INFANT PASSENGER RESTRAINT EDUCATION STUDY

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ABSTRACT

This study evaluates whether a hands-on educational intervention makes a significant difference in the proper use of an infant passenger restraint by a parent. The sample was chosen from parents who were at least seven months pregnant and who planned to transport their infants in passenger motor vehicles. Each participant was randomly placed in one of two groups. All participants received a free infant car seat and a standardized education session on the safety and use of infant passenger restraints. The experimental group received an additional component consisting of a hands-on demonstration and return demonstration of correct installation and use in their own vehicle. All hands-on teaching was done by RNs who were nationally certified Child Passenger Safety Technicians. Follow up observations of correctness of use was done by appointment several months after birth using a standardized observation tool.

The total sample consisted of 111 parents. There were 56 in the intervention group and 55 in the control group. Participants ranged in age from 19 to 53 years, with the majority in their 30's. Most were women. They were well educated, with above average incomes. A high number were of Asian ethnicity. A total of 24 (22%) had correct use. Of these, 18 (32%) were in the intervention group and 6 (11%) were in the control group. The intervention group was 4 times more likely to have correct use than the control group (odds ratio 4.3, P value=0.0074). The number of errors per person was 0 to 7, with most having 0 to 2. The rates of errors were 33% less in the intervention group (ratio of 0.67). There were few serious errors. Secondary variables tested in regression analysis were age, education, income, and help from others. None of these variables was found to have a
significant effect on the outcome.

The hands-on educational intervention made a significant difference in the proper use of a child passenger restraint by a parent. This study demonstrates the value of hands-on teaching for parents to learn how to install and use a child car seat. Everyone who transports a child in a motor vehicle should have access to this type of education. Nurses, physicians, and others working with families should encourage them to seek out this kind of teaching, and should advocate for more programs which offer this service.
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CHAPTER 1
INTRODUCTION

Despite improvements in vehicle design, child restraints, and legislation requiring children to be restrained in motor vehicles, too many children continue to die and receive serious injuries in car crashes. Evidence is clear that most injuries and deaths of children in motor vehicles are preventable with proper use of restraints, yet most children are not properly restrained. Evidence is less clear on what factors prevent parents from properly restraining their children. An area of potential impact is education and information provided to parents.

A variety of educational interventions have been offered to parents, expectant parents, and children over the years to help them learn appropriate passenger restraint use. Few recent articles reporting these programs include a well-designed evaluation component, making it difficult to measure effectiveness.

Purpose

The purpose of this study was to evaluate whether a hands-on component of an educational intervention makes a significant difference in the proper use of a child passenger restraint by a parent. It was expected that the findings would provide information that could be used in designing effective programs to educate parents about child passenger safety, and in so doing, affect a critical factor in determining their overall health and wellness.

Background and Significance

Injuries are the leading cause of death in the United States for children over the
age of 1 year. They are responsible for more deaths and disabilities in children than all
causes of disease combined. Even for the infant less than 1 year, injuries are a significant
cause of death. In Hawaii from 1999 to 2003, unintentional injuries were the fifth leading
cause of death for infants less than 1 year old, following only congenital anomalies, short
gestation, maternal pregnancy complications, and sudden infant death syndrome (National
Center for Injury Prevention & Control [NCIPC], 2006a).

Motor vehicle (MV) related injuries account for the highest number of injury
deaths in children (Anderson, Kochanek, & Murphy, 1997; Centers for Disease Control
and Prevention [CDC], 2005). From 2000 to 2002, motor vehicle injuries were
responsible for 39% of deaths from unintentional injuries for children 1 to 4 years old in
Hawaii (NCIPC, 2006d; NCIPC, 2006e). Infants under 1 year of age also have a high
death rate from MV crashes. In 2003, 144 infants less than 1 year of age died in
unintentional motor vehicle crashes in the United States, second only among
unintentional injury deaths to unintentional suffocation with 619 deaths (NCIPC, 2006b).

The primary reason for MV occupant deaths for all ages is a failure to be properly
restrained. Child restraints, used properly, are highly successful in reducing the risk of
death or serious injury in the event of a car crash. The use of child safety seats has been
found to reduce fatal injury by up to 71% for infants and 54% for toddlers (“Child
spite of this demonstrated effectiveness, many parents do not restrain their children while
riding in cars and trucks, or restrain them improperly. The result of this behavior is that
children are needlessly being killed and seriously injured.
Despite the demonstrated effectiveness of child safety seats, their increased availability, and child restraint laws that have been in effect in every state for over 20 years, the leading cause of death among children between the ages of 1 and 4 years in the United States continues to be injuries sustained as MV occupants ("Child Passenger Restraint Use," 1991; NCIPC, 2006b). In 2004, 1638 passengers under 15 years of age died in MV crashes in the United States. An additional 214,000 child occupants were injured (National Highway Traffic Safety Administration [NHTSA], 2005; NCIPC, 2006c). An average of 5 children were killed and 585 injured every day in MV crashes in 2004 (NHTSA; NCIPC, 2006c). A total of 938 (55%) child passengers who died in MV crashes were not restrained at the time of the crash (NHTSA 1996 data as cited in "Notice to Readers," 1998). In 1994, 5,972 children under 11 were passengers in fatal crashes. About 20% of them (1203) were killed. Approximately 54% (647) of the fatally injured children were not restrained. Only 12% of unrestrained children were not injured (National Transportation Safety Board [NTSB], 1996).

In Hawaii, studies done by the University of Hawaii Department of Urban and Regional Planning since 1990 have shown use of child safety restraints to vary by year and by location (Kim, Hockey, & Watase, 1997; Kim & Keju, 1999; Kim, Keju, & Kinjo, 2000; Kim, Kinjo, & Antonelis, 2001; Kim & Kirschenbaum, 1992; Kim & Lee, 1990; Kim, Lemmo, & Kirschenbaum, 1991; Kim, Lesnet, & Tremblay, 2004: Kim, Lui, & Tremblay, 2005; Kim & Wallenstrom, 1993; Kim, Welch, & Niermann, 1995). After a drop in the overall Hawaii child restraint rate to 43.2% in 2001, the rate climbed to a high of 87.5% in 2004. In 2005 there was another decrease to 78.3%. In the 2005 Hawaii
study, infants were more likely to be restrained, with a rate of 93.4%, and toddlers less so, with a restraint rate of 73.5% (Kim et al, 2005). This is lower than the child restraint use overall in the United States in 2004, with infants restrained 98% of the time, and toddlers 93% (Glassbrenner, 2005).

Variations in usage of child restraints by geographic area in Hawaii are significant (46% to 100%), with the lowest rates of usage found in areas of the state with high proportions of Native Hawaiians and Pacific Islanders, as well as recent arrivals from Pacific Rim and Southeast Asian countries (Kim et al., 2005). This low usage can be associated with the overall lower health status and quality of life experienced by many children in these populations.

