

# Home safe home: Evaluation of a childhood home safety program

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<b>BACKGROUND:</b>	The London Health Sciences Centre Home Safety Program (HSP) provides safety devices, education, a safety video, and home safety checklist to all first-time parents for the reduction of childhood home injuries. The objective of this study was to evaluate the HSP for the prevention of home injuries in children up to 2 years of age.
<b>METHODS:</b>	A program evaluation was performed with follow-up survey, along with an interrupted time series analysis of emergency department (ED) visits for home injuries 5 years before (2007–2013) and 2 years after (2013–2015) implementation. Spatial analysis of ED visits was undertaken to assess differences in home injury rates by dissemination areas controlling differences in socioeconomic status (i.e., income, education, and lone-parent status) at the neighborhood level.
<b>RESULTS:</b>	A total of 3,458 first-time parents participated in the HSP (a 74% compliance rate). Of these, 20% (n = 696) of parents responded to our questionnaire, with 94% reporting the program to be useful (median, 6; interquartile range, 2 on a 7-point Likert scale) and 81% learning new strategies for preventing home injuries. The median age of the respondent's babies were 12 months (interquartile range, 1). The home safety check list was used by 87% of respondents to identify hazards in their home, with 95% taking action to minimize the risk. The time series analysis demonstrated a significant decline in ED visits for home injuries in toddlers younger than 2 years of age after HSP implementation. The declines in ED visits for home injuries remained significant over and above each socioeconomic status covariate.
<b>CONCLUSION:</b>	Removing hazards, supervision, and installing safety devices are key facilitators in the reduction of home injuries. Parents found the HSP useful to identify hazards, learn new strategies, build confidence, and provide safety products. Initial finding suggests that the program is effective in reducing home injuries in children up to 2 years of age. ( <i>J Trauma Acute Care Surg.</i> 2016;81: 533–540. Copyright © 2016 Wolters Kluwer Health, Inc. All rights reserved.)
<b>LEVEL OF EVIDENCE:</b>	Therapeutic/care management study, level V.
<b>KEY WORDS:</b>	Injury prevention; program evaluation; mixed-mode, survey methods; time series.

Injuries are the most important public health issue for children. In fact, injuries are the leading cause of death for children from age 1 year through their teenage years in Canada and many other industrialized countries.<sup>1,2</sup> While the burden of injury globally is astronomical, particularly for youth, this epidemic is largely preventable. According to the World Health Organization's 2008 World Report on Child Injury Prevention, nearly 1 million children (n = 950,000) younger than 18 years are killed each year from an injury, with 87% the result of an unintentional injury and potentially preventable cause.<sup>1,3</sup> To prevent childhood

injuries, strategies must take into account child development and changing environments, family lifestyles, and risk factors of youth.<sup>3–5</sup> For children younger than 5 years, most of their activities, and therefore, their subsequent injuries, take place in the home.<sup>6</sup> Falls, burns, poisonings, and drownings are all leading causes of mortality and morbidity from childhood home injuries that have had prevention programs implemented with varying degrees of reported program effectiveness, depending on outcome and sociodemographic factors.<sup>1,4,6,7</sup> Previous research of parenting interventions found that those using multi-faceted interventions seemed to be effective in reducing unintentional child injury, with interventions providing safety equipment seeming to be more effective in improving some safety practices than those interventions not doing so.<sup>5,7–10</sup>

Based on these findings, as the Regional Pediatric Injury Prevention Program at our Children's Hospital-London Health Sciences Centre (CH-LHSC) Trauma Centre, we developed a home safety program (HSP) for all first-time parents giving birth at our institution or at home in our region with support of a midwife. The goals of our HSP are to provide a primary prevention program to new families aimed at reducing the incidence of home injuries in London, Ontario and the surrounding area; to increase awareness of potential hazards and injury risks to children in the home; and to deliver safety devices along with home safety education to all first-time parents. The HSP provides safety devices, education, a safety video, and home safety checklist to all first-time parents for the reduction of childhood

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home injuries. The objective of this study was to evaluate the HSP for the prevention of home injuries in children up to 2 years of age (i.e., from the start of the program).

## METHODS

Children's Hospital, London Health Sciences Centre (CH-LHSC), is a regional pediatric Level I trauma centre for Southwestern Ontario, Canada. The CH-LHSC serves a geographic area of 19,000 km<sup>2</sup> with a pediatric population of more than 500,000. The LHSC is the only birthing center in the city and serves as a regional referral center providing specialized obstetric care to women in Southwestern Ontario, with approximately 6,000 births occurring at our center annually.

