ORIGINAL ARTICLE

Child passenger safety for inner-city Latinos: new approaches from the community

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Injury Prevention 2006;**12**:99–104. doi: 10.1136/ip.2005.009480

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Accepted 20 January 2006

Objective: Motor vehicle crashes injuries, the leading cause of death for Latino children in the United States, can be reduced by the correct use of child safety seats. This study evaluated the ability of a community health worker education program to improve proper child safety seat usage in urban low income Latino families.

Methods: At a series of check events, proper child safety seat usage in families who had received an education intervention was compared with similar families who had not. The education intervention, provided by Latino community health workers trained as child passenger safety technicians, used videos and an office demonstrator. Members of the target community initiated the study and participated in its subsequent design and implementation.

Results: The families that participated in the study were primarily Mexican with low income, education, and acculturation levels. Forty six rear facing and 44 forward facing child safety seats were checked. Families exposed to the intervention were more likely to have their child's seat within the manufacturer's recommended weight/height range, their child facing the correct direction, the harness straps positioned properly, to have not been in a crash, the harness straps snug, the harness retainer clip used correctly, the seat belt routed correctly, and the seat belt locked.

Conclusions: Exposure to an educational intervention provided by community health workers trained as child passenger safety technicians was associated with child safety seats being used more properly than seats of families not exposed to the intervention in an urban low income Latino community.

Motor vehicle crash injuries are the leading cause of death for Latino children in the United States.[1] Many of these deaths could be prevented through the use of child safety seats, which Latinos have been shown to use much less frequently than non-Latino whites.[2–5] When properly installed and used, child safety seats reduce fatal injury by 71% for infants and 54% for toddlers.[6] Legislation and enforcement have partially improved seat belt and child safety seat usage for the country as a whole,[7 8] but large gaps in usage still remain. An Illinois Department of Transportation observational survey in 2001 showed overall child safety seat usage for infants and toddlers in Illinois to be only 78%.[9] Incorrect usage of child safety seats is also a major problem. A study by the National Highway Traffic Safety Administration (NHTSA) found critical misuses (meaning one or more errors in seat installation or usage that could affect seat performance in a crash) in 72.6% of all child restraint systems observed.[10]

Numerous clinical and community based interventions have attempted, with varying success, to improve seat belt and child safety seat usage.[5 8 11–18] Few of these studies involved interventions intended specifically for Latino communities.[5 16–18] In addition, few actual checks of child safety seat installation have been published.[10 11 17 20] This study evaluates the effectiveness of a child safety seat distribution program that was designed and implemented by members of a Latino community center in Chicago. As part of this program, families received a child safety seat and education on proper child safety seat usage. This study was a non-randomized intervention trial comparing proper child safety seat usage for families who had received the community center intervention to similar families with child safety seats from the community who had not received the intervention. Representatives from the community were actively involved in all phases of the study.

METHODS

The child safety seat distribution program

Centro San Bonifacio (CSB) is a community center which trains lay people from the local Latino community to be community health workers (CHWs).[19] CSB has distributed over 8000 child safety seats to low income Latino families using an office demonstrator as their primary educational tool. The office demonstrator simulates a motor vehicle seat and includes several different types of safety belt systems which provide the opportunity for simulated installation in a variety of vehicles.

The child safety seats CSB provides are priced on a sliding scale and are sold to families who participate in an hour long training session held in their office by Spanish speaking CHWs who are NHTSA certified child passenger safety technicians (CPSTs). Families learn about the program primarily through word of mouth since CSB does not have a formal advertising campaign. Families who request assistance are scheduled for a child passenger safety training session. At the training session, parents watch a NHTSA video *Protecting Your Newborn* (Spanish version, 26 minutes) and Public Service Announcement motor vehicle crash clips (provided by NHTSA, produced by the Insurance Institute for Highway Safety, 15 minutes). Using an office demonstrator, parents receive instruction and practice installing the seat they will receive. Education on installation is often not done in the vehicle because many families do not come to the training session with a vehicle.

