Original Investigation

Risk and Protective Factors for Falls From Furniture in Young Children
Multicenter Case-Control Study

Denise Kendrick, DM; Asiya Maula, MPH; Richard Reading, MD; Paul Hindmarch, MA; Carol Coupland, PhD; Michael Watson, PhD; Mike Hayes, PhD; Toity Deave, PhD

Importance
Falls from furniture are common in young children but there is little evidence on protective factors for these falls.

Objective
To estimate associations for risk and protective factors for falls from furniture in children aged 0 to 4 years.

Design, Setting, and Participants
Multicenter case-control study at hospitals, minor injury units, and general practices in and around 4 UK study centers. Recruitment commenced June 14, 2010, and ended April 27, 2012. Participants included 672 children with falls from furniture and 2648 control participants matched on age, sex, calendar time, and study center. Thirty-five percent of cases and 33% of control individuals agreed to participate. The mean age was 1.74 years for cases and 1.91 years for control participants. Fifty-four percent of cases and 56% of control participants were male. Exposures included safety practices, safety equipment use, and home hazards.

Main Outcomes and Measures
Falls from furniture occurring at the child's home resulting in attendance at an emergency department, minor injury unit, or hospital admission.

Results
Compared with parents of control participants, parents of cases were significantly more likely not to use safety gates in the home (adjusted odds ratio [AOR], 1.65; 95% CI, 1.29-2.12) and not to have taught their children rules about climbing on kitchen objects (AOR, 1.58; 95% CI, 1.16-2.15). Cases aged 0 to 12 months were significantly more likely to have been left on raised surfaces (AOR, 5.62; 95% CI, 3.62-8.72), had their diapers changed on raised surfaces (AOR, 1.89; 95% CI, 1.24-2.88), and been put in car/bouncing seats on raised surfaces (AOR, 2.05; 95% CI, 1.29-3.27). Cases 3 years and older were significantly more likely to have played or climbed on furniture (AOR, 9.25; 95% CI, 1.22-70.07). Cases were significantly less likely to have played or climbed on garden furniture (AOR, 0.74; 95% CI, 0.56-0.97).

Conclusions and Relevance
If estimated associations are causal, some falls from furniture may be prevented by incorporating advice into child health contacts, personal child health records, and home safety assessments about use of safety gates; not leaving children, changing diapers, or putting children in car/bouncing seats on raised surfaces; allowing children to play or climb on furniture; and teaching children safety rules about climbing on objects.

Author Affiliations:
Division of Primary Care, School of Medicine, University of Nottingham, Nottingham, England (Kendrick, Maula, Coupland); Norfolk and Norwich University Hospitals, National Health Service Foundation Trust, Norwich, England (Reading); Institute of Health and Society, Newcastle University, Newcastle upon Tyne, England (Hindmarch); School of Health Sciences, University of Nottingham, Nottingham, England (Watson); Child Accident Prevention Trust, London, England (Hayes); Centre for Child and Adolescent Health, Health, and Life Sciences, Department of Family and Child Health, University of the West of England, Bristol, England (Deave).

Corresponding Author:
Denise Kendrick, DM, School of Medicine, Division of Primary Care, University of Nottingham, Tower Bldg, University Park, Nottingham NG7 2RD, England (denise.kendrick@nottingham.ac.uk).

Published online December 1, 2014.

Copyright 2015 American Medical Association. All rights reserved.
More than 1 million US children and more than 200,000 UK children aged 0 to 4 years attend emergency departments (EDs) following falls each year.²³ Falls account for approximately half the injury-related ED attendances in this age group,³ with falls from furniture being the most common mechanism.⁴ Most of these falls involve beds, chairs,⁴,⁵ baby walkers, bouncers, changing tables, and high chairs.⁶,⁷ Costs in the United States for falls were estimated at $439 million for hospitalized children⁸ and $643 million for ED⁹ attendances in 2005. A recent systematic overview found that interventions could increase safety gate use and reduce baby walker use but included little evidence about other types of fall-prevention practices or whether prevention practices reduced falls or fall-related injuries.¹⁰ Therefore, we have undertaken this study to quantify associations between modifiable risk factors and falls from furniture in young children.

Methods

Full details of the methods of this study are described in the published protocol.¹¹ Approval was granted by Nottinghamshire Research Ethics Committee 1. Parents of cases and control participants provided informed consent through the return of study questionnaires.

