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Free Child Passenger Restraints for Patients in an Urban Pediatric Medical Home: Effects on Caregiver Behavior

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ABSTRACT

Context: Motor vehicle crashes are a leading cause of death in children despite the availability of effective child passenger restraints that reduce morbidity and mortality. Inappropriate restraint is more common in minority and low-income populations. Removing barriers by distributing child passenger restraint systems (CPRS) and providing education has been 1 approach to improve child safety. The objective of this study was to evaluate the efficacy of providing no-cost CPRS in combination with targeted education to improve restraint use for low-income, minority, and urban children in a medical home.

Design: This prospective, non-randomized, community-based cohort study used a certified car seat technician to provide CPRS and training to the caregivers of 101 children when those caregivers reported not owning the appropriate type of restraint system during the index clinic visit.

Results: In the first 3 months of follow-up, caregivers were 2.4 times more likely to report appropriate use of CPRS: relative risk 2.4 (95% confidence interval [CI] 1.7 to 3.5). Reported improvement declined slightly between months 4 and 9.

Conclusions: Appropriate restraint significantly improved, yet rates remained suboptimal. Multifactoral approaches are needed to understand why the set of patients studied and other at-risk populations may not use child restraints properly even when given access and information.

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INTRODUCTION

Motor vehicle crashes (MVC) are a leading cause of death among children in the United States.[1] Forty-five percent of children aged 14 and younger killed in crashes were not restrained in child passenger restraint systems (CPRS), which might have prevented many of the deaths of the younger children if used and used properly.[2] Rear-facing child passenger restraints reduce the risk of death by 71% for infants, and forward-facing systems reduce that risk by 54% for toddlers in passenger cars.[2] Proper restraint in belt-positioning booster seats has also been shown to reduce the risk of serious injury by almost 60%.[3] Factors such as the cost of these systems, lack of information, and beliefs and attitudes about the need for such devices prevent some caregivers from using them.[4-6] Additionally, CPRS can be improperly installed, diminishing their protective effects, and many adults are not sure which type of restraint is appropriate for children as they grow.[7-9]

Despite CPRS's role in saving lives, the best methods for promoting their use and verifying proper installation are still being determined, especially in at-risk minority and impoverished populations. Recommendations put forth by the National Highway Traffic Safety Administration (NHTSA) include vigorous, effective enforcement of strengthened child passenger safety laws, combined with culturally appropriate education by health care professionals and child safety advocates. This education should be focused on perception of risk in conjunction with distribution programs.[10] The US Task Force on Community Preventive Services has recommended distribution of CPRS in combination with educational programming, and the American Academy of Pediatrics (AAP) recommends advising caregivers about traffic safety at all preventive visits.[11-12] Wisconsin is 1 of many states attempting to improve child passenger safety by enacting legislation based on best practice recommendations of the AAP and NHTSA. Wisconsin's strengthened child passenger safety law, which went into effect June 1, 2006, mandated CPRS

for all children <8 years of age, <80 pounds, or <57 inches tall. Accordingly, we conducted a study in the context of the child's "medical home" pediatric clinic to evaluate the efficacy of providing a free CPRS, along with targeted education, to increase restraint use for low-income, minority, and urban children, thereby improving their safety and helping them meet this new legislative mandate.

METHODS

Design

This prospective, non-randomized, community-based cohort study evaluated the efficacy of providing, within a child's pediatric clinic "medical home," a free CPRS in combination with targeted education by a certified car seat technician to improve restraint use for low-income, minority, and urban children.

Population

The Downtown Health Center's (DHC) Pediatric Clinic serves a large, low-income, minority, inner-city population in Milwaukee, Wis, where the child poverty rate ranked fourth in the nation at the time of the study.[13] In 2006, the DHC served 4200 children and their families. Public insurance covers 92% of the clinic's population. The population is mostly black (80%), with a small but significant Latino (11%) population, most of whom reside in ZIP codes with average household incomes below the poverty line. Inappropriate restraint use rates were 37% clinic-wide during the time period of the study.

The sample used in this analysis consisted of 101 children ages <1 month to 7 years old being seen for preventive health care at DHC from February 2006 through January 2007. These children were identified as needing CPRS based on their caregiver's report of not owning an appropriate CPRS.