Abbreviations: CHW, community health worker; CPST, child passenger safety technician; CSB, Centro San Bonifacio; NHTSA, National Highway Traffic Safety Administration.

Community based participatory research

Two academic researchers spent years building relationships with CSB by assisting with CHW training, grant writing, and program evaluation. This study was initiated when CSB requested assistance from the researchers to evaluate the effectiveness of their child safety seat distribution program which was unique from all other published programs. Representatives from CSB and from a neighborhood community health center contributed to the study by assisting with study design, recruiting the CPSTs and participants, advertising, providing space, providing child safety seats, entering data, and disseminating the results to the community after the completion of the study.

Study design

This non-randomized intervention trial compared proper child safety seat usage of infant and convertible seats for families who had received the CSB intervention to similar families from the community with seats who had not received the intervention. Families were included in the intervention group if they had received a child safety seat from CSB. To be included in the comparison group, families must have attended one of the check events in a vehicle with a child in a child safety seat and they must have been either Spanish or English speakers. Only children who presented in infant or convertible seats were included in the data analysis of proper usage although all children who came to the check events were evaluated by the CPSTs, including booster aged children and children in seat belts. We aimed to check as many seats as possible with the number of bilingual CPSTs and funding available. We anticipated we could check 150 child safety seats over three days.

Study implementation

We held child safety seat check events on three Saturdays in May 2004 at a community health center near CSB. Participants were defined as being in the CSB group if they reported receiving assistance from CSB. Participants were defined as being in the comparison group if they had no CSB affiliation and had come to the event in response to a community announcement. To recruit the CSB group, a CHW called parents who had received infant or convertible child safety seats from CSB in the nine months prior to the checks and invited them to the events. Parents were called up to three times before being coded as not available. Community organization leaders helped recruit participants for the comparison group. Comparison group participants learned about the events through notifications posted at various medical centers, other community centers, and through word-of-mouth; they were not scheduled or contacted by CSB or investigators. All CSB and comparison group participants were told they must come to a child safety seat check event with their child safety seats installed, children present, and that they would receive a $10 gift certificate for their participation.

Fourteen bilingual Latino and two African American CPSTs participated in the three child safety seat check events. The majority of CPSTs were staff or volunteers at CSB. CPSTs received $40 gift certificates for groceries as reimbursement for their time.

Each child safety seat check event lasted four hours. Six stations were set up in the parking lot of the community health center—three for CSB participants and three for comparison group participants. Three CPST instructors reviewed the check points before the checks began and were then available for questions throughout the day. The CPSTs worked in teams of two and checked all seats in each vehicle for proper installation and child placement before correcting them. Seats that were damaged, recalled, or the wrong size for the child were replaced with new seats. Finally, a CPST instructor inspected each seat for proper usage before the vehicle left. Depending on the number of children, each vehicle took between 20–60 minutes.

No single standard scale exists for measuring proper child safety seat usage. Thus we compiled a list of measures defining proper child safety seat usage based on data from the National SAFE KIDS Campaign[21] and from a study published by Decina for NHTSA.[10] The SAFE KIDS campaign evaluated up to 40 elements for proper use of child safety seats. In the Decina study, a panel of experts compiled a consensus report identifying critical misuse errors for rear facing and forward facing seats that were most commonly encountered. We combined these results to make a scale for rear facing and forward facing child safety seats that incorporated all of the common and critical misuse measures identified by these two studies. CPSTs then recorded these measures for all rear facing and forward facing seats on a standard form. These measures are listed in table 1.

Data analysis

Data were entered into Excel and then double checked by investigators. The demographic analysis was performed using only one data point from each family, while subsequent analyses counted each child individually. Data were imported into Stata8 SE[22] where χ^2 analyses and Fisher's exact tests (if $n<6$) were performed to compare proportions between the CSB and comparison groups on the demographic variables. Generalized estimating equations (GEE) logistic regression[23]

Table 1 Measures used at child safety seat check events to assess proper child safety seat usage for rear facing and forward facing child safety seats*