Study Design and Setting

We undertook a multicenter case-control study in EDs, inpatient wards, and minor injury units (services treating a limited range of nonserious injuries that are not set in acute hospitals) in National Health Service hospitals in Nottingham, Bristol, Newcastle upon Tyne, Norwich, Gateshead, Derby, and Great Yarmouth, England. This was 1 of 5 concurrent case-control studies, each recruiting children with 1 type of injury (falls from furniture, falls on 1 level, stair falls, or poisoning or scalds) from these hospitals. Recruitment of cases commenced on June 14, 2010, and ended on November 15, 2011. Recruitment of control participants commenced with recruitment of the first case and ended on April 27, 2012.

Participants

Cases were children aged 0 to 4 years with a fall from furniture attending an ED, minor injury unit, or admitted to the hospital. Children with intentional or fatal injuries or those living in children's homes were excluded. Cases were eligible to be recruited once to the study. Control participants were children aged 0 to 4 years without a medically attended fall from furniture on the date of the case's injury. We aimed to recruit an average of 4 control participants per case, individually matched on age (within 4 months of a case's age), sex, and calendar time (within 4 months of a case's injury). Control participants were recruited from the cases' general practice or a neighboring practice, all of which were within the same study centers as the cases. Control participants were eligible to be recruited a second time to the study as a case or additional control after at least 12 months from the first recruitment.

To increase power and make efficient use of control participants from cases with more than 4, control participants who were no longer matched to cases (eg, the case had subsequently been excluded), and control participants from the other ongoing case-control studies (falls on 1 level, stair falls, or poisoning or scalds) as extra control participants. These were matched on age (within 4 months of a case's age), sex, calendar time (within 4 months of a case's injury), and study center and were only used once as an extra matched control participant.

Potentially eligible cases were invited to participate during their medical attendance or by telephone or mail within 72 hours of attendance. Ten control individuals were invited to participate by mail from the practice register for each case. General practice or primary care trust staff searched practice registers for children of the same sex as the case and within 4 months of the case's date of birth. Where more than 10 control participants met inclusion criteria, the 10 with the dates of birth closest to that of the case were chosen. Postal study invites for cases and control participants included a £5 (US $8) voucher, a second questionnaire reminder, university logos on study information, personalized invitations, and first class mailing.¹²,¹³

Definition and Measurement of Outcomes, Exposures, and Confounding Variables

The outcome of interest was a fall from furniture in the child's home or garden (including yard) resulting in hospital admission, ED, or minor injury unit attendance. Falls from play equipment (eg, trampolines, climbing frames, or slides) were excluded.

The exposures of interest were safety behaviors, safety equipment, and home hazards. These included binary exposures measured 24 hours prior to the fall for cases or prior to questionnaire completion for control participants, with yes/no response options:

- Use of stair/safety gates anywhere in the home
- Use of baby walkers (ages 0-36 months only)
- Use of playpens/travel cots (ages 0-36 months only)
- Use of stationary activity centers (ages 0-36 months only)
- Presence of things child could climb on to reach high surfaces

Ordinal exposures measured in the week prior to the fall for cases or prior to completing questionnaires for control participants included the following response options: every, most, some days, never, and not applicable. Responses were grouped into at least some days vs never. Analyses excluded the following not applicable responses:

- Leaving children on raised surfaces
- Changing diapers on raised surfaces
- Putting children in car or bouncing seats on raised surfaces
- Using high chairs without harnesses
- Children climbing or playing on furniture
- Children climbing or playing on garden furniture

Two binary exposures measured whether parents had ever taught children safety rules with the following yes/no response options:

- Rules about not climbing on objects
- Rules about not jumping on furniture
The following 3 confounding variables were dealt with by matching and conditional logistic regression: (1) age (within 4 months), (2) child sex, and (3) calendar time (within 4 months of case injury date). Because some control participants’ general practices came from very different neighborhoods than cases’ practices and extra control participants were not matched on practice, all odds ratios were adjusted for neighborhood deprivation using the Index of Multiple Deprivation (IMD14; linear term) and the distance between residence and hospital15 (quintiles of kilometers: ≤2, 2.1-3.2, 3.3-4.6, 4.7-8.2, and >8.2). The IMD is an area-based (400-1200 households) measure of multiple deprivation, containing 7 domains (income, employment, health and disability, education skills and training, barriers to housing and services, living environment, and crime).