The chances of children being correctly restrained, even when in a car seat, are minimal (Murphy, 1998; “Notice to Readers,” 1998; NCSA, 1997). In a study conducted by Ruffin and Cantor (1992), adults surveyed had inadequate knowledge of how to properly use child restraint devices, and this lack of knowledge contributed to the improper use of the devices. One factor affecting parents’ ability to properly use child restraints may be difficulty in reading the instructions. Wegner and Girasek (2003) measured readability level of child safety seat installation instructions, and found them ranging from the 7th to 12th grade reading level, with an overall SMOG score of 10.34. A study (NTSB, 1996) analyzing data from 120 vehicle crashes in which there was a child passenger younger than age 11, and in which at least one occupant was transported to the hospital, concluded that over half of the parents or care givers in the study who said they had read the manufacturer’s instructions for the child restraint and/or the vehicle owner’s
manual still made errors securing the restraints in the vehicle or the child in the restraint. Also, more than two-thirds of the children were not in the correct restraint for their age and size, and half of those who were in restraints were not in them properly.

Many national, regional, and local studies have been done to measure the impact of the use and misuse of child safety seats, and they show varying degrees of use and correctness of installation. Decina and Lococo (2003) found an overall critical misuse rate of 72.6% in data collected for 5,527 children in 4,126 vehicles in 6 states in the fall of 2002. Critical misuse was identified as that most likely to put the child at risk for injury in a crash. Winston, Chen, Elliott, Arbogast, and Durbin (2004) analyzed data from 8730 crashes involving 10,195 children. They found that despite some improvements in child restraint use, many children are still inappropriately restrained.

Currently the rate of correctly installed seats is reported at from 1% to 10%. Child car seat check-ups conducted in all counties in the state of Hawaii from 1998 to the present continue to find nearly all of the thousands of seats inspected incorrectly installed and used (unpublished data reported to the writer). What makes this frightening is that parents who take the time to come to these check-ups can be presumed to be among the most conscientious about actively doing all they can to ensure the safety of their child. One can only speculate about the thousands of families who never take the time to have their car seat checked, and about the many thousands more who never even use child restraints.
CHAPTER 2
REVIEW OF THE LITERATURE

Following an extensive overall review of the literature in this area, attention was focused on two concepts. The first was parent factors in non-use or misuse of child restraints. The intent was to look for those factors most associated with parents not restraining their child, and to separate those factors least likely to change from those with more possibility of being changed. The second concept was interventions to promote child passenger safety. This followed logically from the parent factors. After first identifying the most frequently cited parent factors that are amenable to change, interventions can be targeted to address these factors, hopefully providing an increased chance of success in increasing proper use of child restraints.

Parent Factors in Child Passenger Safety

Search Method

In exploring the first concept, the literature was searched for parent factors that were related to the use of safety measures for protecting their children. Articles were initially identified through an online database search. Medline and The Combined Health Information Database (CHID) were used. The initial search terms included child passenger safety, child auto restraint, child car seat, infant car seat, injury prevention, parents, attitudes, and behavior. Few recent research studies on child passenger safety were found, therefore the search was widened to include other child safety areas. Search terms used this time were child safety and parents.

The search was limited to articles published after 1990, in English, with abstracts
available. Inclusion criteria included studies of attitudes, beliefs, knowledge, and behaviors of parents related to child safety; influences on parents; and demographic factors. Exclusion criteria included studies done outside the United States or Canada, non-research studies, and those that did not address parent factors related to child safety. Additionally, other online databases of injury prevention resources were searched, and web sites of government agencies involved in gathering and reporting health statistics and injury prevention information were visited. Additional sources were found in the reference lists of the first articles used, and in subsequent readings during the writing of the paper.

Findings

Twenty-two articles met the criteria and were included in the final sample. A matrix was created, and a conceptual meta-analysis was done of the findings. The majority of the studies were descriptive, with questionnaires and interviews most commonly used to gather data. Questionnaire results were obtained through telephone calls, by self-administration in a variety of settings, and in-person with a member of the research team. Interviews were conducted using a variety of tools, guides, and unspecified methods. Three investigators used focus groups as part of the procedure (Agran, Anderson, & Winn, 2004; Lannon et al, 1995; Webster, Wilson, Duggan, & Pakula, 1992), and three included an observational component (Agran et al, 2004: Arneson & Triplett, 1990; Decina, Temple, & Dorer, 1994). Peterson and Schick (1993) also used observations, but by the parents and children themselves, rather than by the investigator. Two studies included an intervention phase, with pre and post intervention data collected
(Arneson & Triplett; Decina et al). Decina et al also used a control group as part of the procedure. Three of the investigators used analysis of objective data obtained from official reports of deaths and injuries as either all or a part of their study (Agran, Winn, & Castillo, 1992; "Impact of adult safety-belt use," 1993; Rock, 1996).

Sample size varied widely among the studies, with one cluster of studies having a sample size between 50 to 100, others around 200 and 400, and another between 1000 and 1500. The smallest sample consisted of 50 mothers from five separate counties who participated in focus group sessions of three to seven mothers each (Lannon et al, 1995), and 15 parents and 35 children for a pretest-posttest, intervention, parent questionnaire, and observation of car seat use (Arneson & Triplett, 1990). The largest sample was 20,905 people surveyed by random-digit-dialed telephone interview ("Impact of adult safety-belt use," 1993). Several samples were obtained by random sampling methods, and the rest were convenience samples accessible to the investigators. In general, sample size was congruous with the study method. Smaller samples were used for focus groups and in-person interviews, and larger samples for reviews of written data and for random dial telephone surveys. Two exceptions were the studies by Dietz, Lewin, Zell, and Rodewald (1997), and Eichelberger, Gotschall, Feely, Harstad, and Bowman (1990). Each of these studies consisted of national surveys of parents to assess attitudes, knowledge, and/or behavior. Dietz et al. had a sample of 781 respondents, and Eichelberger et al. had just 404 parents in their sample.

The parent factor that was cited most frequently (in 11 of the studies) as having an association with safety status of the child was perception of risk from injury. Parents
believe that their children are in more danger from kidnaping, drugs, and assault than from injury. This perception is closely associated with knowledge about the causes of injury, and the parents' belief that there is nothing they can do to make a difference in whether their child is injured. Another factor cited frequently was educational level of the parent (in five of the studies). A higher level of education was associated with more protective safety behavior.

Parent behavior was also cited frequently as a factor. Parents who took more steps to protect their children were those who always used seat belts, and who had rules that they consistently enforced. Other behaviors cited were having the child up-to-date on immunizations and always using child safety seats.

Other parent characteristics mentioned more than once included socioeconomic status, race and culture, status of being a parent, need for information, and sources of information. Others were stress, risk factors in the home, structural and environmental barriers, feeling of competence, age and temperament of the child, home environment, such as family chaos, and previous injury of the child.

Measures of the relationship of parent factors with child safety were mixed. Some showed a significant relationship while others appeared to have no association with either positive or negative outcomes. Parent factors that were found to be most associated with a higher safety status of the child included (a) educational level of the parent, (b) compliance with laws, (c) participation in educational programs, (d) adult behavior, for example modeling, rules, and response to child, (e) following other protective health practices, like immunizations, (f) access to the health system, (g) availability of
information, including from the media, and (h) a combination of more than one of those listed.

Discussion

Parent factors were sorted by the writer according to the likelihood of them changing or not changing (see Tables 1 and 2). Those factors that cannot be changed have to do with inborn characteristics such as race, age, gender, and temperament. Other factors that are difficult to change are social, economic, and educational characteristics.

Factors that have a greater possibility of being changed include external barriers like transportation, organizational rules and regulations, access, supplies, and information sources. Others that can be influenced are particular characteristics of the individual, such as beliefs, attitudes, perceptions, and knowledge.