1. Seat certified that it meets FMVSS 213 (federal safety standards for child safety seats)
2. Child within manufacturer's recommended weight/height range†
3. Child facing correct direction†
4. Harness used†
5. Harness straps snug†
6. Harness straps at or below shoulders (rear facing)/above shoulders (forward facing)†
7. Safety belt routed correctly†
8. Safety belt holding seat tightly in vehicle (1 inch test)†
9. Safety belt locked†
10. Seat not involved in crash
11. Seat not in front of airbag
12. Harness retainer clip used
13. Harness retainer clip threaded correctly
14. Harness retainer clip at armpit level
15. Not using after-market add on products (rear facing seats only)

*Measures developed from the National SAFE KIDS Campaign[21] and from a study published by Decina for the National Highway Traffic Safety Administration.[10]
†Described in Decina[10] as the most common critical misuse errors.

(using PROC GENMOD in SAS 9.1 for Windows) was used to examine if there were significant differences between groups in terms of type of seats checked and to control for any family correlations. Infant only seats and convertible seats installed in the rear facing position were combined into one ''rear facing seat'' category. All other convertible seats and combination toddler/belt positioning boosters used with a harness were categorized as ''forward facing seats.''

For the analysis of proper usage, children in booster seats (n = 16), seat belts (n = 9), or who had not yet been born (n = 3) were dropped. In both the rear facing and forward facing seat categories, four families had two children in the dataset while the rest had only one child. GEE logistic regression was attempted using SAS[23] to compare installation and usage measures and to control for any family correlations, but about half of variables had convergence problems. Estimates of variables that did converge were similar to those generated by ordinary logistic regression; thus we converted to ordinary logistic regression. Quasi separation of several data points was noted. (For logistic regression model intended for binary outcomes, parameter estimation is usually based on maximization of the (log) likelihood function (maximum likelihood method). However, in some cases the parameter estimates do not converge to finite values, which is due to a special data configuration known as ''separation''. The simplest example of separation is a 2×2 table with one zero cell.[25] In that case, the predictor can almost perfectly allocate observations to their response groups. Separation occurs when all values below some cutoff are associated with one category of outcome. When that happens, the odds ratio associated with the predictor is not defined (because there is no gradual changeover from one category to the other). In our analysis of a binary outcome and a single binary covariate, ''quasi separation'' of several data points was noted. For these variables, we used logistic regression with Firth's bias reduction (penalized maximum likelihood approach) to lead to finite parameter estimates in the SAS macro FL.[23–25]

Ethics

The children's caregivers signed a written consent prior to participation. This study was approved by the Institutional Review Boards at the University of Chicago and the University of Illinois at Chicago.

RESULTS

Seventy eight families attended the child safety seat check events. Forty five families (58%) received the CSB intervention and 33 families (42%) were in the community comparison group. Demographics of CSB and comparison group parents are presented in table 2. Parents in both groups were primarily married, Mexican, and had low education, acculturation, and income levels. The comparison group contained more ethnic groups with higher education levels and higher acculturation scores than the CSB group. There

Table 2 Demographic characteristics of caregivers at child safety seat check events for Centro San Bonifacio and Comparison Group Participants

Demographic characteristic	Centro San Bonifacio group (n = 45)	Comparison group (n = 33)	p Value *
Median child age	1 year (range 3 weeks–3 years)	1.9 years (range 3 days–7 years)	0.19
Median parent age	29 years (range 17–48)	33 years (range 18–56)	0.22
Parent marital status			0.34
Married/common law union	39 (87%)	28 (85%)	
Single	5 (11%)	4 (12%)	
Divorced/Separated/Widowed	1 (2%)	0	
Parent ethnic group†			0.00
Mexican	39 (87%)	18 (55%)	
Puerto Rican	0	8 (24%)	
Central/South American	5 (11%)	3 (9%)	
Other	0	4 (12%)	
Parent years of education			0.01
6 years or less	13 (29%)	8 (24%)	
7 to 12 years	19 (42%)	5 (15%)	
Graduated high school/GED	8 (18%)	8 (24%)	
Attended university	4 (9%)	11 (33%)	
Parent mean acculturation level‡	1.5 (range 1–4)	2.5 (range 1–5)	0.01
Parent median years living in US	11 (range 2–30)	20 (range 3–56)	0.15
Parent median monthly income	$2120 (range 0–26,000)	$1747 (range 0–10,000)	0.60