Directed acyclic graphs included age, sex, IMD, and distance from hospital as adjusted variables and the potential confounding variables, which included the following: the number of children in family; race/ethnic group (white/other); single-adult household (yes/no); the Child Behavior Questionnaire Score (activity and high-intensity pleasure subscales,19-21 linear term); Hospital Anxiety and Depression Scale score (activity and high-intensity pleasure subscales,19-21 linear term); Hospital Anxiety and Depression Scale score indicates greater symptoms of anxiety/depression. A higher Child Health Visual Analog Scale score indicates better health. A higher PedsQL score indicates better quality of life.

### Table 1. Characteristics of Cases and Control Participants (continued)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Cases (n = 672)</th>
<th>Control Participants (n = 2648)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance from hospital, km, median (IQR)</td>
<td>3.4 (1.9-5.4)</td>
<td>3.9 (2.4-7.4) (29)</td>
</tr>
<tr>
<td>Child Behavior Questionnaire score, mean (SD)</td>
<td>4.68 (0.92) [45]</td>
<td>4.67 (0.88) [234]</td>
</tr>
<tr>
<td>Long-term health condition, No. (%)</td>
<td>60 (9.0) [5]</td>
<td>185 (7.0) [14]</td>
</tr>
<tr>
<td>Child Health Visual Analog Scale (range 0-10), median (IQR)</td>
<td>9.9 (9.3-10.0) [6]</td>
<td>9.7 (8.5-10.0) [22]</td>
</tr>
<tr>
<td>Health-related quality of life in children ≥2 y (PedsQL)</td>
<td>(n = 287) [4]</td>
<td>(n = 1270) [21]</td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>93.1 (86.9-97.6)</td>
<td>90.0 (82.9-94.4)</td>
</tr>
<tr>
<td>Parental assessment of child’s ability to climb</td>
<td>[18]</td>
<td>[57]</td>
</tr>
<tr>
<td>All scenarios not likely</td>
<td>166 (25.4)</td>
<td>536 (20.7)</td>
</tr>
<tr>
<td>≥1 Scenarios quite likely and none very likely</td>
<td>85 (13.0)</td>
<td>235 (9.1)</td>
</tr>
<tr>
<td>≥1 Scenarios very likely</td>
<td>403 (61.6)</td>
<td>1820 (70.2)</td>
</tr>
<tr>
<td>Parenting Daily Hassles Tasks Scale, median (IQR)</td>
<td>13 (10-17) [65]</td>
<td>14 (11-18) [168]</td>
</tr>
<tr>
<td>Hospital Anxiety and Depression Scale, mean (SD)</td>
<td>10.7 (6.0) [8]</td>
<td>10.8 (6.0) [39]</td>
</tr>
</tbody>
</table>

Abbreviations: IQR, interquartile range; PedsQL, the Pediatric Quality of Life Inventory.

a Age when questionnaire was completed.

b Numbers in brackets are missing values.

c Only applicable where mothers completed questionnaire.

d A higher Index of Multiple Deprivation score indicates greater deprivation. A higher Child Behavior Questionnaire score indicates more active and more intense behavior. A higher Parenting Daily Hassles Scale score indicates more hassle. A higher Hospital Anxiety and Depression Scale score indicates greater symptoms of anxiety/depression. A higher Child Health Visual Analog Scale score indicates better health. A higher PedsQL score indicates better quality of life.

e Missing values refer to those with 50% or more items on any scale missing.

f Missing values refer to those with more than 1 item missing.
months). Some exposures (Table 2) were validated with home observations in a sample of 162 cases and control participants as previously reported.26