Usefulness of the results of this analysis is tempered by the limitations of the studies, which affect how they can be applied in other settings. One limitation is the frequent use of questionnaires and interviews. While these tools are useful for assessing knowledge, attitudes, and beliefs, they are less reliable as indicators of actual behavior. Parents may be tempted to report what they think is “the right thing,” even when it is not an accurate representation of their actual practice. In a random telephone survey of Hawaii residents, 90% of households with children under 4 years said they use a car seat in the back seat for those children (Mattson Sunderland, 1999). Observational data reported an actual use rate of 31.4% in 1997 (Kim et al., 1997). Use of safety seats for infants in 1998 was 84.4% and for toddlers was 37% (Hawaii Department of Transportation, 1999). The discrepancy in these numbers is apparent.
Other concerns about the studies have to do with the characteristics of the participants. The majority were white, middle-class, Midwestern, female, and well-educated. Of those that specified race, three included African-Americans, three “non-white,” two Hispanic, and one each Native American and Haitian. Some investigators eliminated non-whites to control for that variable. The results of studies on such homogeneous groups may not be applicable to other populations.

In order to change parent behavior related to the safety of their child, strategies must be directed at those factors which are most likely to actually change. These appear to be “system” or environmental conditions which present barriers to the parent who is trying to obtain what is needed to protect their child, and internal personal characteristics of the parent. Once these parent characteristics are identified, strategies can be explored that will have the greatest potential for success in increasing safe conditions for children.

Interventions to Promote Child Passenger Safety

Search Method

The second literature review investigated interventions to promote child passenger safety. A search was done to find interventions that had been used to increase the correct use of child restraints. As in the previous search, articles were initially found using online databases including Medline, CHID, and the Cumulative Index in Nursing and Allied Health (CINAHL). Online databases of injury prevention resources were again utilized, as were government agency web sites reporting health statistics and injury prevention information. Other sources were identified from reference lists of the first articles used, and in subsequent readings during the writing of the paper. Search terms used were child
passenger safety, child injury prevention and evaluation, child safety and programs, child accidents, child injuries, prevention and control, traffic accidents, child safety restraints, child protective devices and automobiles or motor vehicles, parents, and strategies.

Other than review articles, few recent studies on child passenger safety were found, so the search was extended to include articles published from 1981 to 2006. Inclusion criteria included articles written in English, interventions that were actually carried out (rather than editorial or opinion pieces with an idea or suggestion), strategies directed to either a parent or a child, and a description of an evaluation of the program. Exclusion criteria included program descriptions with no evaluation component, review articles, overviews, meta analyses, and reports of legislative interventions. The last was eliminated because of the large number of articles reporting various states’ implementation of their child restraint laws, and the length of time since most of them were published. The last state to enact a child restraint law was Alaska in 1986 (Zaza et al, 2001). A matrix instrumentation was used to sort and organize the data. Categories included author and date, design, sample and setting, intervention, evaluation method, and results.

Findings

Forty-four articles describing 42 studies met the criteria and were included in the final sample. The most recent was an evaluation of a program for mostly female, Hispanic violators of a child passenger safety law (Agran et al, 2004). Child safety seat use and knowledge were compared between parents who received citations and were required to attend a class (citation and education group) with those in a neighboring community that
did not require a class for violators of the law (citation group). At the time of the follow-up visit, a difference of just 1 point was found between the groups in both correct use and knowledge scores.

Ebel, Koepsell, Bennett, and Rivara (2003) described a multifaceted community campaign consisting of a variety of components, including media, educational programs, incentives, and printed literature. The results showed an adjusted seat use increase from 13.3% to 26.1% in the intervention communities, and from 17.3% to 20.2% in the control communities, which was statistically significant (P=.008 for time trend).

A study by the Injury Prevention and Control Program of the Hawaii Department of Health (IPCP, 2002) reported the results of an in-class, self-administered survey given to all participants in a required class for violators of the child restraint law, administered by the driver education division of the state judiciary in all counties. The results indicated that 95% of the respondents reported being more motivated to restrain their child after the class, and to feel able to properly install the car seat in their vehicle.

Istre et al (2002) described a multifaceted program tailored to a Hispanic community in west Dallas, conducted by a bilingual staff. The program included a car seat loaner program, small class education for parents, pamphlets, radio and TV messages, and blessing of car seats by local priests. Results showed that restraint use increased significantly between 1997 and 2000 (P<.0001 for trend). It also showed that use in the community remained significantly lower than at the health centers (approximately 35% versus 70%).

A study published in 2000 described another multifaceted campaign with a public
health education focus (Hanfling, Mangus, Gill, & Bailey, 2000). Another study reported
the results of a random sample post intervention mail-out survey of individuals who had
been reported to a car seat “hotline” for not having their child restrained while traveling
(IPCP, 2000). Self-reported use of car seats “all the time” increased significantly after
these individuals received a letter and educational materials on child passenger safety
from the Department of Health.

A study evaluating a reporting program in Missouri similar to the one in Hawaii
described earlier did not show that the intervention had any effect, and it was
discontinued in 1995 (Land, Romeis, & Gillespie, 1997).

Louis and Lewis (1997) compared 53 families who were randomly assigned to
one of two groups, both of which got car seats and instructions in their use. In addition,
the intervention group received a one hour education session on the importance of using
restraints. Observations of car seat use were conducted before distribution, immediately
after, at four to five months, and at one year. Both groups showed a tremendous increase
in seat use ($P<.0001$) immediately after the intervention, with some decline at one year.
There was no difference between the groups, and a conclusion put forth was that access
rather than education seemed to be the key factor.

Two studies described home visiting programs where an initial assessment of safe
behavior was done, followed by interventions including access to car seats, education,
and counseling (Bablouzian, Freedman, Wolski, & Fried, 1997; Johnston, Britt,
D’Ambrosio, Mueller, & Rivara, 2000). Both programs resulted in a significant increase
in children being restrained.
Six articles were published from 1990 to 1994, and 25 from 1981 to 1989. A variety of interventions were described, with results that varied widely, from highly successful to those that found no lasting effect.

Discussion

Interventions. Interventions described in the articles included a variety of education programs for parents and children, counseling, rewards and incentives, enforcement activities, media campaigns, and the distribution of free or loaner seats. Interventions were targeted to individuals, small groups, or across whole communities.

In 35 of the 38 studies, two or more interventions were combined in a program, rather than relying on a single strategy. The single intervention in two of the remaining three programs was rewards for those who were observed to have correct seat usage at any time during the evaluation. These included tokens to redeem gift certificates in one program (Roberts & Turner, 1986), and stickers, coloring books, and weekly drawings for pizza in the other (Roberts & Fanurik, 1986). The third single intervention was a six month media campaign (Pless, Stulginskas, & Zvagulis, 1986).

In the other 35 programs, from two to 12 or more components were utilized. Those programs with the most components were often found to be the most effective. A difficulty in analysis of these programs is determining whether one specific strategy was most responsible for the effectiveness, and which one that was, or whether the combination of strategies was the reason for the successful outcome.

The intervention components described most often in the studies were (a) written materials given to the participants (22 programs), (b) video and/or audio presentations (14
(c) small group parent education (14 programs), (d) demonstration of use of the restraint (14 programs), (e) individual parent education (13 programs), (f) free or loaner car seat (13 programs), (g) counseling by a professional such as the primary care provider (11 programs), (h) rewards or incentives (9 programs), (i) media campaigns (9 programs), (j) education of the child (8 programs), (k) community based education (7 programs), and (l) coercive/enforcement (4 programs). Other components used included reporting systems, home visitors, physician prescription for a child restraint, education for professionals, web site, and cultural considerations.