Intervention

After enrolling in the study, the families spent an additional 30 minutes with a certified car seat technician who selected the appropriate CPRS and instructed the caregiver about how to use it. The certified car seat technicians underwent a 1-hour-long clinic training conducted by the lead author, in addition to the 4 days of training necessary to complete the certification to be a car seat technician. The clinic training of each technician included a review of current state child passenger safety laws and instructions on how to: (1) provide families with information on their susceptibility to a car crash by providing local data about risk of injury and death resulting from crashes; (2) show families how to appropriately use car seats to reduce the risks outlined above; (3) teach families appropriate adjustments and positioning of car seats and straps to fit the child. Caregivers were required to demonstrate to the car seat technician proper installation of the child in the seat before leaving the clinic.

The technicians verbally provided these instructions to the caregiver, using a printed educational outline that was signed at the completion of the instruction by the caregiver and the technician to ensure all necessary topics were addressed. In addition, the caregiver was given a handout titled "Make Sure your Child is Riding Safely," published by the local agency Safe Kids Southeast Wisconsin. The caregiver took the CPRS home with instructions to install the seat in the vehicle used most frequently to transport the child and to visit the YMCA car seat fitting station for verification of proper installation.

Measures and Definitions

The Milwaukee Safe Passenger Survey was used to assess CPRS usage (Figure 1). This self-report survey was distributed to participants by clinic reception staff at the initial visit and, when possible, on return visits. The survey collected information on the child's age, weight, height, sex, ethnicity, home ZIP code, household income, the educational level of the caregiver, the type of restraint used for the child (pictorially represented), and the restraint's location in the front or back seat the last time the family used a vehicle. This survey has been assessed for face validity, content, and concurrent validity (κ 0.93), as well as inter-rater reliability (κ 0.70).

Our main outcome variable was appropriate use of CPRS as determined by the child's height, weight, and the restraint type the caregiver reported using. Appropriate use was based on current Wisconsin state law. The Wisconsin law, enacted in 2006, was modeled on best practice recommendations of the AAP and NHTSA.[14-16] Consistent with current Wisconsin state law, we classified a child as appropriately restrained if the caregiver indicated that the child was restrained in a rear-facing child safety seat in the back seat and the child was <1 year of age or weighed <20 pounds. Children in a forward-facing child safety seat in the back seat were appropriately restrained if they were at least 1 year old but <4 years old and weighed >20 pounds but <40 pounds. A belt-positioning booster seat was required for appropriate restraint when the child was >4 years of age but <8 years of age, weighed >40 pounds but <80 pounds, and was <57 inches tall. A safety belt was required if the child weighed >80 pounds

ID # _____**Voucher#**_____ **Today's Date** _____

Child's Age:_____yrs months **Child's Weight**:___lbs **Child's Ht** _____inches

Please circle the appropriate choice:
Child's Sex: a. Male b. Female
Child's Race/Ethnicity: a. Black b. White c. Latino d. Other _____
Child's Home ZIP Code _____

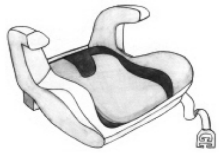
1. How did you arrive here today? *Please mark one choice for questions 2-6*
a. Car b. SUV c. Truck d. Van e. Taxi f. Bus g. Walked h. Other _____

2. The last time this child was in a car/van/truck/taxi where did they sit?
Please circle one answer either A1, A2, B1, B2, C, D, E, F1 or F2

A. In an infant carrier?
Please circle one: **A1. Facing Front A2.Facing Back**

B. In a car seat?
Please circle one: **B1. Facing Front B2. Facing Back**

C. In a high-back booster?



D. In a low-back booster?

E. In the seat with a seat belt?

Please circle one:
F1. In the seat? or **F2. In someone's lap?**

3. Where did your child sit? a. Front Seat b. Back Seat

4. Have you been involved in a car crash in the last 3 months when the child was riding with you? a. Yes b. No

5. At the time of the car crash where was the child sitting? (*see pictures in Question 1*)
A1. Infant Carrier Facing Back **A2.** Infant Carrier Facing Front **B1**. Car Seat Facing Front
B2. Car Seat Facing Back **C**. High Back Booster **D**. Low Back Booster
E. Seat Belt **F1**. In the Seat **F2**. In Someone's Lap