**Table 2. Sensitivity, Specificity, and Predictive Values for Self-reported Exposures Compared With Observed Exposures for Cases and Control Participants**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Reported but Observed</th>
<th>Not Reported but Observed</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Positive Predictive Value</th>
<th>Negative Predictive Value</th>
<th>( k ) Value</th>
<th>( \chi^2 )</th>
<th>( P ) Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Gate at Top of Stairs</td>
<td>34</td>
<td>9</td>
<td>5</td>
<td>28</td>
<td>.872</td>
<td>.757</td>
<td>.791</td>
<td>.848</td>
<td>.63 (0.46-0.80)</td>
</tr>
<tr>
<td>Control participants [2]</td>
<td>41</td>
<td>8</td>
<td>3</td>
<td>20</td>
<td>.912</td>
<td>.714</td>
<td>.837</td>
<td>.870</td>
<td>.67 (0.49-0.85)</td>
</tr>
<tr>
<td>Safety Gate at Bottom of Stairs</td>
<td>25</td>
<td>7</td>
<td>3</td>
<td>41</td>
<td>.893</td>
<td>.854</td>
<td>.78</td>
<td>.932</td>
<td>.73 (0.57-0.88)</td>
</tr>
<tr>
<td>Control participants [3]</td>
<td>29</td>
<td>8</td>
<td>2</td>
<td>30</td>
<td>.935</td>
<td>.789</td>
<td>.784</td>
<td>.938</td>
<td>.71 (0.55-0.88)</td>
</tr>
<tr>
<td>Has Baby Walker</td>
<td>9</td>
<td>1</td>
<td>11</td>
<td>56</td>
<td>.45</td>
<td>.98</td>
<td>.90</td>
<td>.83</td>
<td>.52 (0.29-0.74)</td>
</tr>
<tr>
<td>Control participants [0]</td>
<td>15</td>
<td>3</td>
<td>22</td>
<td>34</td>
<td>.405</td>
<td>.919</td>
<td>.833</td>
<td>.607</td>
<td>.32 (0.14-0.51)</td>
</tr>
<tr>
<td>Has Static Play Center</td>
<td>2</td>
<td>14</td>
<td>2</td>
<td>40</td>
<td>.50</td>
<td>.741</td>
<td>.12</td>
<td>.95</td>
<td>.01 (1.12-0.23)</td>
</tr>
<tr>
<td>Control participants [0]</td>
<td>6</td>
<td>13</td>
<td>4</td>
<td>47</td>
<td>.60</td>
<td>.783</td>
<td>.31</td>
<td>.922</td>
<td>.28 (0.03-0.53)</td>
</tr>
<tr>
<td>Has Playpen</td>
<td>6</td>
<td>6</td>
<td>1</td>
<td>45</td>
<td>.83</td>
<td>.882</td>
<td>.45</td>
<td>.97</td>
<td>.52 (0.22-0.82)</td>
</tr>
<tr>
<td>Control participants [0]</td>
<td>4</td>
<td>14</td>
<td>5</td>
<td>47</td>
<td>.44</td>
<td>.77</td>
<td>.22</td>
<td>.904</td>
<td>.15 (0.09-0.40)</td>
</tr>
<tr>
<td>Has Travel Cot Instead of a Playpen</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>54</td>
<td>.10</td>
<td>.964</td>
<td>.50</td>
<td>.100</td>
<td>.65 (0.21-1.00)</td>
</tr>
<tr>
<td>Control participants [1]</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>63</td>
<td>.66</td>
<td>.95</td>
<td>.40</td>
<td>.984</td>
<td>.47 (0.03-0.91)</td>
</tr>
</tbody>
</table>
| * Sensitivity was the exposure reported and observed/total observed to have exposure. Specificity was the exposure not reported and not observed/total not observed to have exposure. The positive predictive value was the exposure reported and observed/total who reported exposure. The negative predictive value was the exposure not reported and not observed/total not reporting exposure.

**Study Size**

To detect an odds ratio of 1.43 with \( \beta = 0.2 \) and \( \alpha = 0.5 \), the correlation between exposures in cases and control participants of 0.1 and 4 control participants per case required 496 cases and 1984 control participants, based on exposure prevalences ranging from to 35% (child left on raised surface) to 76% (no stationary activity center).27,28

**Statistical Methods**

Odds ratios (ORs) and 95% confidence intervals were estimated using conditional logistic regression adjusted for neighborhood deprivation, distance from hospital, and confounders identified from DAGs. We assessed the linearity of relationships between continuous confounders and case/control participant status by adding higher-order terms to regression models and categorized where there was evidence of nonlinearity. We used interaction terms to study whether associations varied by age, sex, race/ethnicity, single parenthood, nonowner-occupied housing, and unemployment, with a likelihood ratio test \( P \) value of less than .01 taken as significant.

For the The Pediatric Quality of Life Inventory, mean scale scores were computed by summing items and dividing by the number of items answered. Means were not computed where 50% or more items were missing.29 Four percent of observations had missing data on less than 50% of items. We imputed single missing item values for subscales of the Hospital Anxiety and Depression Scale using the mean of the remaining 6 items. This applied to 3% of observations. Where more
Figure. Flowchart of Case (A) and Control Participant (B) Recruitment