The intervention found most often in effective programs was education combined with one or more other components. This is consistent with findings in other reviews. Roberts and Turner (1984) reviewed and synthesized the literature on various attempts to motivate safety seat usage, and concluded that no one strategy could solve the complex problem of motivating parents to be preventive in acquiring and consistently using safety seats. They recommended the use of comprehensive programs with a developmental focus, and identified the need for more research to find ways to maximize use.

DiGuiseppi and Roberts (2000) reviewed randomized clinical trials evaluating the impact of interventions provided in the clinical setting on child and parental safety practices and unintentional injuries. Strategies aimed at increasing the use of child motor vehicle restraints were among those found to be effective. Additionally, those clinical interventions were found to be most effective when they combined several strategies, such as providing car seats, education, and reinforcement.

Zaza et al (2001) systematically reviewed the literature for scientific evidence of
effectiveness for five interventions to increase child safety seat use. They found strong
evidence of effectiveness for child restraint laws, and distribution plus education
programs. They also found sufficient evidence for community-wide information and
enforcement campaigns, and incentive plus education programs. They found insufficient
evidence for education only programs. In this current review, the components most often
combined with education in the effective programs were free seats, written materials,
media campaigns, counseling, demonstration, and audio-visual aids.

Design. A variety of designs were used, including two, three, and four group
comparison, either pre and post or post evaluation only, one group pre and post
comparison or post evaluation only, and community wide pre and post comparison.
Eleven of the studies used random assignment of subjects, either individually or by
population groups, while the others used convenience samples or nonrandom assignment.
Assignment to intervention or control group was done by community in 4 studies, by
center or school in 8 studies, and by individual in 11 studies.

Generalizing results to a wider population is easier in studies where assignment is
done by individual, rather than by center or community, especially if individuals in both
control and intervention groups are located in more than one community or center. With
assignment to study group by community or center, there is more chance for imbalances
between groups due to differences in the characteristics of the population in those areas.
These imbalances are likely to affect the results. Examples of imbalances which were
mentioned as characteristics of certain communities or centers were level of education,
income, and ethnicity.
Random assignment of participants to either a control or intervention group is considered the "gold standard" for quantitative research design. This was the design for nine of the studies. Six of these randomly assigned individuals to groups (Christophersen, Sosland-Edelman, & LeClaire, 1985; Christophersen & Sullivan, 1982; Hletko, Robin, Hletko, & Stone, 1987; Land et al, 1997; Liberato, Eriacho, Schmiesing, & Krump, 1989; Louis & Lewis, 1997), and three randomly assigned complete programs to one of the groups (Bowman, Samson-Fisher, & Webb, 1987; Johnston et al, 2000; Stuy, Green, & Doll, 1993). Interestingly, only one of the studies employing random assignment showed any difference in effectiveness of the intervention between groups by the end of the evaluation phase (Johnston et al). Their study used self-report rather than observation as the evaluation method to determine restraint use, and it was done at baseline and once at a 3 month follow-up. While several strategies from the other studies showed promise when evaluated immediately following the intervention, none of the effects persisted.

Sample and setting. Sample sizes overall were appropriate for the study design. They ranged from as low as eight mother-child pairs for an intensive intervention and observation design which involved an observer accompanying mother and child on numerous 15 minute automobile rides (Christophersen & Gyulay, 1981), to as large as 7413 children observed over the course of three years in the program targeting Hispanic children (Istre et al, 2002).

Samples for community based interventions were more likely to be composed of hundreds or thousands of individuals who were observed for correct usage, while individual or small group intervention samples ranged from 53 (Louis & Lewis, 1997) to
Thirty-three of the programs evaluated were in the United States, in rural, suburban, and urban locations in 20 states throughout the country. Two of the studies were done in Canada (Robitaille et al., 1990; Pless et al., 1986), one in Sweden (Lindqvist, 1993), one in Australia (Bowman et al., 1987), and one in New Zealand (Geddis & Pettengell, 1982). Few of the studies stated the ethnic or racial makeup of the participants in any detail. Of the 14 that did, they were described as white, Hispanic or Mexican, biracial, multi-ethnic, or minority. Income information was found in 24 of the reports, with the majority either low or middle income.

**Evaluation methods.** Evaluation methods used in these studies included interviews, surveys, observations of use, and comparison of injury rates. These were used alone or in combination, and were either done once after the intervention, once before and once after, or periodically over a period of time. The longest reported evaluation period was three years (Istre et al., 2002).

The most ideal evaluation method is to measure the endpoint outcome measure, which in this case is death and injury rates. Because the number of motor vehicle occupant deaths and serious injuries for infants and young children in one community or child care center over the length of most studies is not large, measuring injury rates is usually not feasible. The amount of time it would take to accrue large enough numbers to determine a significant change is beyond the time allotted for most studies, making it difficult for investigators to get a large enough sample.

Two of the studies in this review did use injury rates as an evaluation measure.
Guyer et al (1989) used a hospital based injury surveillance system as one of their outcome measures for a community based injury prevention effort that included five injury prevention programs, two of which were specific for child passenger safety. It was conducted in nine Massachusetts towns over a period of two years, and was estimated to reach 42% of households with children 0 to 5 years old. The incidence of motor vehicle occupant injuries among children in the intervention communities decreased 54%, while rates rose in the control communities.

Bass, Mehta, and Ostrovsky (1991) evaluated the same population based injury data as that used by Guyer et al (1989). They compared rates at baseline and during the program for both intervention and control towns for a project in four suburban Massachusetts communities which was part of the larger effort described by Guyer et al. Five pediatricians trained in the Pediatric Accident Prevention Project (PAPP) assessed safety risks and then provided targeted counseling with provision of written materials for parents of their patients from 0 to 5 years old. They reached 29.6% (594) of the population in this age group in the intervention towns. Results showed a 15.3% decrease in injury rates in the intervention group, and an increase in the control group. There was a substantial improvement in relative risk for injury in the intervention towns compared with the control towns (0.85 versus 1.45). Because this project was part of the larger program, it cannot be accurately determined how much of an effect this particular component had on the outcome.

Observation of use of child restraints is the most accurate intermediate evaluation measure, since evidence supports the effectiveness of proper restraint use in reducing
21 deaths and injuries from crashes ("Child Passenger Restraint Use," 1991; Johnston et al, 1994; Kahane, 1986; NTSB, 1996). Gielen and Radius (1984) applied the PRECEDE model to the problem of child motor vehicle injuries to show how interventions aimed at parent factors such as knowledge, attitudes, or beliefs can affect behavior change (in this case restraint use), which then affects injury rates.

Observations provide objective data that is usually the most practical outcome measure that can be evaluated, and, as was noted earlier, is directly related to the rate of injury and death. Thirty-two of the studies used observation of restraint use as an evaluation method, either singly or in combination with other measures. Twenty-four studies evaluated use at baseline and during or after the intervention, either for intervention and control groups, or for one group before-and-after designs. Eight studies did not include the baseline component, and compared intervention and control groups during or after the intervention.