6. If yes, was the child injured or hurt in any way? *(Please check one answer.)*
No
Minor injury (did not need to go to doctor, clinic or emergency room)
Moderate injury (was treated by doctor, clinic or in emergency room)
Serious injury (was admitted to a hospital)

Figure 1. An example of the Milwaukee Safe Passenger Survey given to all participants.

or was 57 inches tall. If the child's weight was unknown and the caregiver did not indicate the direction of the car seat, we classified the child as appropriately restrained if he or she was 18 months of age or older, because 95% of these children would be >20 pounds according to the Centers for Disease Control and Prevention growth charts. Children 12-17 months were classified as having unknown restraint status if data about weight and direction of the seat were missing.

Analysis

In reporting percentages of appropriate restraint use, we excluded visits for which we had insufficient information (missing weight or restraint). Bivariate comparisons of appropriate restraint and each of the categorical independent variables were done using Chi-square or Fisher's exact tests. A Poisson regression model, which accounted for repeated measures on participating children using the Huber/White/Sandwich estimate of variance, was estimated to evaluate improvement in our outcome of appropriate restraint after the intervention, within age group.[17] Besides age, we also examined the effects of visit time since enrollment, household income, and caregiver's education level in the regression model. The number of visits was capped at 5 since only 1 child each had 6, 7, 8, or 9 total visits. Visits were classified into 4 groups: (1) enrollment visit, (2) visits within 3 months of enrollment, (3) visits within 3-6 months of enrollment, and (4) visits within 6-9 months of enrollment. Relative risks and their 95% confidence intervals (95% CIs) are reported to compare the probability of appropriate restraint in subsequent visit periods to the enrollment time point.[17] Our Poisson regression model sample included 149 visits by 54 children.

RESULTS

Study Sample

For this study, 101 enrollment and 120 subsequent (follow-up) survey forms were collected from participants. The average number of post-enrollment clinic visits was 2.8, with the median time between visits being 3 months (range 0-11 months). No follow-up restraint survey data was captured for 47 children. Participating children were nearly equally divided by sex (52 male, 49 female). Participating children spanned all age groups, with 17% being <1 year of age, 42% being 1-3 years of age, and 42% being 4-7 years of age. The racial/ethnic distribution was 88% (89) black, 10% (10) Latino, and 2% (2) white. Appropriate restraint use for all post-enrollment visits combined was 73%. Only 2 of the 101 restraints provided (2%) were inspected at the Northside YMCA. In children with ≥2 visits, appropriate restraint use

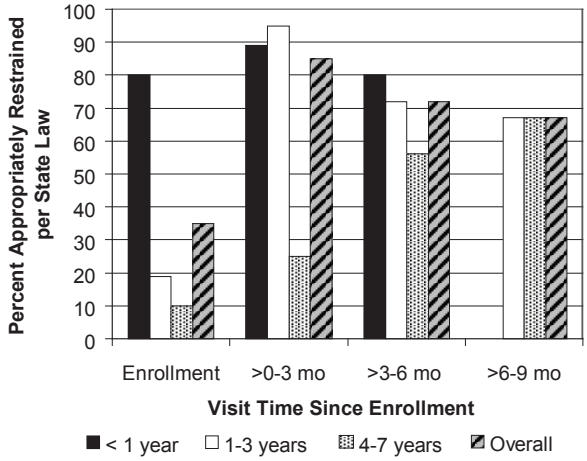


Figure 2. Appropriate restraint use among children with ≥1 follow-up visit(s).

increased from 35% at the enrollment visit to 85% at visits within 3 months of enrollment, and then gradually declined to 72%, and 67%, respectively, at 3-6 and 6-9 months after enrollment (Figure 2). The corresponding unadjusted relative risks for appropriate use compared to the enrollment visit were 2.4 (95% CI=1.7-3.5), 2.0 (95% CI=1.3-3.0) and 1.9 (95% CI=1.2-3.0) over the 3 follow-up time intervals. This pattern of an initial increase followed by a gradual decline in appropriate use held true for children <4 years old, but not for the 4- to 7-year-old age group, which showed a gradual increase over time (Table 1 and Figure 2). Families that reported higher annual household incomes and/or educational levels reported non-significant increased levels of appropriate restraint after the intervention compared to those with the lowest levels of income and/or education (Table 1).