A Cases

2267 Screened for inclusion (emergency department attenders with a fall from furniture)

2263 Invited

2162 Sent study invite

93 Approached face to face

8 Invited telephone call

793 Agreed to participate (35.0%)

121 Excluded after agreeing to participate

58 Injury not at home address

38 Case has no matched control participants

11 Previously recruited to study

10 Incorrect injury mechanism

1 Lived out of area

1 Child too old

1 Received after close of recruitment

1 Injury mechanism data entry error

672 Included in analysis (29.7%)

B Control participants

7930 Study invites sent

2593 Agreed to participate (32.7%)

527 Excluded after agreeing to participate

233 Sex or date of birth does not match case

141 Received after close of recruitment

46 Already in study

41 Case subsequently excluded

34 Received after at least 4 control participants were already matched to the case and used only as extra matched control participants for other cases

30 Injury mechanism, sex, or date of birth data entry error

1 Matched to case received after close of recruitment

1 Other data entry error

2066 Eligible for inclusion (26.1%)

582 Extra matched control participants

83 Fall from furniture

49 Not already matched to a case

34 Matched

209 Fall on 1 level

158 Stair fall

81 Poisoning

51 Scald

2648 Included in analysis

* Assumed to be 10 times the number of cases because practices were asked to invite 10 control participants for each case.

* Control participants for cases who had more than 4 control participants and control participants who were not matched to a case (eg, because the case was excluded from the study).

* Control participants for cases from the other 4 ongoing case-control studies.

than 1 item was missing, subscale scores were not computed.22
The Infant Behavior Questionnaire, Early Child Behavior Questionnaire, and Child Behavior Questionnaire allowed for missing values and were scored as the total score divided by the number of questions answered. Missing values represented those with missing data on all scale items.22 We were unable to find missing data guidance for the Parenting Daily Hassles Scale so we treated missing data in the same way as for the Hospital Anxiety and Depression Scale. Fifteen percent of observations had a single missing item. The main analyses were complete case analyses including single imputed values for the Pediatric Quality of Life Inventory, Hospital Anxiety and Depression Scale, and Parenting Daily Hassles Scale. The percentage of observations excluded from multivariable analyses owing to missing data ranged from 15% to 25%. We imputed missing data based on all exposure and potential confounding variables (including single imputed values for scales described earlier) and case/control participant status to create 20 imputed data sets. These were combined using Rubin rules.31

Results

In total, 672 cases and 2648 control individuals (including 582 extra matched control participants) participated in this study (Figure). Thirty-five percent of cases and 33% of control participants agreed to participate. Age, group, and sex were similar among case participants and nonparticipants (0-12 months, 34% vs 31%; 13-36 months, 44% vs 49%; ≥37 months, 23% vs 21%, respectively; 54% male in both groups). The mean number of control participants per case was 3.94. Median days from date of injury to questionnaire completion was 10 (interquartile range, 6-20). Most cases (86%) sustained single injuries; the most common were bangs on the head (59%), cuts/grazes not requiring stitches (19%), and fractures (14%). Most cases (60%) were seen and examined but did not require treatment; 29% were treated in the ED, 7% were treated and discharged with follow-up appointments, and 4% were admitted to hospital.

Cases were slightly younger than control participants (1.74 vs 1.91 years), had fewer hours of out-of-home child care per week (7.5 vs 12), more of their parents were unemployed (51% vs 1 unemployed parent vs 43%), received state benefits (43% vs 36%), lived in nonowner-occupied housing (40% vs 52%), and lived in neighborhoods with higher deprivation scores (mean, 16.8 vs 14.9). Fewer parents of cases than parents of control participants thought their children were very likely to climb in at least 1 of 8 scenarios (62% vs 70%; Table 1).