Most of the studies using observation data were able to measure the effectiveness of their intervention, although the precise method for carrying out the observation may have affected the validity of the observation data. Observations done where the door to the vehicle can be opened provide more accurate information on correctness of use than when only the head of the child is seen through a window, especially when looking for older children in booster seats. Observation of moving vehicles is less likely to yield accurate information than when the car is stopped, because of the brevity of the interaction and the amount of data needed.

Another factor affecting accuracy of observation is the training received by the
observers. In order to have data that is reliable and valid, the observers must be trained in the precise observation procedure, and should participate in an exercise to measure inter-rater reliability. Some of the reports did describe the procedure for training the observer and methods for achieving an acceptable inter-rater reliability (Berger, Saunders, Armitage, & Schauer, 1984; Bowman et al, 1987; Christophersen & Gyulay, 1981; Decina et al, 1994; Pless et al, 1986).

Other evaluation methods used were surveys and interviews. Because these rely on self-report, they cannot be considered accurate measures of child restraint use. Parents may give the answer they perceive to be correct, even if it is not true. They may report "always" using the restraint when in fact they sometimes do not buckle up their child. They may also believe that the restraint is correctly installed when it might be found incorrect upon observation. An example of this is positioning an infant forward-facing in the vehicle. A parent may believe the child is correctly restrained, when in fact an infant in this position is at greatly increased risk for head and spinal cord injuries. In observation studies conducted nationally by NHTSA in 2002, 66% of infants were in front-facing seats (Glassbrenner, 2003).

A project that provided a special 30 minute curriculum to pregnant couples used a telephone interview four to six months postpartum as the evaluation measure (Goodson, Buller, & Goodson, 1985). More parents in the intervention group said they used a car seat than those in the control group (96% vs. 78%). The reliability of this information can be questioned because it is based on self-report. Observation of use would have given additional data to either support the parents' report or dispute it.
McCooey and Feun (1984) used both observation and telephone surveys at baseline and six months after the start of their program. In this case, the two evaluation methods found a statistically significant increase in both reported and observed restraint use.

Surveys and interviews can be useful measures of attitudes, beliefs, and knowledge, and were used for this in many of the studies. They provide information that can be helpful in designing interventions which take these factors into account. While behavior change is the intermediate outcome needed to make a difference in restraint use, a change in attitude, belief, or knowledge is usually needed to change behavior.

After an educational curriculum for preschool children entitled “Bucklebear,” Chang, Dillman, Leonard, and English (1985) evaluated children’s knowledge using a structured interview with a random 25% sample of the children. They reported a significant increase in knowledge. Observation at that time found an increase in restraint use in the intervention group from 21.9% to 44.3%. No change was seen in the control group. In this case they demonstrated an association between the children’s knowledge and their behavior.

An evaluation of another “Bucklebear” program by Arneson and Triplett (1990) had a different result. In this case, children’s knowledge scores in the interviews increased significantly (p=.002), but increase in use of seat belts was not significant (p=.33).

Results. The rigor of the design was highly variable among the studies, which makes comparing results difficult. There was also great variability in how the results were
reported, and in the level of detail describing methods and data analysis. All of the reports did include numerical values for results, usually in terms of percent of use or correct use at the indicated measurement points for the study. These were compared to baseline measures in those studies employing them as part of the design, and between groups for the two, three, or four group designs. Some reports included tables and graphs to display the results in greater detail, or included more detailed analysis of results, such as measurement of relative risk, magnitude of the difference, and statistical significance of the difference (Bowman et al, 1987; Decina et al, 1994; Foss, 1989; Guyer et al, 1989; Liberato et al, 1989; Robitaille et al, 1990).

Some of the studies demonstrated effectiveness immediately after the intervention, although the effectiveness did not always persist later (Christophersen & Sullivan, 1982; Geddis & Pettengell, 1982; Louis & Lewis, 1997). An example of a program that showed an intermediate effect that did not last was reported by Foss (1989). He evaluated a community-wide incentive program with ongoing observation of restraint use throughout the program and seven weeks after the end. Children under 6 years of age went from a rate of 27% at baseline to 43% during the campaign to 28% after it was completed.

Other studies found that both control and intervention groups showed improvement, or that neither group did, resulting in no difference between groups (Christophersen et al., 1985; Land et al, 1997; Lindqvist, 1993; Robitaille et al, 1990). This demonstrated that the intervention as delivered and measured was no more effective than that received by the control group. A multifaceted patient education program based
on the health belief model resulted in restraint use increasing in both the intervention and control groups. Change over time was statistically significant, but differences between the groups was not (Chang, Hearey, Gallagher, English, & Chang, 1989). Goebel, Copps, and Sulayman (1984) found a greater increase in restraint use in the study group, but no significant difference in correctness of use. Another program combining incentives for children and printed materials for parents had minimal effect in increasing use of car seats or boosters (Roberts & Layfield, 1987).

Some studies found that the intervention was effective in increasing restraint use in infants, but not in older children (Nichol & Cooney, 1984; Robitaille et al, 1990). After a hospital-based education and loan program, Nichol and Cooney found that correctly restrained infants increased from 28% to 63% (p<.02), but found no difference for other ages.

Some programs did continue to show significant effectiveness over time. Reisinger et al (1981) described a program for new parents that consisted of three educational sessions delivered by the pediatrician: immediately postpartum, at the one month visit, and at the two month visit. The parents also received pamphlets, a “prescription” for a car seat, and a demonstration of correct use. Effectiveness was evaluated by observation of correct use, and the difference between groups persisted through the 15 month evaluation.

Colletti (1983, 1984, 1986) described a statewide network of hospital based education and car seat rental programs that was evaluated repeatedly from 1979 to 1984. Among those participants in the programs, correct car seat use of infants at discharge
increased from 21% at baseline to 82% in 1984. Use of seats by children from 0 to 3 years old observed at a county fair went from 34% in 1982 to 67% in 1984.

**Conclusion**

The intervention that was found to be most effective was actually not a single strategy, but a multifaceted program which combined education with other components. No one combination was clearly more effective than others, however those that included access to a car seat were among the most successful. Other components that appeared repeatedly in effective programs were written materials that the parents could take home, demonstration of the seat, and counseling by a care provider. Programs were more effective when targeted to pregnant or new parents, or tailored to a specific group, such as the culturally based program reported by Istre et al (2002).

A limitation to this review is the paucity of recent studies on this topic. Only five of the reports were published in the last five years, with seven more less than 10 years old. While findings from older reports may still be applicable, replication of studies in today’s environment may yield different results. It was not unusual in the 1980's for people to believe that it was acceptable to carry an infant on the lap when traveling in a motor vehicle. Restraint use at that time was very low, so an increase in restraint use from none or 5% to 12% or 20% was considered a success. Today more people acknowledge the need to restrain a child, and the goal of intervention programs is focused more on correctness of use, which is still low. Well designed studies using randomly assigned control and intervention groups are needed to evaluate interventions for today’s families.

Another consideration for new studies is to include a component to evaluate the
intervention in different ethnic and cultural groups. What is acceptable to a white, middle-class parent in a suburban community may not be relevant to someone who has just moved to a large city from a developing area where cars are not that common, let alone car seats.

Studies to evaluate the effectiveness of interventions over longer time frames are needed. Many interventions were found to not be effective over time, and reasons for this should be investigated. Parents' needs change as the child grows, and interventions must be found that are relevant to those changing needs. For preschool and older children, programs that include both parent and child components may be useful.