In the Poisson regression analysis, household income and caregiver education were not found to be significant predictors of appropriate use and were dropped from the model, leaving age, time since enrollment, and the interaction of these 2 factors as predictive variables. The relative risk (probability) of appropriate restraint increased initially in the 0-3 month time period compared to enrollment for all 3 age groups (Table 2). Children <1 year old and 1-3 years old had subsequent declines in the relative risk of appropriate restraint, while 4- to 7-year-old children showed monotonically increasing but non-significant relative risks over the 3 post-enrollment time periods.

DISCUSSION

Overall, this study found that all 3 age groups initially increased CPRS usage, but the <1 year and 1 to 3 year

Table 1. Appropriate Child Passenger Restraint Use Rates by Age, Income, and Education Over Time

Characteristic	Enrollees (n)	Percent of Appropriate Child Passenger Restraint Use[a] (n) Enrollment Visit n=51[b]	>0-3 months n=34	>3-6 months n=43	>6-9 months n=21
Age (years)					
<1	17	80 (12)	89 (8)	80 (4)	No visits
1-3	42	19 (5)	95 (20)	72 (21)	67 (12)
4-7	42	10 (1)	25 (1)	56 (5)	67 (2)
Household Income					
<$30,000	84	33 (14)	86 (25)	63 (20)	67 (12)
≥$30,000	8	50 (2)	75 (3)	100 (5)	100 (1)
Unknown	9	40 (2)	100 (1)	83 (5)	50 (1)
Caregiver's Education					
Less than high school	36	33 (6)	80 (8)	71 (5)	56 (5)
High school or more	65	36 (12)	88 (21)	69 (25)	75 (9)

[a] Includes only the 54 children with at least 1 follow-up visit.
[b] Includes 3 children with insufficient restraint information on their enrollment visit to determine appropriateness.

olds gradually declined, while the 4- to 7-year-olds continued to improve. Appropriate car restraint was poor for the children before the intervention, improved to 85% during the first 3 months after receiving free CPRS and education, and then showed evidence of decline over the next 9 months to approximately 65%. This improvement to 65% leaves 35% of followed children, whose caregivers received a free car seat and education, inappropriately restrained by self-report. In the first 3 months, caregivers were 2.4 times more likely to report appropriately restraining their child. More than one-third of the families with follow-up were no longer reporting appropriate use 9 months after receiving the education and a CPRS. It is no surprise that sustaining behavior change is difficult. However, we had hypothesized that overcoming the barrier of cost, adding education, and including periodic follow-up survey questions in the medical home about restraint use would have reinforced the positive behaviors with better results. Household size, income, and educational attainment did not show a significant effect in this study population.

Providing injury prevention tools within the context of a medical home that focuses on prevention and care coordination could encourage appropriate CPRS. The benefits of the medical home model for improving car seat use rate were evident, yet were far from optimal beyond the first few months after receiving the car seats and booster seats. Consistent with national data, the older a child became, the less likely they were properly restrained. Most enrolled children given a booster seat were in safety belts upon their first visit. The educational program stressed the importance of moving out of a safety belt and into a belt-positioning booster seat. It may be particularly difficult to sustain behavior change for these families because children are transported by multiple caregivers in multiple vehicles. Additionally, children may object to moving back into a child seat once they have been using a safety belt. As adherence to child restraint use was better with younger children in this study, it is possible that focusing on reaching families before the point at which the child outgrows the forward-facing car seat would have better results than interventions at older ages. However, it was promising to observe the steady increase in the relative risk of appropriate restraint in 4- to 7-year-olds over time, despite these figures not reaching significance.

The study population did not follow through on inspection of the seat installation within the vehicle. We hypothesize that this may be due to the use of multiple vehicles, caregiver beliefs that older cars are safer than newer cars, or insufficient education about the importance of proper installation of the CPRS in the vehicle seat. Having to go to a separate location also may have been unduly inconvenient, and on-site inspection may have been preferable, although it would have increased the cost of the intervention. An alternative currently under evaluation at the clinic would include an on-site vehicle demonstration seat. Not only would the family need to install the child into the car seat as was done in this study, but we would have the parent install the seat into the demonstration vehicle seat to improve self-efficacy with what can be a difficult task.