*Determined by χ^2 analysis and Fisher's exact test between two groups.
†Ethnicity determined by self report.
‡Acculturation level is measured using the Marín Marín Language Use Scale. The range is from 1 to 5 where one is the lowest acculturation (Spanish only) and 5 is the highest (English only).[26]

Table 3 Child restraint systems inspected at child safety seat check events

Type of child restraint system	Centro San Bonifacio group, 66 seats checked (%)	Comparison group, 52 seats checked (%)	p Value*
Infant only	26 (39)	16 (31)	0.26
Rear facing convertible	5 (8)	2 (4)	0.50
Forward facing convertible	26 (39)	18 (35)	0.35
Booster	6 (9)	10 (19)	0.90
Seat belt	3 (5)	6 (12)	0.16

*Determined by generalized estimating equations (GEE) logistic regression.[23]

was no difference in the rates of vehicle ownership (p = 0.66) or type of vehicle (p = 0.22).

The child safety seats, booster seats, and seat belts of 118 children were checked at the events (see table 3). No statistical difference existed between the CSB and comparison group regarding type of seats checked. Twenty nine of the comparison group participants reported where they had received their child safety seat. (The remaining 24 participants were missing data on this question.) Sixteen reported buying their seats from a store, six were gifts, six received them from a hospital/health center, and one was borrowed. Only four reported receiving any education other than the standard written instructions when obtaining their seat.

Table 4 shows odds ratios comparing proper child safety usage measures. Rear facing seats in the CSB group were more likely than the comparison group to have the seat facing the correct direction for weight and height, to have the harness straps below the shoulder, and to have the seat belt routed correctly. Forward facing seats in the CSB group were more likely than the comparison group to have met federal safety standards for child safety seats, to not have been in a crash, to have the correct seat for weight and height of the child, to have harness straps snug, to have the harness retainer clip threaded correctly, to have the harness retainer clip at armpit level, and to have the seat belt locked.

Some of the individual proper usage measures were incorrect in a large portion of participants. Very few participants had snug harness straps. (Rear facing seats: CSB group 23%, comparison group 27%. Forward facing seats: CSB group 39%, comparison group 6%.) The safety belt was tight enough only for a few participants. (Rear facing seats: CSB group 13%, comparison group 13%. Forward facing seats: CSB group 31%, comparison group 11%.) The harness retainer clip was at armpit level for about half of participants. (Rear facing seats: CSB group 48%, comparison group 27%. Forward facing seats: CSB group 65%, comparison group 11%.)

New seats were provided to any family attending the check events if incorrect child size or seat damage was noted. Twelve new rear facing seats were provided to CSB families and nine were provided to comparison group families (OR 0.42; 95% CI 0.12 to 1.49; p = 0.20). Only one CSB family required a new forward facing seat, while 17 comparison group families were provided forward facing seats (OR 0.002; 95% profile penalized likelihood CI <0.001 to 0.04; p<0.001).

DISCUSSION

The data from this study suggest that receipt of child passenger safety education, which includes demonstrated installation from Latino CHWs trained as CPSTs, is associated with improved proper child safety seat usage compared to community families not exposed to this education. These results add to our understanding of child passenger safety by showing an intervention which overcomes language, cultural, and socioeconomic barriers. Latinos have been shown to have significantly lower knowledge of child safety seats than non-Latino whites with knowledge scores that decrease with less fluency in English, lower income, and fewer years of education.[27] In addition, they frequently lack consistent access to one vehicle and fear enforcement and government agencies who often serve as educators on vehicle safety. The traditional Latino belief systems of *familismo* (family included in all decisions) and *personalismo* (information is more reliable if comes from a trusted source) also complicate education in this community.[28 29] These barriers would be expected to produce more incorrect child safety seat usage than seen in the general population, but we saw the opposite in this study.