### Intervention

The HSP given to first-time parents consisted of a home safety kit containing nine different home safety products [in Canadian dollars (US dollars at 0.75 exchange rate)<sup>11</sup>]:

1. Door knob covers [cost, Can \$3.03 (US \$2.27)/unit]
2. Oven lock [cost, Can \$2.75 (US \$2.06)/unit]
3. Bath thermometer [cost, Can \$4.40 (US \$3.30)/unit]
4. Multipurpose cabinet latches [cost, Can \$3.03 (US \$2.27)/unit]
5. Press and pivot latches [cost, Can \$2.75 (US \$2.06)/unit]
6. Side-by-side cabinet lock [cost, Can \$1.93 (US \$1.45)/unit]
7. Electrical outlet cover [cost, Can \$1.93 (US \$1.45)/unit]
8. Furniture corner cushions [cost, Can \$1.65 (US \$1.24)/unit]
9. Window blind cord wind-ups [cost, Can \$1.93 (US \$1.45)/unit].

In addition to these safety devices, the kit also contained a home safety checklist for the parents to assess areas in their home that may not be safe for children, and a safety video entitled "Give Your Child a Safe Start" [cost, Can \$0.60 (US \$0.45)/unit] (<https://www.youtube.com/watch?v=PUxI8SqU2mk&list=PLXYSd3E5ACSieJmBRu9ssp7IAiuBIybUd>). This was a professionally produced video that promoted changes in parental knowledge, attitudes, and practices regarding injury prevention for children 0 to 5 years of age.<sup>12</sup> In addition to the video, the home safety kit also contained a safety booklet summarizing the information presented in the video. The home safety kit was in a bag at Can \$2.27 [US \$1.70] for a total of \$26.27/kit was distributed to all first-time parents, primarily in the birthing preadmission clinic. The kit was given to parents by the registered nurse (RN) at the clinic visit along with education via a 3-minute script consisting of information on the home safety checklist, safety in the home, developmental changes of the baby, and the importance of supervision to prevent injuries. Most expectant mothers were approximately in week 32 of their pregnancy at their preadmission clinic appointment. The HSP intervention was implemented at LHSC on April 2, 2013, for first-time families giving birth in our institution or during a home delivery, via regional midwives. This program is ongoing but contingent on grant funding.

### Survey Evaluation and Analysis

The HSP was evaluated through a mixed-mode survey using both Internet and telephone surveys. This evaluation was approved by the Western University's Health Sciences Research

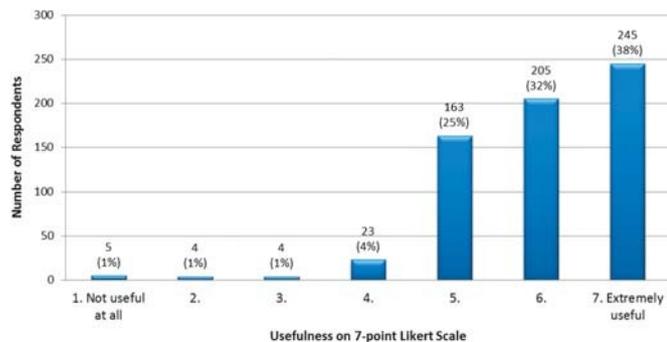
Ethics Board (REB# 102955). The 37-item questionnaire was developed and pretested to ensure the wording of the questions was not confusing. Following this, the reliability was examined via test-retest of new parents at a parenting class. The questionnaire contained questions on participant and child demographics; home injury and safety knowledge, attitudes, and behaviors; program implementation, satisfaction, and usefulness; and program improvements. Survey participants included all first-time parents receiving a home safety kit who agreed to a follow-up survey and provided a correct email address or telephone number. The distribution of the online and telephone surveys followed a modified Dillman technique.<sup>13</sup> Participants who provided an email address received an initial email invitation to participate, followed by three reminders, at 1 week, 2 weeks, and 1 month, for a total of four email invitations. Potential participants that provided a telephone number were called a minimum of three times, at varying times of the day, to help increase successful completion of the survey. Participation was anonymous, voluntary, and was not compensated. Online survey responses from May 2014 until September 2015, along with telephone survey response from January until May 2015, were summarized.