The sensitivity, specificity, and predictive values for exposures validated by home observations are shown in Table 2.
<table>
<thead>
<tr>
<th>Exposures</th>
<th>Cases (n = 672)</th>
<th>Control Participants (n = 2648)</th>
<th>Complete Case Analysis</th>
<th>Multiple Imputation Analysis</th>
<th>Confounders Adjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety gates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used in the last 24 h</td>
<td>389 (63.2)</td>
<td>1800 (72.4)</td>
<td>1 [Reference]</td>
<td>1 [Reference]</td>
<td>PDH, HADS, hours out-of-home care, ability to climb, first child</td>
</tr>
<tr>
<td>Did not use</td>
<td>227 (36.9)</td>
<td>688 (27.6)</td>
<td>1.65 (1.29-2.12)</td>
<td>1.62 (1.25-2.10)</td>
<td></td>
</tr>
<tr>
<td>Missing values</td>
<td>56</td>
<td>160</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High chair without harness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did not use</td>
<td>330 (73.7)</td>
<td>1239 (70.4)</td>
<td>1 [Reference]</td>
<td>1 [Reference]</td>
<td>CBQ, hours out-of-home care</td>
</tr>
<tr>
<td>Used</td>
<td>118 (26.3)</td>
<td>522 (29.6)</td>
<td>0.77 (0.57-1.03)</td>
<td>0.81 (0.63-1.04)</td>
<td></td>
</tr>
<tr>
<td>Missing values</td>
<td>11</td>
<td>34</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not applicable responses</td>
<td>213</td>
<td>853</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reaching high surfaces</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did not have things child could climb on in the last 24 h</td>
<td>412 (62.4)</td>
<td>1551 (59.1)</td>
<td>1 [Reference]</td>
<td>1 [Reference]</td>
<td>Hours out-of-home care, ability to climb, first child, safety gate, safety rules about climbing in kitchen and jumping on furniture</td>
</tr>
<tr>
<td>Had things child could climb on</td>
<td>248 (37.6)</td>
<td>1075 (40.9)</td>
<td>0.96 (0.75-1.24)</td>
<td>0.88 (0.68-1.13)</td>
<td></td>
</tr>
<tr>
<td>Missing values</td>
<td>12</td>
<td>22</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On a raised surface</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Had not left child</td>
<td>262 (42.3)</td>
<td>1273 (51.0)</td>
<td>1 [Reference]</td>
<td>1 [Reference]</td>
<td>CBQ, hours out-of-home care</td>
</tr>
<tr>
<td>Left child</td>
<td>357 (57.7)</td>
<td>1221 (49.0)</td>
<td>1.66 (1.34-2.06)</td>
<td>1.68 (1.37-2.05)</td>
<td></td>
</tr>
<tr>
<td>Missing values</td>
<td>13</td>
<td>33</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not applicable responses</td>
<td>40</td>
<td>121</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Changed diaper on a raised surface</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Had not</td>
<td>233 (44.0)</td>
<td>947 (46.1)</td>
<td>1 [Reference]</td>
<td>1 [Reference]</td>
<td>CBQ, hours out-of-home care</td>
</tr>
<tr>
<td>Had changed</td>
<td>297 (56.0)</td>
<td>1106 (53.9)</td>
<td>1.10 (0.87-1.40)</td>
<td>1.13 (0.93-1.38)</td>
<td></td>
</tr>
<tr>
<td>Missing values</td>
<td>10</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not applicable responses</td>
<td>132</td>
<td>565</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Car or bouncing seat on raised surface</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Had not put child in</td>
<td>460 (88.6)</td>
<td>1816 (91.2)</td>
<td>1 [Reference]</td>
<td>1 [Reference]</td>
<td>CBQ, hours out-of-home care</td>
</tr>
<tr>
<td>Put child in</td>
<td>59 (11.4)</td>
<td>176 (8.8)</td>
<td>1.35 (0.91-2.01)</td>
<td>1.24 (0.87-1.77)</td>
<td></td>
</tr>
<tr>
<td>Missing values</td>
<td>11</td>
<td>33</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not applicable responses</td>
<td>142</td>
<td>626</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climbed or played on furniture</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child had not</td>
<td>132 (21.9)</td>
<td>543 (22.2)</td>
<td>1 [Reference]</td>
<td>1 [Reference]</td>
<td>CBQ, hours out-of-home care, things child could climb on to reach high surfaces</td>
</tr>
<tr>
<td>Child had</td>
<td>472 (78.2)</td>
<td>1909 (77.9)</td>
<td>1.03 (0.73-1.44)</td>
<td>1.04 (0.77-1.42)</td>
<td></td>
</tr>
<tr>
<td>Missing values</td>
<td>7</td>
<td>27</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not applicable responses</td>
<td>61</td>
<td>169</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climbed or played on garden furniture</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child had not</td>
<td>345 (65.6)</td>
<td>1272 (60.9)</td>
<td>1 [Reference]</td>
<td>1 [Reference]</td>
<td>CBQ, hours out-of-home care, things child could climb on to reach high surfaces</td>
</tr>
<tr>
<td>Child had</td>
<td>181 (34.4)</td>
<td>816 (39.1)</td>
<td>0.74 (0.56-0.97)</td>
<td>0.75 (0.59-0.95)</td>
<td></td>
</tr>
<tr>
<td>Missing values</td>
<td>10</td>
<td>28</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not applicable responses</td>
<td>136</td>
<td>532</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climbing in kitchen</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Had taught child rules</td>
<td>351 (55.5)</td>
<td>1540 (60.0)</td>
<td>1 [Reference]</td>
<td>1 [Reference]</td>
<td>HADS, PDH, first child, things child could climb on to reach high surfaces</td>
</tr>
<tr>
<td>Had not taught child rules</td>
<td>282 (44.5)</td>
<td>1026 (40.0)</td>
<td>1.58 (1.16-2.15)</td>
<td>1.46 (1.11-1.93)</td>
<td></td>
</tr>
<tr>
<td>Missing values</td>
<td>39</td>
<td>82</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jumping on bed or furniture</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Had taught child rules</td>
<td>353 (55.5)</td>
<td>1489 (58.0)</td>
<td>1 [Reference]</td>
<td>1 [Reference]</td>
<td>HADS, PDH, first child, things child could climb on to reach high surfaces</td>
</tr>
<tr>
<td>Had not taught child rules</td>
<td>283 (44.5)</td>
<td>1079 (42.0)</td>
<td>1.21 (0.87-1.68)</td>
<td>1.22 (0.91-1.63)</td>
<td></td>
</tr>
<tr>
<td>Missing values</td>
<td>36</td>
<td>80</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(continued)
Specificities were high (>70%) for all 7 items of safety or nursery equipment in cases and control participants. Sensitivity was only high for 4 items in cases and 2 in control participants. Negative predictive values were high for all 7 items in cases and for all except 1 item in control participants. Positive predictive values were only high for 3 items (all safety gate exposures) in cases and control participants. The only items with high values for sensitivity and specificity were safety gates at the top and bottom of stairs.