We believe part of the effectiveness of this program can be attributed to the CHW training received by the CPSTs. These specially trained CPSTs were able to communicate appropriately with families and understand their concerns and challenges, while at the same time empowering the families to overcome common barriers to properly securing their

Table 4 Odds ratios of proper child safety seat usage measures for Centro San Bonifacio group (n = 57) compared to comparison group (n = 33)*

	Rear facing seats (n = 46)			Forward facing seats (n = 44)		
Proper usage measures	Centro San Bonifacio group, n = 31 (%)	Comparison group, n = 15 (%)	Odds ratio (95% CI)	Centro San Bonifacio group, n = 26 (%)	Comparison group, n = 18 (%)	Odds ratio (95% CI)
Seat certified that it meets FMVSS 213 (federal safety standards for child safety seats)	27 (87)	15 (100)	0.25 (0.002–2.87)§	26 (100)	13 (72)	21.59† (2.19–2914.73)§
Child within manufacturer's recommended weight/height range	28 (90)	11 (73)	5.09‡ (0.81–31.90)	23 (88)	6 (33)	21.08† (3.65–121.84)
Child facing correct direction	30 (97)	11 (73)	10.9† (1.10–108.55)	25 (96)	17 (94)	4.37 (0.22–653.34)§
Harness straps snug	7 (23)	4 (27)	0.84 (0.20–3.47)	10 (39)	1 (6)	10.67† (1.21–93.69)
Harness straps at or below shoulders (rear facing)/above shoulders (forward facing)	23 (74)	3 (20)	10.54† (2.33–47.67)	18 (69)	12 (67)	1.20 (0.27–5.40)
Safety belt routed correctly	26 (84)	8 (53)	4.88† (1.10–21.69)	24 (92)	15 (83)	4.80 (0.46–50.50)
Safety belt holding seat tightly in vehicle (1 inch test)	4 (13)	2 (13)	0.92 (0.015–5.75)	8 (31)	2 (11)	3.76 (0.67–20.47)
Safety belt locked	19 (61)	10 (67)	0.63 (0.16–2.48)	19 (73)	7 (39)	4.34† (1.06–17.86)
Seat not involved in crash	29 (94)	14 (93)	2.07 (0.12–35.61)	25 (96)	11 (61)	13.64† (1.46–127.13)
Seat not in front of airbag	29 (94)	15 (100)	0.38 (0.003–5.07)§	26 (100)	18 (100)	¶
Harness retainer clip threaded correctly	23 (74)	9 (60)	2.19 (0.58–8.33)	20 (77)	5 (28)	8.0† (1.87–34.23)
Harness retainer clip at armpit level	15 (48)	4 (27)	2.75 (0.71–10.61)	17 (65)	2 (11)	14.57† (2.57–82.73)
Not using after-market add on products	26 (84)	10 (67)	1.95 (0.37, 10.31)	NA	NA	NA

*Incorrect and missing results included but not individually shown.
†p<0.05.
‡p<0.10.
§Firth's bias reduction was used instead of ordinary logistic regression which generated 95% profile penalized likelihood confidence intervals.[23–25]
¶Unable to calculate using logistic regression because all were correct for both groups.
NA, not applicable.

children. The unique educational format of this intervention may also have contributed to its effectiveness; families watched a standard safety video but also practiced installation and use with an office demonstrator. CSB felt the office demonstrator was crucial for education in this low income community where families often share vehicles and have to frequently transfer child safety seats. It offers families the means to learn how to install the seat correctly in a variety of vehicles and seat belt systems. This study suggests the need for a rigorous trial to clarify the effectiveness of the office demonstrator compared to the more standard practice of training families in their own vehicles.

Not all of the individual proper usage measures were better in the CSB group, indicating the intervention worked better only for some measures. Thirty three percent of comparison group participants with forward facing seats had the child within the recommended weight/height range and only 61% knew if their seat had been involved in a crash. These percentages were much higher in the CSB group which suggests the intervention is strong in these areas. However, few participants in either group had the harness straps or seat belt tight enough. The harness retainer clip also was frequently used incorrectly. These areas need further emphasis in future interventions.