For the quantitative component, a combination of dichotomous "Yes/No" questions, multiple choice, and ordinal opinion questions ranked on a 7-point Likert scale were included. Descriptive analyses of the responses were undertaken including totals, percentages, medians, and interquartile ranges (IQRs). All analyses were performed using IBM SPSS Statistics version 23 (IBM Corporation, Armonk, NY).<sup>14</sup> For the qualitative component of the questionnaire, open-ended, opinion questions were included to provide insight into parents' thoughts on home safety, the program, and suggested improvements. Parent responses were then themed and divided into conceptual categories, independently by two data reviewers. Major and minor themes were derived from the response data. Qualitative results were presented in accordance with a reporting checklist for focus groups and qualitative research.<sup>15</sup>

### Statistical Analysis

#### Time Series Analysis

Time series analyses are advantageous in estimating the effects of interventions over time and in accounting for instability and variations in the data that may otherwise result in spurious statistical conclusions.<sup>16,17</sup> With the use of IBM SPSS Statistics version 23 (IBM Corporation),<sup>14</sup> an interrupted time series analysis with autoregressive integrated moving average (ARIMA) modeling was performed on the quarterly data of ED visits for home injuries, which included any injury occurring in the home by any mechanism such as falls, burns, drownings, struck/crushed by objects, contact with sharp objects and poisonings, from January 2007 to March 2015. Children, living in London, younger than 2 years were used in this analysis to coincide with the maximum age of the children who may have benefitted by the end of the study period. The intervention time point for the time series analysis was set at June 2013, which was the first complete quarter after the initiation of the HSP.



**Figure 1.** Respondents rating of the usefulness of the home safety program on a 7-point Likert scale ranging from 1, “not useful at all”, up to 7, “extremely useful”.

An additional series of analyses used the following covariates in the time series models to control for differences in socioeconomic status (SES) at the neighborhood level. For each SES measure, a cut-point was assigned to dichotomize the variables to be used in the time series analysis. The cut-point assigned to each of the following variables was for the lowest quartile to compare whether there were significant differences in trends based on the most vulnerable subpopulations. The variables and the cut-points used in this analysis included percentage of the neighborhood between 25 and 64 years with no high school diploma ( $\geq 8.8\%$ ), percentage of lone parent families ( $\geq 25\%$ ), median household income ( $\leq$  Can \$43,726), and percentage of the population who lived under the Statistics Canada low-income cutoff ( $\geq 54\%$ ). Neighborhood data were provided at the census dissemination area level through the 2011 National Household Survey.<sup>18</sup>

While it would have been ideal to collect SES data for each family during the ED visit, the hospital did not collect individual level SES data. Instead, we were required to use families' postal codes to determine the neighborhood level SES of the family through Canada census data. ArcGIS 10.3 (Redlands,

CA; Environmental Systems Research Institute)<sup>19</sup> was used to spatially identify the dissemination area for each family based on postal code. The SES variables of the dissemination area were then assigned to each individual child who visited the ED during the study period.

To assess if there was a change in all ED visits for children younger than 2 years living in London, additional interrupted time series analyses with ARIMA modeling were performed on the quarterly ED visits data for the following two control groups:

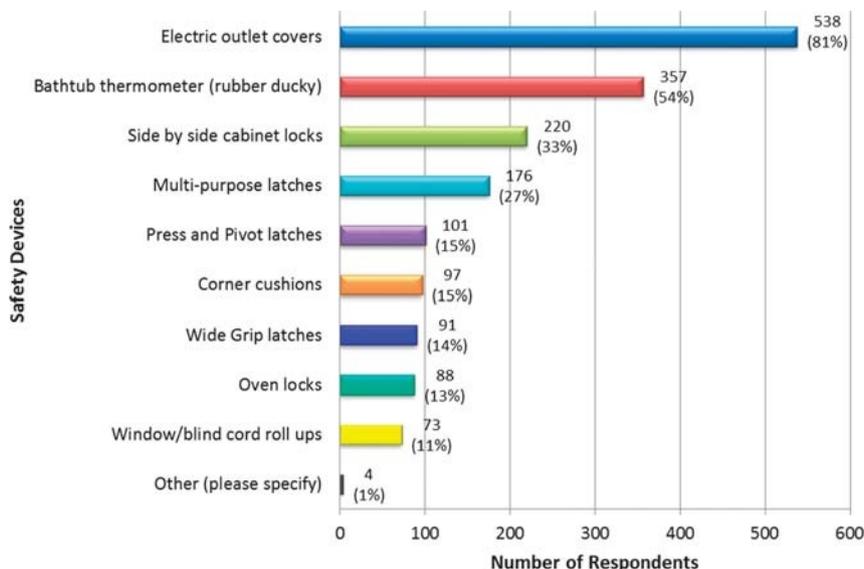
1. Non-home injuries, which included ED visits for all injuries that did not occur in the home; and
2. Non-injury, which included ED visits for reasons excluding trauma.