CONCLUSION

Nationwide, minority children are at a greater risk of injury in MVCs despite overall improvements in unin-

Table 2. Change in Relative Risks of Appropriate Restraint Use Within Age Groups Over Time

		Months Post-Enrollment		
Age Group	**Enrollment**	**>0-3**	**>3-6**	**>6-9**
<1 year	1.0	8.9 (1.3-59.1)	8.0 (1.1-55.9)	-
1-3 years	1.0	9.5 (1.5-62.4)	7.2 (1.1-48.1)	6.7 (1.0-44.6)
4-7 years	1.0	2.5 (0.2-34.2)	5.6 (0.6-51.5)	6.7 (0.9-51.4)

Relative Risk (95% Confidence Intervals).

tentional injury rates.[18-20] Although great strides have been made in increasing the rates of appropriate child passenger restraint, minority children and children in low-income families have documented lower rates of appropriate restraint use.[21-23] Child passenger restraint use by families served by the DHC was lower than that seen in national and state data for children of similar ages and ethnic groups. Our study found that 73% of black children ages 1-3 years and 56% of those ages 4-7 years were appropriately restrained according to self-report. Considering that self-reported data may overestimate appropriate use, it is possible that actual proper use rates by participants in this study were even lower. Our data reveal use rates lower than those reported by the National Survey of the Use of Booster Seats (NSUBS), which found appropriate restraint use for 89% of black children ages 1-3 years and 74% of those ages 4-7, compared with rates for white children, which were 99% and 93%, respectively.[24] Nationwide data from the National Electronic Injury Surveillance System-All Injury Program (NEISS-AIP) identified the percentages of unrestrained black and Latino children passengers in hospital emergency departments to be 6 times greater than those of non-Hispanic white children.[25] Rangel identified a significant disparity in appropriate restraint use rates between minority and white populations with black race found to be an independent predictor for inappropriate restraint use.[23] Race is a proxy for many other things and perhaps reflects factors such as community norms, competing concerns regarding community safety, and other factors not adjusted for in Rangel's study. Overall, Rangel's finding, which was from a trauma center sample, and our ambulatory clinic data consistently show limited use of CPRS for black children and suggest the need for further studies exploring the underlying reasons for these disparities.

Our findings that a no-cost CPRS in combination with targeted education had an effect on restraint use for low-income, minority, and urban children may have been influenced by several factors. First, this is a community clinic-based study and a convenience sample with the attendant limitations of such studies. Self-report studies are prone to the social desirability response bias and may have an inflated number of responses participants consider approved or expected. However, as the overall appropriate use reported after enrollment was only 73%, it is unlikely that this bias affected our conclusions. An observational study would more accurately describe use patterns, but such studies are quite expensive. Furthermore, safety limitations related to public parking prevented installing the CPRS at the DHC and verifying proper use. Funding limitations of the grant prevented the research team from tracking use rates beyond those of the 101 car seats provided. There are many more children in need of appropriate CPRS in the clinic. Although there were 611 visits by the enrollees to the clinic during the study period, self-report surveys were only collected for 36% due to time constraints at visit registration, limiting the generalizability of the results. Second, the small sample of enrolled children precluded using multivariate models with more than a few predictor variables. Finally, we did not collect data on the use of restraints by the driver or other family members. While a cost-effectiveness analysis was not performed, the estimated cost of the convertible or combination seat provided was approximately $50 each. The cost of educating caregivers on proper installation included the cost of training a medical assistant as a certified car seat technician, was approximately $500. Each installation required approximately 30 minutes of the medical assistant's time.

In conclusion, improvement in appropriate use of CPRS can be seen within a medical home model of education coupled with distribution. Yet much more needs to be done to assess effective interventions that improve this population's rates of proper, long-term use of CPRS. Interventions may need to include more support of families and communities as they struggle to move on the continuum of behavior change. Further research and evaluation are imperative for creating effective targeted, community-based, culturally appropriate messages based on social theories of behavioral change and interventions to improve child-passenger safety for minority and low-income communities. Incorporating

behavioral and social science theories to improve unintentional injury prevention is important as we strive to understand the most effective means of influencing health-related decisions.

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