.11†	0.019
Interviewer classified child's home as "cluttered", 1988	1.46	0.70	4.31	1.09 to 17.11†	0.038
Interviewer classified child's home as "dark or cluttered", 1988*	1.52	0.57	4.56	1.50 to 13.89	0.008

*The effects of this variable on the 1990 injury outcome were tested in a model that did not include the separate influences of "dark" and "cluttered". The variables representing dark and cluttered homes were correlated with each other at $r=0.2$.

†Interactions were used to test whether or not the dark and cluttered parameter estimates differed significantly from table 2 to table 3. Results indicated that the effects of "dark" ($p=0.004$), "cluttered" ($p=0.017$), and "dark or cluttered" ($p=0.001$) on home injuries in 1990 were significantly different between the samples.

Note: Those on Medicaid and who were uninsured were referenced against those with private insurance coverage.

chance. Furthermore, as the indicators of dark and cluttered homes were only correlated at $r = 0.2$ with each other, they appeared to exert largely independent influences on the home injury outcome measure.

Discussion

Although financial access to care as measured by family income and insurance coverage status can be directly adjusted for in multivariate models, family based *non*-financial barriers to care are not easily measurable in data collection activities. However, these non-financial barriers to care may remain as important constraints on a child's (and that child's family's) willingness to obtain medical care when injured. To account for individual differences in financial and non-financial access to care, we conducted separate analyses of medically attended injuries in samples of children that had (table 3), and had not (table 2) demonstrated a prior ability to access the medical care system for injury treatment. That is, based on prior behavior, we have strong reason to assume that the sample reflected in table 3 has the ability, whether for economic, social, or psychological reasons (or likely a mixture of all three), to access medical assistance for injury treatment when needed. To the extent that our understanding of home environmental and sociodemographic risk factors for injury is confounded by a lack of access to care, this approach would presumably reduce this confounding influence.

Among children who did *not* access the medical care system for injury treatment in 1988 (table 2), those who were uninsured or on Medicaid were less likely than those who were privately insured to have a medically attended injury that occurred in the home in 1990. In addition, home environmental risk factors (indicators of "dark" and "cluttered" homes as captured by an independent observer), did not distinguish those injured at home from those not injured at home in 1990.

Among children who *did* access the medical care system for injury treatment in 1988 (table 3), however, the home environmental measures were significantly and positively predictive of home injuries in 1990. In addition, the effects of differences in insurance status on the odds of reporting a medically attended injury became non-significant. Taken together, these findings suggest that, if not accounted for in data collection or analyses, individual differences in non-financial barriers to medical care may lead to an underestimation of important home environmental risk factors for injury. This may be due to the fact that non-financial barriers to care tend to cluster among children who live in homes with more risk factors for injury.

It should be noted that these findings have several limitations that can be addressed by future research in this area. First, while a sample of 2036 is usually large enough for most types of analyses, injuries in the home, statistically speaking, are a relatively rare event and only 112 were observed in this sample. To reduce the likelihood of type II error, we

conducted more powerful supplementary analyses using statistical interactions instead of sample stratification, and no substantively meaningful changes to the results occurred. However, it would be useful to replicate these findings in larger epidemiological samples where children with home injuries are present in larger numbers.

Second, while we stratified our results based on a demonstrated prior ability to access the medical care system for injury treatment, we could not directly include measures of non-financial barriers to injury care. Thus, the specific barriers at work could not be identified. Non-financial barriers may include geographic difficulties, child care values and constraints, language barriers, legal restrictions, provider shortages, provider prejudices, and a lack of trust in the medical system. These factors may vary greatly across families in the same insurance and income categories,³⁹ and clearly may affect the decision to seek medical attention for an injury.

Finally, in these analyses the home environment was observed at a single point in time, by an independent observer. While any operationalization of the physical home environment is rare in large sample injury research, this operationalization was by no means optimal. As a result there is some reason to suspect that the observed associations between dark and cluttered home environments and injuries in the home may be conservative. This would especially be the case if the presence of these risk factors in the home is less important than their duration to the occurrence of injury events. However, due to the use of multiple reporter constructs, we can be confident that these reported effects are not inflated by any systematic measurement error or shared method variance (common reporter bias).

Implications for prevention

Research that further assesses the causal chain of events that link what has been termed "dark" and "cluttered" in these analyses, to specific home injuries, could inform existing injury prevention activities. Causality can be established in epidemiological research when a strong and biologically plausible association between exposure and effect is observed; when findings are demonstrated not to be the result of chance or confounding; when the exposure precedes the outcome in a "dose-response" manner; and when findings can be replicated across diverse samples and populations.⁴⁵ This research has documented a longitudinal relationship between independent reports of dark and cluttered home environments, and medically attended injuries that occurred in the home, in a national sample of children. Care has been taken to account for many potential confounders including demographic risk factors, behavioral risk factors, and barriers to medical care. In addition, the magnitude and consistency of observed associations indicates that these findings are unlikely to be due to chance. However to further establish this causal etiology, these findings need to be

replicated in additional populations of children. Perhaps most importantly, these data did not allow us to establish a "dose-response" mechanism by which increasing degrees of environmental risk correlate with increasing rates of home injuries. While average lighting levels in homes can, and should, be quantitatively linked to injury outcomes, the nature of the association between "cluttered" homes and injuries is less easily understood. Thus, to the extent that existing data allow, the direct associations between home injury events and unstored toys, the proximity of adult items and tools to children, hazards in the children's play environments, the unsafe placement of home furnishings, and other common sources of home "clutter", need to be quantified in generalizable samples of children.

With such an extension, recommendations for environmental modification could be integrated into existing population based injury prevention programs. Although some have questioned the feasibility of using risk factors to identify children at high risk for injury,⁴⁶ children with injuries presenting to medical facilities might also be targeted for prevention. In situations where economic considerations preclude population approaches to prevention, this may be an attainable strategy. Among children who are known to have accessed the medical care system for injury treatment, 39% of those who reported a home injury in 1990, and 14% of those who did not, came from homes characterized by an independent observer as "dark or cluttered". Given the large number of children's injuries that occur in homes each year,^{1,2} these children may well represent a targetable and high risk sample of injury "repeaters" who could benefit from interventions that exist within currently operating programs.

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