## RESULTS

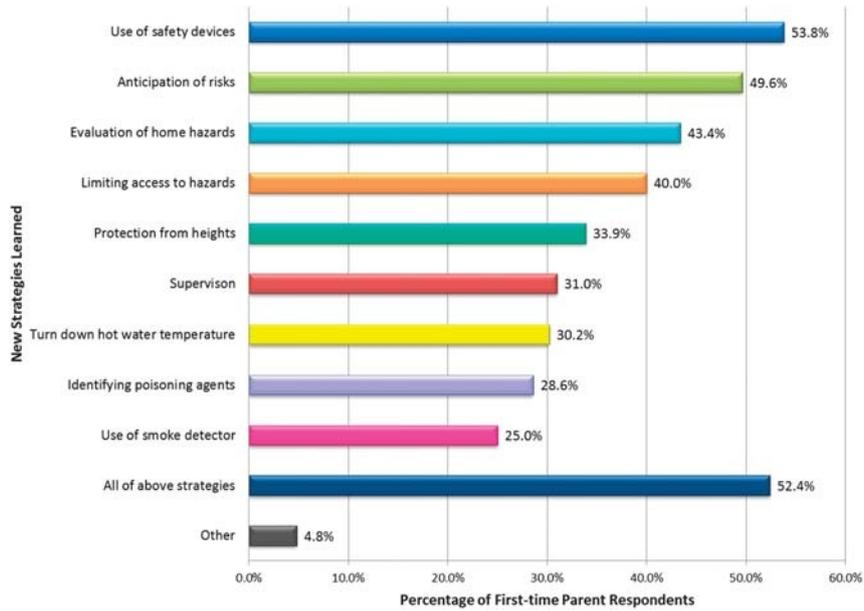
### Survey Evaluation and Analysis

A total of 3,458 first-time families participated in the HSP (a 74% compliance rate). Of these, 20% ( $n = 696$ ) of parents responded to our questionnaire, with 94% reporting the program to be useful (median 6; IQR, 2; Fig 1). In total 93% of respondents reported using the home safety kit provided. Parents reported electric outlet covers to be the most useful product in the kit (81%; Fig 2). When asked if these home safety devices were not given to them, 92% of parents reported they would have purchased them on their own. The majority of responding first-time parents (84%) was interested in having other home safety equipment, such as baby gates or car seats available at a low cost through CH-LHSC.

The median age of the respondents' infants were 12 months (IQR, 1), ranging from 8 to 18 months. More than half (55.3%) of respondents' infants were 11 to 12 months old at the time of completing the questionnaire. The home safety checklist was used by 87% of respondents to identify hazards in their home, with 95% taking action to minimize risks. The most common safety hazards reported were open electrical outlets (70%),



**Figure 2.** A summary of the most useful safety products contained within the home safety kit, as reported by first-time parents.



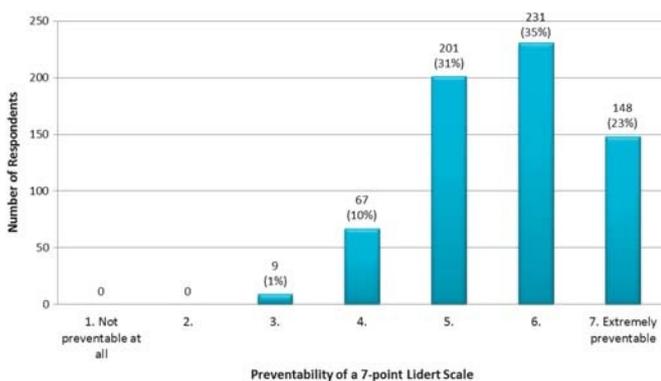
**Figure 3.** A summary of the strategies learned from the home safety program, as reported by first-time parent respondents.

followed by open stairways (65%) and accessible cupboards/drawers (55%). In total, 81% (n = 545) of respondents reported learning new strategies for preventing home injuries (Fig. 3). A review of parental attitudes found 88% of respondents rating home injuries as preventable (median, 6; IQR, 1; Fig. 4). Overall, 98% of respondents would recommend this program to other parents. Qualitative comments were themed into major and minor categories based on first-time parent survey responses (Table 1).