While it would seem logical to implement programs based on those found to be most effective, especially long term, the length of time since publication of many of these articles could be problematic. Conditions in the environment, and in attitudes and knowledge, may have changed since then, leading to different results being obtained. Cultural considerations are more important now as our communities have diversified, and programs may be more effective if targeted specifically to the particular population served.

While new research is critically needed on this topic, findings from this review and analysis can still be helpful for those planning to develop a program to increase correct use of child restraints. A multifaceted program combining several of the interventions found to be most effective would have the best chance of success. Recommended components to include are some form of individual or small group education with one or more other strategies, such as access to seats, hands-on
demonstration, or take home material written at an appropriate level for the group being served. It is important that an evaluation component be built into the program, so that effectiveness can be measured on a periodic or ongoing basis.

Current Study

The literature reviews and analyses discussed above identified parent factors and intervention strategies related to child passenger safety. The study described in the following chapters collected information about key parent factors, and systematically tested a specific intervention. Results from this study provide data on the outcomes of a particular intervention that is frequently used, and for which there are few reported reliable indicators of effectiveness.
CHAPTER 3

METHODOLOGY

This study tested, with standardized instrumentation and nationally certified trainers, a combination program which included a multifaceted educational program. The specific concept that was measured was that an educational intervention that included a hands-on demonstration and return demonstration of a new psychomotor skill (correct car seat installation) would be more effective in helping a parent retain the learning than an educational session that did not include the hands-on component. The hypothesis tested was that, given a standardized education program, which includes a hands-on component, a parent will exhibit proper installation and use of a child passenger restraint in a vehicle.

Design

The study design was a randomized clinical trial. It included two groups, one control and one experimental. Eligible participants were enrolled between the seventh and ninth month of pregnancy, and randomly assigned to one of two groups. Block randomization ensured that there were an equal number of participants in each group and an even balance at any one time between the two groups.

Setting

The setting for the initial data collection and educational intervention was the medical center from which the clients were recruited. Locations in various parts of the island that were convenient for the parent were used for the hands-on educational component for the intervention group, and for the follow up check for correct use.
Participants

The target population for this study was all parents on the island of Oahu in the state of Hawaii who transport their infant in passenger motor vehicles. The study population was all expectant parents of at least 7 months gestation who had some connection with a large urban women’s and children’s medical center in Honolulu, and who planned to transport their infant in passenger motor vehicles.

A convenience sample was recruited from the study population. Either one of the parents was eligible for participation. The sample was multiethnic, consisting primarily of Asians and Pacific Islanders, many of whom were of mixed ethnicity. The participants were of mixed socioeconomic status.

Inclusion criteria were: (a) access to a passenger motor vehicle with which to transport the infant after birth, (b) agreement to attend a follow up check when the infant was between 2 and 3 months old using the provided restraint, (c) ability to read and understand written and spoken English.

Exclusion criteria were: (a) birth weight of less than 5 pounds, (b) fetal or infant death, (c) delivery prior to educational intervention, (d) anticipated move from Oahu before the infant was 3 months old, (e) previous hands-on instruction in the installation and use of a child restraint system.

The sample size was projected to include 61 parent/infant pairs in each group, for a total of 122 pairs enrolled. This allowed for a 15% dropout rate, for a minimum of 104 follow-up observations (52 parent infant pairs in each group). The sample size calculation was based on the intervention group showing a rate of correct infant passenger restraint
use of 40%, as compared to the control group having a 10% rate of correct use. The projected sample size was computed using nQuiry Advisor 3.0 to achieve a power of 90, or a 90% chance of detecting an effect from the intervention. The projected odds ratio was computed to be 6, which would make the odds of correct restraint use 6 times greater in the intervention group than in the control group.

Protection of Human Subjects

Approval to conduct this study was obtained from the Institutional Review Board (IRB) of the medical center from which the participants were recruited. A data safety monitoring plan was developed at the request of the IRB, with members of the dissertation committee composing the data safety monitoring committee.

Procedure

Recruitment. Parents were given the opportunity to participate after the mother had reached her seventh month of pregnancy (28 weeks gestation) and prior to delivery. Either parent could be the participant, as long as the participant agreed to attend the follow up check when the infant was 2 to 3 months old.

A recruitment poster was prominently displayed in the OB/GYN Clinic, and recruitment flyers (Appendix C) were made available for clinic staff to distribute to all eligible clients in the OB/GYN Clinic. Participants were also recruited from physician offices, parenting and childbirth classes, and by word of mouth. Interested clients contacted study personnel using contact information on the flyer, and the study was explained to them.

If the client agreed to participate, a signed informed “consent to participate” form
was obtained (Appendix D), and the demographic questionnaire (Appendix E) was completed. A copy of the consent was given to the participant. The participant was then assigned a randomly chosen number placing him or her in one of two groups, and the initial education session was delivered.

**Educational intervention.** A standardized education session on the use of child passenger restraints was provided to all participants. The education consisted of a video, “Protecting Your Newborn” (NHTSA, January, 1997), and a review of the current Hawaii Child Restraint Law. The parent received brochures about child passenger safety, and a new car seat. Those in the control group received the seat with the manufacturer’s instructions at the end of the education session. Those in the experimental group were scheduled for an additional session, where they were given the seat and the manufacturer’s instructions, and in addition, were shown how to correctly install the seat in their vehicle and (using a doll) how to secure the infant in the seat. The session ended when correct use had been demonstrated by the parent. The hands-on portion of the education was provided by nationally certified Child Passenger Safety Technicians who have completed a standardized 32 hour training developed and administered by the National Highway Traffic Safety Administration.

**Followup observation.** Follow up observations of each participant were done by the certified Child Passenger Safety Technicians, using the study observation tool (Appendix F). An appointment was made for each participant to attend a follow-up observation at a site convenient to them after their infant was two to three months old. They were to bring the infant in the vehicle, restrained in the seat that was given to them.
as part of the study.

Potential Risks

There could have been a very slight psychological risk of anxiety, frustration, or embarrassment to the experimental group participants if they had difficulty installing the car seat despite the guidance of the instructor. There could have been potential physical, psychological, social or legal risks to those in the control group if they were unable to install their seat correctly using the manufacturer’s instructions, or if they chose not to use the seat provided. The risks could have included injury to the infant and distress for the parents, citation by law enforcement for violating the child restraint law, and any of the risks listed above for the experimental group.

Procedures to Minimize Potential Risks

Technicians were instructed to allow as much time as necessary for the parent in the experimental group to feel comfortable installing the seat. Parents in the control group received more information and support than those in the general population, including the provision of a free car seat. All personal information was kept confidential. Every participant had the right to return the car seat and withdraw from the study at any time.

Any potential risks to participants were less than, or equal to, those they would have encountered in the normal course of their daily activity. Parents in the control group had the same information they would have had if they had purchased the seat themselves, in addition to the information they received from the educational session. Parents in the experimental group received more information and hands-on support than the general public, which should have put them at a lower risk than without the intervention.
Data Collection

Sources of Data

Data were obtained by interview, using a standardized questionnaire, and by observation of correctness of use. Data collected specifically for the study were limited to the demographic information collected from the participant at the time of enrollment, and the observation and questionnaire information about correctness of the restraint installation and use collected at the end of participation.