This study has several limitations. We could find only 14 Spanish speaking CPSTs in Chicago, the majority of which had an affiliation with CSB and had seen some of the study participants previously, making us unable to blind the CPSTs to the study groups. Funding limitations made randomization unfeasible. In addition, language appropriate child safety services in this community are so poor that we could not determine an ethically acceptable option for a control group. A possible solution in the future would be to train bilingual CPSTs who can be compared to CPSTs with additional CHW training. The study is also not population based and therefore cannot be generalized to the Latino population as a whole, although it does provide useful pilot data which can be used to design future interventions.

Because the intervention and comparison groups were not randomly assigned, differences between them introduced potential biases. Selection bias likely occurred for the intervention group because people who were more highly motivated or who had more immediate need of services were more likely to seek out CSB for child safety seats. Comparison group participants seemed to have been motivated to attend the check events because of an acute need, such as the need for a new seat, while the CSB participants probably attended the check events more out of a desire for the gift certificate or for further education. Some of the CSB clients who were invited to the check events but declined reported they did so because they did not have access to a vehicle on that day, which suggests the families that did attend had more consistent access to vehicles. Both these factors could have made the CSB program appear more effective. Alternately, the higher education and acculturation levels in the comparison group would be expected to result in increased proper use of child safety seats among comparison group participants. Thus the benefit of the CSB program might have been even greater if the two groups were more similar demographically. Because this was a pilot study and no data exist predicting the effect size of this intervention, we did not calculate a sample size or use power calculations in the design phase of the study. However, post hoc power calculations do suggest that we were underpowered on many of our variables. Given that we saw an effect of the intervention when underpowered, this underscores the importance of those effects we did identify.

While community based interventions have been shown in multiple small studies to increase child safety seat usage,[5 13] this study highlights a unique intervention in the Latino community where motor vehicle safety is still understudied. The child safety seats of the CSB program participants were used more correctly than the seats of families from the same community. This implies that effective child safety seat education can be provided in inner-city low income Latino communities through the use of an office demonstrator and CHWs trained as CPSTs. In addition, involving these communities in the prevention effort, not just as recipients of services and education, but also as planners and implementers of safety programs, can reduce barriers to proper child safety seat usage. The CSB program may serve as a model which can be replicated to improve motor vehicle safety for Latino children in other areas of the United States.

Key points

- The effectiveness of child passenger safety technicians to improve proper child safety seat usage in Latino communities is not known.
- The effectiveness of community health workers to improve proper child safety seat usage in Latino communities is not known.
- Our follow up checks show that child safety seats were used more properly in Latino families who had received an education intervention from Latino community health workers trained as child passenger safety technicians than in families who had not received the intervention.
- This study suggests that Latino child passenger safety technicians from the target community can improve proper child safety seat usage.

ACKNOWLEDGEMENTS

Financial support for this study came from the Robert Wood Johnson Clinical Scholars Program at the University of Chicago and from the Department of Pediatrics at the University of Chicago. The West Town Neighborhood Health Center donated the use of its facilities and helped significantly to advertise the check events in the community. Child safety seats distributed to families at the check events were provided by Centro San Bonifacio who had received them as part of grants from the National Highway Traffic Safety Administration (DTNH22-03-05153) and State Farm Insurance. Special thanks go to all the CPSTs, CHWs at Centro San Bonifacio, and staff at the West Town Neighborhood Health Center who gave generously of their time and enthusiasm despite rainy and unpleasant conditions. They participated in these events out of a commitment to child safety and because of love for their community. They include: Gilma Arguello, Guadalupe Avila, Maria Chavez, Toni Frank, Jose Galaza, Lizbeth Harrison, Aurora Mendez, Irma Pacheco, Nancy Rivera, Mariana Ruano, Ervin Sample, Dolores Sanchez, Gustavo Sanchez, Julio Sanchez, Orlando Sanchez, Rosario Sanchez, Cruz Tapia, Wanda Vasquez, Elizabeth Villatoro, and Eligio Zareo.

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Competing interests: none.

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Lacunae

''Danger, drunk sign-writers''