Process evaluation questions identified several areas of improvement. Approximately half of all new parents (57%) did not have the RN discuss home safety with them. As well, not all new parents received a copy of the video (23%). More specific suggestions for program improvement are presented in Table 1.

### Time Series Analysis

The time series analysis was performed on a total of 3,860 children younger than 2 years residing in London, Ontario



**Figure 4.** Respondents' rating of the preventability of home injuries on a 7-point Likert scale ranging from 1, "not preventable at all", up to 7, "extremely preventable".

(n = 2,796 before HSP; n = 1,064 after HSP) using an ARIMA (0,1,1) model to account for variability and seasonal effects in the outcome.<sup>17</sup> There was a significant decline in quarterly ED visits for home injuries both before (mean pre-HSP slope, -0.492 per quarter; SE, 0.162; t, -3.035; p = 0.005) and after (mean post-HSP slope, -5.717 per quarter; SE, 1.912; t, -2.748; p = 0.011) the initiation of the HSP, with a greater decline occurring after HSP (Fig. 5). In addition, there was a sudden rise of 27.525 (SE, 9.350; t, 2.944; p = 0.007) ED visits for home injuries between the HSP initiation and the quarter immediately following the HSP initiation, but ED visits continued to decline thereafter. With regard to SES effects, time series analyses did not find any significant associations over time between ED visits for home injuries and all four SES variables: no high school education, lone parent status, median household income, and low-income cutoff (all p values > 0.05). Moreover, the declines in ED visits for home injuries before HSP and after HSP remained significant over and above each SES covariate.

Results of the time series on the two control groups (non-home injury ED visits and noninjury ED visits for London children younger than 2 years) over the same 2007–2015 period did not reveal any change in the ED visits after HSP implementation.

### DISCUSSION

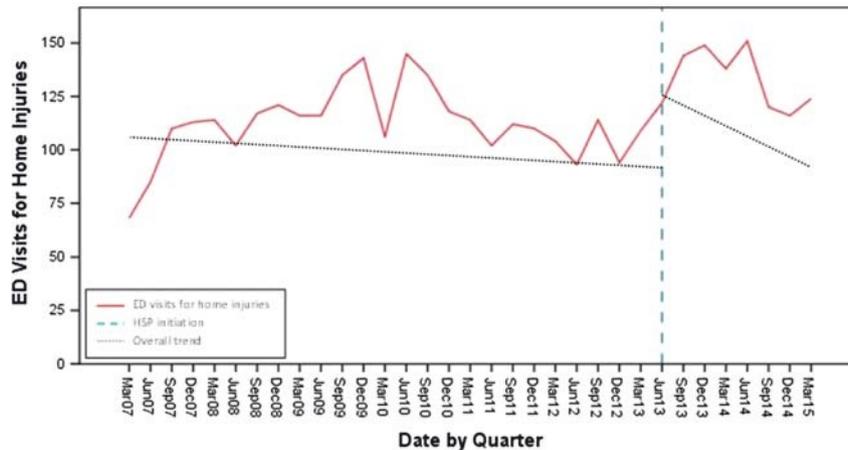
Injuries are the leading cause of mortality and a significant source of morbidity for youth.<sup>1,3</sup> The types and rates of injury are influenced by a child's age, stage of development, and environment.<sup>4,6,7,20</sup> Children younger than 5 years experience most of their trauma in the home, the environment in which they spend most of their time and where they are exposed to hazards that often result in fall, poisoning, drowning, and scalding injuries.<sup>4,20,21</sup> Injury prevention initiatives for children need to be age appropriate, aimed to minimize the injury risk in their environment.<sup>21</sup> Young children are vulnerable to many hazards but