Table 3 shows the frequency of exposures and ORs for the complete case and multiple imputation analyses, adjusted for confounders listed in Table 3. Parents of cases were significantly more likely not to use safety gates (adjusted OR [AOR], 1.65; 95% CI, 1.29-2.12) and not to have taught children rules about climbing on objects in the kitchen (AOR, 1.58; 95% CI, 1.24-1.99) than parent of control participants. Cases were significantly more likely to have been left on raised surfaces (AOR, 1.16-2.15) than parent of control participants. Odds ratios from the complete case and multiple imputation analyses did not differ by more than 10%.

The only significant interactions were between child age and 4 exposures (eTable in the Supplement). Cases aged 0 to 12 years were significantly more likely to have been left on raised surfaces (AOR, 5.62; 95% CI, 3.62-8.72), had their diapers changed on raised surfaces (AOR, 1.89; 95% CI, 1.24-2.88), and been put in car or bouncing seats on raised surfaces (AOR, 2.05; 95% CI, 1.29-3.27) than control participants. Cases aged 13 to 36 months were significantly less likely to have been put in car or bouncing seats on raised surfaces (AOR, 0.22; 95% CI, 0.05-0.94) than control participants. Cases aged 3 years and older were significantly more likely to have climbed or played on furniture (AOR, 9.25; 95% CI, 1.22-70.07) than control participants. Five of the odds ratios from complete case and multiple imputation analyses differed by more than 10%.

Discussion

Main Findings
A range of modifiable factors were associated with secondary care–attended falls from furniture in children aged 0 to 4 years. Not using safety gates anywhere in the home, leaving children on raised surfaces, changing diapers on raised surfaces, putting car or bouncing seats on raised surfaces, climbing or playing on furniture, and not teaching children rules about things they should not climb on in the kitchen were all associated with increased odds of a fall.

Strengths and Limitations
To our knowledge, this is the largest published case-control study to date exploring modifiable factors for falls from furniture. The study was conducted in National Health Service hospitals across England, including urban and rural areas. Adjustment was made for a wide range of potential confounding factors using DAGs. None of the AORs differed by more than 10% between analyses using complete cases and those using multiple imputation for the main analyses but there were differences of more than 10% in AORs for 5 interaction analyses.

Validation of exposures showed high (>70%) specificities and negative predictive values for 6 items of safety or nurs-
Falls From Furniture in Young Children

ARTICLE INFORMATION
Accepted for Publication: August 28, 2014.
Published Online: December 1, 2014.