Instruments

The instrument used for the observation portion of this study contains 14 items to document correct or incorrect installation and use of the infant restraint. Content and face validity of the instrument was determined by using the same items as those on forms used by nationally certified Child Passenger Safety Technicians at car seat checkups across the United States. Specific forms used for comparison are the Keiki Injury Prevention Coalition/SAFE KIDS Hawaii checklist, the Safe Kids Buckle Up Car Seat Checklist of the National Safe Kids Campaign, the Operation Kids Child Safety Seat Checklist developed by the International Association for Chiefs of Police, and the Child Passenger Safety Inspection Form used by the Center for Injury Prevention. A tool measuring similar elements was used by in a study done in 1985 and 1986 (Margolis, Wagenaar, & Molner, 1992). The instrument for this proposed study reflects updated current practice in correct child restraint usage, reflecting elements used in a survey reported by Kohn, Chausmer, and Flood (2000).

Each item on the observation tool was marked with an X if observed. Any marked
item indicated an incorrect use of the restraint. For a seat to be considered correctly used, no item could be marked.

Inter-rater reliability was established by each of the observers having independently observed and recorded several standardized misuse scenarios in their certification training. Percentage of agreement for inter-rater reliability was greater then 95%. Random field visits to monitor observations were also done by the investigator during the course of the study.

A second instrument is a questionnaire that was used to collect demographic data from the study participants, including parent age, gender, household composition, ethnicity, educational level, number and ages of children, geographic area of residence, household income, and previous instruction on car seat use or installation.

Data Analysis

The primary outcome is percent of correct use of child passenger restraints by parents in the experimental group as compared to the control group. All identifying information was omitted. In initial analysis the baseline distributions of demographic and study variables were compared in terms of frequency and percent between the randomly assigned groups. With successful random assignment, it is expected that the distributions of variables would be similar for the two study groups.

All analyses were undertaken following the "intention to treat" principle, in which subjects are retained in their treatment group as randomly assigned, regardless of whether they adhere to their assigned treatment post-randomization. Only if participants failed to keep their follow-up appointment were they dropped from the study.
The primary outcome dependent variable is the correct use of the child restraint. Differences between the treatment and control groups were tested using a logistic regression probability model. The regression analysis yielded p-values showing the statistical significance of the differences between the study groups. The analysis also provided regression coefficients that measured the magnitude of the differences. The relative odds of failing to use the seat correctly were calculated by taking the exponential of the regression coefficients. The standard error was used for testing the significance and estimation of the confidence limits of the relative odds.

Baseline data collected allowed for secondary analysis of selected variables. In the secondary analysis, data were explored for variations by age, educational level, income, ethnicity, and any teaching received about child safety seats between the initial study visit/s and the follow up visit.
CHAPTER 4
RESULTS

A total of 124 participants were enrolled in the study, 64 in the intervention group and 60 in the control group. Three of those in the intervention group delivered before they could receive their hands-on teaching session, and were disqualified from further participation. Ten participants, five in each group, were lost to followup. Two of these never responded to calls following delivery of their child. The other eight could not be scheduled for their followup visit, for a variety of reasons. These included not using the seat provided for the study, moving away or going on extended vacation, not having a vehicle available, or just not returning multiple calls to schedule the visit. There were 111 participants remaining, 56 in the intervention group and 55 in the control group, and data from all of them are included in the results.

Demographics

Participants ranged in age from 19 to 53 years, with the majority in their 30's (71 of 111), including a large number (33) who were 31 to 33 years of age (Figure 1). There were 95 women and 16 men. Most of them (n=90) had a college education (Figure 2), and had incomes above $50,000 (n=73) (Figure 3). The majority were of Asian descent, with the highest numbers of these Chinese (n=41) and Japanese (n=44). Other Asian were Filipino (n=11), Korean (n=9), and other (n=3). There were 35 Caucasian and 15 Hawaiian/Part-Hawaiian. Nine were mixed or other. The numbers add up to more than 111 because the participants could choose more than one ethnicity.
Correctness of Use

A total of 24 participants (22%) had correct use of the car seat (Figure 4). Of these, 18 (32%) were in the intervention group and 6 (11%) were in the control group (Figure 5). The intervention group was greater than four times more likely to have correct use than the control group, when adjusting for other variables. The adjusted odds ratio was 4.3, and adjusted p-value was 0.0074.

Secondary variables tested in regression analysis for effect on the outcome were age, education, income, and help from others after the teaching session. No variable other than the intervention had a significant effect on the results.

Errors

The number of errors per participant ranged from 0 to 7, with most having 0 to 2 (Figure 6). The most frequently occurring errors were having the harness straps not snug on the child (n=48) and the car seat not tightly secured in the vehicle with the seat belt or LATCH (Lower Anchors and Tethers for CHildren) (n=42). LATCH is a system intended to make car seat installation easier for parents.

The next most common error was the harness retainer clip not being at the child’s armpit level (n=37). Other frequently occurring errors were the harness straps not being at or below the baby’s shoulders (n=20) and extra padding placed between the infant and the back of the car seat (n=16). Next most frequent errors were the car seat being at too steep an angle of recline (n=10), carry handle not placed in the proper position for travel (n=9), and locking clip not used properly (n=8).

Less frequent errors were the seat belt or LATCH not routed correctly through the
car seat and the seat belt or LATCH not being locked (5 each). Other errors were the child
not being restrained in the seat or the seat not being anchored in the vehicle (2 each). Two
potential errors were not found with any participant: car seat placed in front of an air bag
and seat not positioned rear facing. The rates of errors were 33% less in the intervention
group than in the control group (ratio of 0.67).

There were few serious errors, which are defined as those that alone could have
resulted in death or serious injury in a crash. Three participants had 1 serious error. Two
of these were in the intervention group and one in the control group. Three participants
had 2 serious errors. Two of these were in the control group and one in the intervention
group. Serious errors observed (Figure 7) were: not securing the child seat in the vehicle
(1 intervention and 1 control), not restraining the child in the car seat (2 control), and not
locking the seat belt or LATCH straps (3 intervention and 2 control).
CHAPTER 5
DISCUSSION

The results show that a hands-on educational intervention did make a significant difference in the proper use of a child passenger restraint by a parent. The hands-on demonstration and return demonstration of this skill was more effective in helping the parent retain the learning than the educational session that did not include the hands-on teaching.

One explanation for this result is that the learning was of a psychomotor skill, and actual hands-on practice would be expected to reinforce the cognitive learning. Modeling, demonstration, return demonstration, and practice are all components of learning a psychomotor skill.

Research has shown that there is overlap between cognitive and psychomotor ability, and that they are not distinct and separate (Chaiken, Kyllonen, & Tirre, 2000). Chaiken et al. found that people who did well cognitively also performed well on psychomotor skills, which they defined as tasks requiring perceptual and motor ability rather than strength, stamina, and dexterity. They also noted that performance on psychomotor skills improved with practice. This was also a point emphasized by Oermann (1990) in her discussion of psychomotor skill development in nurses. Practice and feedback are both important in psychomotor learning, as is initial demonstration of the skill. Oermann points out that “motor skills have a cognitive base” (p.202), and that there is also an affective aspect involving the learner’s values and emotions.
The three domains of learning were identified by a working group of psychologists in the mid twentieth century. Bloom (1956) was the editor of the initial report from this group, which delineated a taxonomy of educational objectives. They described the domains as cognitive, affective, and psychomotor. There has been extensive development of the cognitive domain, and to a lesser extent, the affective domain. They did not describe the psychomotor domain in the same detail, but this designation of three learning domains has become a common way of differentiating teaching strategies for different learning tasks (Piccininni, 2000; Oermann, 1990; McBride & Gabbard, 1990). The parents in the intervention group were not taught the hands-on skill in isolation, but as one component of a multifaceted program, which included both cognitive and affective aspects as well as the psychomotor skill.