**TABLE 1.** Major and Minor Themes Derived From First-Time Parent Survey Responses Regarding the HSP

Survey Theme	Examples of Comments From First-Time Parents Receiving a Home Safety Kit
1. Safety knowledge and awareness	<ul style="list-style-type: none"> <li>• “Thank you for all of the useful information. I felt much safer bringing my son home because of it.”</li> <li>• “It was great to receive the items in the kit and know they were there when I needed them. The program helped me to remember the importance of ensuring a safe environment for our little one as he continues to develop. I would recommend it to other parents, particularly to have a checklist of things that are easy to overlook (i.e., changing hot water temperature) if you don't know about them. Thank you!”</li> <li>• “There are so many topics to consider as new parents. It's great there's a program to help new parents become informed on home safety.”</li> <li>• “This is a great program! It saved us from having to determine many of the home safety devices we would need and made us aware of the hazards our little guy might face. Thank you for offering it! :)”</li> <li>• “I really appreciated getting this kit. As a first time mom with not too much access to young babies and children, it proved instrumental in raising my awareness and assisting me in making my home safe for my baby girl :) Thnx again”</li> </ul>
2. Confidence builder/decrease fears	<ul style="list-style-type: none"> <li>• “I think this program is fantastic! As a child and youth worker I was very aware of the possible hazards in our house but as a new parent with all the fears and worries that one would normally have it was nice to have a reminder of the little things that all add up to make a big difference.”</li> <li>• “Thank you. The information built confidence for first time parents.”</li> <li>• “The rubber ducky made it so that my husband was comfortable running our daughter's bath.”</li> </ul>
3. Cost savings	<ul style="list-style-type: none"> <li>• “This is an amazing program! I was on a tight budget with baby on the way and definitely couldn't afford to buy all the safety items needed for my home, this program helped me out huge and I used almost everything they gave me! Thank you !! :)”</li> <li>• “It was wonderful to receive the home safety kit. It saved our family some money at a time when it seems like you're constantly spending money on something for baby. A very generous (and important) program.”</li> <li>• “Great program, especially for families with less money or knowledge on keeping baby safe.”</li> <li>• “Excellent program, especially where people that don't have much money come in. Those safety devices are expensive and some people may not be able to afford them. This program makes them available for everyone and helps keeps all babies safer!”</li> </ul>
4. Accessibility	<ul style="list-style-type: none"> <li>• “I think distributing the products help make them more accessible to some parents. People are more likely to use them if they already have them than going and buying them.”</li> <li>• “I work with small children, so for me, I am accustomed to close supervision and potential hazards. This program very beneficial to low income and immigrant families. Thanks for providing.”</li> </ul>
5. Prepared in advance	<ul style="list-style-type: none"> <li>• “This was a great program. We got it before our son was born so I made the house safe before he arrived. Was nice not having a lot of fears or rushing to make things safe. It really helped prepare and make things easier. I am a first time mom so I never thought of all of these things. I am glad I was able to participate in it :)”</li> <li>• “This kit allowed us to be prepared in advance. Thank you so much for this wonderful program!”</li> </ul>
6. Room for improvement	<p><b>Presentation of Information</b></p> <ul style="list-style-type: none"> <li>• “The information was very basic, non-engaging to the reader, and did not highlight risks and benefits of the products being provided. It presented more like a marketing promo for the brand of safety products included. Recommend focusing on the function of products and a top down approach to scanning for safety issues within the home. The safety issues my toddler came upon were not addressed in any of the information (i.e. crossing raised thresholds, pulling down floor lamps, wiggling on change table and effectiveness of change table restraints).”</li> <li>• “Simplifying the message would help (i.e. Not so much paper). Choose a few key points and make an infographic or something more accessible to everyone. The language and layout of materials may discourage people who may not have high health information literacy. Overall - great work.”</li> </ul> <p><b>Timing</b></p> <ul style="list-style-type: none"> <li>• “Great program, just the wrong time for it. Before you have a baby you're worried about the delivery and getting to know baby. My baby is almost 11 months old and crawling and only now do I have a need for the products and info. I think that you should provide this stuff to moms around 6 months of age when they have the need for it and will ask more questions, and will be more receptive. Not pre baby...I just dug out my bag of stuff now.”</li> <li>• “The timing of the delivery of the information. We received the information at the</li> <li>• PAC appointment...not really relevant at the time as I was a first time parent and more concerned about the labor and delivery and the days immediately following birth. However on the other hand it was useful to have the devices ahead of time and access to the information.”</li> </ul> <p><b>Products</b></p> <ul style="list-style-type: none"> <li>• “The corner cushions were not effective, our child was able to remove them, might have to try a different manufacturer.”</li> <li>• “The oven latch isn't good. Just include more all-purpose latches.”</li> <li>• “Coupons towards baby gates - we live in a side split and have a lot of stairs so we need quite a few gates, and they are pricey.”</li> </ul>

have limited ability to recognize the danger. As such, children rely on parental supervision and physically limiting access to hazards in their home; interventions directed at the parents, not

the child.<sup>7,21,22</sup> Our study aimed to evaluate an HSP targeted to first-time parents for the prevention of home injuries in children up to 2 years of age, with regard to parental satisfaction



**Figure 5.** Solid red line represents quarterly ED visits for home injuries in children younger than 2 years in London, Ontario, Canada, from January 2007 to March 2015. Dotted black line represents the average decline in ED visits over time, predicted by the time series model. The dashed blue line represents the initiation of the home safety program.

with the program and reduction of ED visits for childhood home injuries.