Author Contributions: Prof Kendrick had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.
Study concept and design: Kendrick, Reading, Coupland, Watson.
Acquisition, analysis, or interpretation of data: All authors.
Drafting of the manuscript: Kendrick, Maula, Hindmarch.
Critical revision of the manuscript for important intellectual content: All authors.
Statistical analysis: Kendrick, Maula, Coupland.
Obtained funding: Kendrick, Reading, Coupland, Watson.
Administrative, technical, or material support: Hindmarch, Deave.
Study supervision: Kendrick, Reading, Watson.
Conflict of Interest Disclosures: None reported.
Funding/Support: This article presents independent research funded by grant RP-PG-0407-10231 from the National Institute for Health Research through its Program Grants for the Applied Research Program.
Role of the Sponsor: The funder had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

Disclaimer: The views expressed in this article are those of the authors and not necessarily those of the National Health Service, the National Institute for Health Research, or the Department of Health.

Additional Contributions: We thank the principal investigators, liaison health visitors, research nurses, and other staff from the emergency departments and minor injury units who assisted with recruiting participants from the Nottingham University Hospitals National Health Service Trust, Derby Hospitals National Health Service Foundation Trust, Norfolk and Norwich University Hospitals National Health Service Foundation Trust; James Paget University Hospitals National Health Service Foundation Trust, University Hospitals Bristol National Health Service Foundation Trust, North Bristol Healthcare National Health Service Foundation Trust, University Hospitals Birmingham National Health Service Foundation Trust, University Hospitals Birmingham National Health Service Foundation Trust, North Bristol Healthcare National Health Service Foundation Trust, University Hospitals Bristol National Health Service Foundation Trust, North Bristol Healthcare Trust, Newcastle upon Tyne Hospitals National Health Service Foundation Trust, Gateshead National Health Service Foundation Trust, and Northumbria Healthcare National Health Service Foundation Trust. We acknowledge the support provided for recruitment by the primary care research networks for East Midlands and South Yorkshire, Leicestershire, Northamptonshire and Rutland, East of England, Northern and Yorkshire and from South West and Trent, Norfolk & Suffolk, and Northumberland Tyne and Wear and Western Comprehensive Local Research Networks. We thank Joanne Ablewhite, PhD, Penny Benford, PhD, Clare Timblin, BA, Philip Miller, PhD, Jane Stewart, MA, Persephone Wynn, PhD, and Ben Young, MSc, University of Nottingham; Gosi Majsk-Newman, MSc, Lisa McDaid, MSc, Clare Ferns, and Nathalie Horncastle, Norfolk and Norwich University Hospitals National Health Service Foundation Trust; Trudy Goodenough, PhD, Pilar Munoz, and Benita Laird-Hopkins, BSc, University of the West of England, Adrian Hawkins, BSc, Emma Davison, BA, and Laura Simms, BA, Great North Children’s Hospital, Newcastle upon Tyne; and Bryony Kay, BSc, Bristol Royal Hospital for Children, who helped with recruitment, and data collection, prepared data for analysis, or commented on drafts of papers. We acknowledge the following principal investigators who contributed to obtaining funding, study design, project management in their centers, interpretation of analyses, and comments on paper drafts: Elizabeth Towner, PhD, University of the West of England, Elaine McColl, PhD, Newcastle University, Alex J. Sutton, PhD, and Nicola Cooper, PhD, University of Leicester, and Frank Coffey, MMEdSci, Nottingham University Hospitals National Health Service Trust. All previously listed individuals received salaries for their contribution as this was part of their work. We are also grateful to Rose Clacy, lay research adviser, who attended project management meetings, helped draft and

Comparisons With Existing Literature
We found 1 Australian case-control study of infants with head or face trauma27 with which to compare our findings. Findings were consistent for changing diapers on high surfaces (OR, 1.77; 95% CI, 1.07-2.92) and the use of high chairs without harnesses (OR, 1.47; 95% CI, 0.90-2.31). We found a slightly raised odds of a fall in children who had not used walkers (OR, 1.22; 95% CI, 0.90-1.65), consistent with the Australian study (OR for ever using a baby walker, 0.83; 95% CI, 0.50-1.38). However, this was inconsistent with an increased odds of a head injury in those using a walker most days (OR, 2.47; 95% CI, 0.97-6.48) found in the same study.

Conclusions
If our estimated associations are causal, some falls from furniture may be prevented by incorporating fall-prevention advice into child health surveillance programs, personal child health records, home safety assessments, and other child health contacts. Larger studies are required to assess associations between use of bunk beds, baby walkers, playpens, stationary activity centers, and falls.

pilot study documentation, advised on recruitment strategies, and commented on drafts of the paper. Ms Clacy did not receive a salary but did receive payment for her time and expenses.

REFERENCES