The most successful injury prevention programs have used a multifaceted approach, geared to the parents, to reduce unintentional childhood home injuries.<sup>8,23</sup> Previous research has found that interventions providing free, low cost, or discounted safety equipment seemed to be more effective in improving safety practices than interventions that did not provide devices.<sup>7,10,23</sup> Based on these findings, our trauma program developed an HSP for first-time parents giving birth in our institution or at home with a midwife. This program provided education, nine home safety products, and a home safety video and accompanying booklet. Most similar programs are delivered via a home safety visit or in primary care;<sup>8,23-25</sup> thus, the current study is unique in providing this program in a birthing and trauma center located in the same hospital, CH-LHSC, as well as through RN home visits, specifically for higher-risk families or those who speak English as a second language.

A previous program delivered counseling and safety devices for safety improvement in homes that received safety kits, specifically related to falls, burns, poisonings, and suffocation.<sup>23</sup> While this study found that 64% of parents used the safety equipment in the safety kit, our study results were much higher at 93%. This may be partially explained by our lower response rate, and the parents that did respond to our survey may have been more safety conscious, using the safety items provided in the kit.

Based on the results of the time series with a mean post-HSP slope =  $-5.717$  ( $p = 0.011$ ), this translated into a statistically significant average decrease of six ED visits for home injuries per quarter, or 24 ED home injury visits per year, following HSP initiation. To put that in perspective, over a year, there was an average decrease of approximately two ED visits before HSP compared to the significantly larger average decrease of approximately 24 ED visits after HSP. There was not a direct cause-and-effect relationship between the decrease in ED visits for home injuries and the implementation of our program, but the greater decline in ED visits for home injuries after HSP is suggestive of a positive impact of the HSP, in combination

with the survey results. Further support included both control groups failing to demonstrate a significant decrease in other types of ED visits for children younger than 2 years. The only significant change in ED visits after HSP was for home injury. Further monitoring and examination of ED visits for home injuries is warranted.

Based on the survey results, first-time parents liked the HSP. Overall, 94% of parents reported that the program was useful, and nearly all (98%) respondents would recommend the program to other parents. The qualitative comments presented in Table 1 reinforce that our program increased safety knowledge and awareness, built confidence in new parents, made them feel prepared in advance, and increased accessibility. Access is a concern particularly in populations in need owing to financial or cultural reasons, such as low income and new immigrant families. As such, it is important to tailor the delivery method for difference SES, ethnic and educational groups,<sup>20</sup> which is what we have done by providing the HSP to high-risk parents and families that speak English as a second language in conjunction with our public health unit.

Increasing safety knowledge and awareness is a precursor to behavior change, but translation of knowledge into practices can be a difficult behavioral change to achieve in a one-off educational intervention.<sup>20</sup> Despite this, we were able to note self-reported behavioral changes in our respondent parents approximately 12 to 14 months after intervention including assessing their home for hazards and taking action to minimize those hazards. Parents reported using the home safety devices, particularly electrical outlet covers and the bath thermometer. Previous studies also found use of socket covers and other safety devices, as well as a home environment more conducive to child safety, and fewer observed hazards in the home of parents who participated in home safety interventions.<sup>8,24,26</sup>

These behaviors likely were not solely due to the safety education and the availability of safety devices. Parental beliefs and behaviors have been found to influence their willingness to embrace injury prevention messaging and change behavior, such as installing the safety equipment.<sup>20</sup> Given that 88% of our respondents rated home injuries in children as preventable, this

was a receptive audience to our safety messages, willing to read the information and watch the video provided, in addition to looking for and removing hazards in their home. This is evidenced by our results demonstrating that 87% of respondents used the home safety checklist to identify hazards in their home, with nearly all parents (95%) taking action to either eliminate the hazard or minimize the risk.

While our results of the potential effectiveness of our HSP are encouraging, this was an expensive program to deliver. The cost per kit was Can \$26.27 (US \$19.70), which translated into approximately Can \$60,342.19 (US \$45,256.64) per annum [based on an average 2,297 first-time mothers giving birth per year (CH-LHSC 2011–2015 data)]. Given that most parents reported that they would have purchased safety equipment on their own if not provided to them, this suggests an opportunity to target the program to those families most in need owing to financial, access, or educational concerns. The current results found that there were no SES factors, such as low income, lone parent status, or no high school education, that affected the overall time series findings for ED visits for home injuries. Further analysis in the future, with the accumulation of more data, will allow for continued examination of this issue to determine certain populations at high risk for which the program could be targeted. Examining rates of ED visits for home injuries before and after the intervention at a neighborhood level may also allow us to determine the social demographic characteristics of neighborhoods in which the intervention may provide the most benefit. This future work would provide evidence that could decrease program expenditures and allow for efforts focused at the parents and toddlers most in need of this intervention.

While targeting our HSP would decrease program expenditures, it would also limit the reach of our program to all first-time parents. Alternatively, a reduced kit consisting of the safety video, booklet, home safety checklist, and the most used safety device, the electrical outlet covers, could still be provided to all first-time parents, along with safety education, as we found 92% of parents reported they would have purchased safety devices on their own if not given to them. The establishment of a safety resource center at CH-LHSC could be considered, as most of the responding first-time parents (84%) reported being interested in having other home safety equipment, such as baby gates or car seats available at a low cost at our institution. Many American pediatric trauma centers have safety centers affiliated with their ED, gift shop, or at their primary care center.<sup>10,27</sup> A review of a safety resource center at a busy Level I pediatric trauma ED that provided both safety information and availability of safety products was found to be useful, well accepted, and 97% of families reporting using the safety products purchased at the center.<sup>10</sup> This could be a potential future option for CH-LHSC to provide home safety education and have safety products available for parents.

This study has several limitations. First, there was a low response rate. A mixed-mode survey design was used to increase response rates, in addition to improve sample composition, data quality, and lower survey costs.<sup>13,28</sup> Nevertheless, only 20% of our first-time parents responded, which may limit the generalizability of the survey results, favoring a more safety conscious group of parents. While our response rate was low at 20%, the average response rate from online surveys is generally

much lower than traditional mail out surveys at 33%.<sup>29</sup> Our survey data were self-reported and have all of the previously identified limitations associated with these types of data, including the primary threat to validity in our study that parents may have responded with what they believed we wanted to hear from them.<sup>30,31</sup> To overcome the desirability bias associated with self-reported data, we also used objective ED visits for home injuries and found that these significantly decreased after HSP, providing support for our initiative. Visits to the ED for home injuries had a sharp increase as our HSP was implemented. We have no data on changes or events that occurred in our region at this time to explain this increase. The increase in ED visits for home injuries was not associated with the implementation of the intervention, as the devices and education provided in the HSP are generally not used for months following the intervention, not at the time of receiving the intervention when the mothers were still expecting or have just given birth. Despite the initial increased ED visits, we were still able to demonstrate a significant decline in the number of ED visits for home injuries in the post-HSP implementation time period, particularly at 1-year after intervention at a time when most of the home safety products are starting to be required and used to restrict access to potential dangers. Again, we cannot conclude a direct causal relationship between the implementation of the HSP and the decline in childhood ED home injury visits, but it is suggestive, in addition to the survey results of parents receiving and using safety devices, as well as identifying and minimizing injury hazards in their homes.

## CONCLUSIONS

Removing hazards, supervision, and installing safety devices are key facilitators in the reduction of home injuries. First-time parents found our HSP useful to identify hazards, learn new strategies, build confidence, and provide safety products. More time is required to definitively assess the HSP effect on home injury incidence, but initial findings suggest the program is effective in reducing home injuries in children up to 2 years of age. Future directions include using spatial analysis to target the HSP to families at highest risk for home injuries, thereby decreasing the costs associated with implementing this program.

## AUTHORSHIP

All authors made substantial contributions to the conception, content, and revision of the manuscript. Additionally, T.C.S. designed the study, developed the questionnaire, performed literature searches, analyzed data and drafted the initial manuscript, as well as revisions. A.C. and J.G. developed the spatial methods and analysis of home injury and census data, as well as wrote the spatial methods and revised the manuscript. M.M. undertook the time series methods and analysis, in addition to revising the manuscript. J.E. implemented the Home Safety Program and revised the manuscript. T.H. and B.B. distributed the survey, interviewed parents, checked and summarized the data, performed literature searches, and revised the manuscript. K.V., N.P., D.F., and N.M. critically reviewed and revised the manuscript. All authors approved of the manuscript, as it has been submitted.

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## DISCLOSURE

The authors declare no conflicts of interest.

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