The results also showed that very few of the parents in either group had serious errors. This may demonstrate that all parents received some benefit from the other components of the multifaceted program, including the video, printed material, and the free car seat with manufacturer’s instructions.

Elder, Ayala, and Harris (1999) discussed several theories for use in changing health behavior. One of these is Social Cognitive Theory, which is derived from Social Learning Theory (Bandura (1977). Social Cognitive Theory recognizes that people’s cognitive processes interact with their behavior. It describes outcome expectancies, which is the belief that a certain behavior will lead to a positive outcome. The parents in this study exhibited that pattern, in that they believed they would be able to accomplish the task they set out to do. This was shown by participants in both
groups - those who got just the car seat to take home and install, and those who had the additional instruction. Neither group demonstrated high anxiety, or the fear that they would be unable to install the seat properly. Unfortunately, the reality in this case is that neither group was able to perform the task as well as they expected. This may be partly due to the complexity of the task, and partly because they were only observed once after the teaching session, when they may not have practiced enough. An advantage to conducting several follow-up sessions would be the chance for the parents to be corrected on improper use, and then to practice the new learning. In this way, correct use would be more likely to be achieved.

Roden (2004) found that parents who were of a higher socioeconomic level believed that they were more able to perform child health promoting activities than those who had lower income. The majority of the participants in this car seat study had high income. This may explain why few of the parents in either group had many errors, or serious ones. There also may have been some self-selection bias in the sample, in that parents who are more highly educated and have higher income may be more likely to seek out programs that they perceive will benefit their family.

Barriers

There were several barriers encountered in the course of this study. Some were related to the implementation of the study itself, such as sample, procedure, and data analysis problems. Others had to do with how the results can be used.

Sample

Initially the sample for this study was to be patients in a prenatal clinic. It was felt
that they would be most in need of both a free car seat and instruction in its use. From the
time the study was first proposed until it actually began, the population of the clinic
changed. Many of the current clients are from small Pacific Islands. They do not speak
English; do not own cars; and have no prior experience with motor vehicles or car seats.

After several weeks with no clinic clients expressing interest in the study,
enrollment was expanded to include parents who were in parenting or childbirth classes,
those seen by private physicians affiliated with the medical center, and others referred by
medical center personnel. This snowballed to include friends and co-workers of early
participants. Most people who heard about the study were eager to participate.

**Time Frame**

It was initially anticipated that the study would be completed in 1 year, from first
enrollment to data analysis. It actually took longer than expected. The time frame from
enrollment of the first participant in July 2004 to the last teaching session in October
2005 was 15 months. Follow-up observation visits took place over 18 months, from

There were several reasons for the extended time frame. It took longer to recruit
the total sample than had been initially projected. The supply of car seats was variable,
based on availability from both manufacturer and vendor. Several times the car seat
model being used was discontinued by the manufacturer, and there was a delay before a
replacement was available. During these times recruitment was suspended.

It was initially planned that all participants would be seen for their follow-up visit
within two to three months after birth. This was not always possible, either because of
unavailability of the certified technicians or of the families. It was difficult to reach some of the parents to schedule a visit within that time frame. Other parents had not used the seat given to them for the study at the time of the first followup call, despite that requirement being explained to them at enrollment, and it being contained in the written consent. They were instructed to start using the seat, and a new followup visit had to be scheduled. Because the variable being studied was correct use over time, it was felt that information gathered at any point following birth would still be valuable in measuring retained knowledge.

Procedure

In order to control one set of variables, car seats were supplied to participants in the study. Two types of car seats were used, with each seat in a type being the same brand and model. This made installation and use more standardized, which allowed the technicians to focus on the technique rather than variations in design.

Parents could choose which type of seat they wanted. Inventory was adjusted to keep a supply of each on hand. One choice was an infant seat with a base. This is the type of seat used by many new parents because of its convenience. They can secure the base in the vehicle, and snap the seat in and out. This can be used with a stroller, or to carry a sleeping infant. The other seat was a convertible, which can be used rear facing for an infant, and turned forward facing for an older child. One reason for including this seat in the study was to accommodate large babies who might have outgrown the infant seat before the observation visit.

When observation visits were being scheduled, it was discovered that some
parents had chosen the convertible seat with the intention of not using it until their baby was bigger. They were using an infant seat they had purchased, often as part of a “travel system,” which included a stroller. This was an unexpected finding, and delayed the observation visits. A requirement of the protocol was to have the baby in the seat supplied for the study at the time of the followup visit. They were also to have used the seat long enough to become familiar with it.

Data Analysis

It was not possible to use all of the secondary variables in the data analysis. Gender was one of these. Gender was noted for each person enrolled, but in practice it was not always the person enrolled who installed the car seat, especially for the control group. One explanation for this was that the advanced state of pregnancy made it difficult for most mothers to physically install the car seat, even though they were the ones who had signed the consent and watched the video. In other cases both parents worked together to install the seat.

The item for ethnicity allowed the participants to choose as many of the categories as applied to them. Since the categories were not mutually exclusive, ethnicity was another variable that could not be analyzed for its effect on the outcome.

Limitations

There were some limitations to this study. One is that it was a cross sectional design that measured proper use just one time after the intervention. It could be that at a subsequent observation several months later, the results would be different for any of the participants, and the rate of proper use would change. It is possible that correctness of use
would increase with repeated regular use of the child seat. It is also possible that correct use would decrease. The parents might try harder when they were preparing for the observation visit, knowing they would be evaluated, and then become less vigilant later.

Another limitation is the lack of an absolute way to restrict either group from receiving additional education, including hands-on instruction, from other sources outside the study. This could have had an effect on the difference in proper use rate between the two groups, although both groups had equal opportunity to receive this kind of help. At the time of the follow-up visit, the participants in both groups were asked if they had received any additional instruction or assistance in installing their seat since the initial intervention. Most of them answered no to this question. Of those who did have help, it was most often from friends or family members, and not from trained personnel. This was analyzed to determine if there was indeed a difference, and it was found that it had no measurable effect on the outcome.

Because participants were self selected by volunteering for the study, ability to generalize to the larger population could be limited. The majority of the participants were in their thirties, well educated, with relatively high incomes, living in an urban area. There was also a higher proportion who were of Asian ethnicity than in the general population. It is possible that younger, less educated parents with lower incomes would have different results.

Recommendations for Research

This study should be replicated with different populations and in different locations. Including those from lower socioeconomic groups would be valuable, since these may be parents who are more in need of education on proper car seat use. It would
also be helpful to include younger families, those with less education, and those who live in rural areas.

Making sequential observations over a longer period of time is recommended for a future study. It would be helpful to learn if the knowledge and skills are retained over a longer time frame, or if they decrease or are lost. The time frame for conducting the first followup visit could be lengthened in future studies. Two to three months is difficult to arrange. Many parents are immersed in the care of their new infant, exhausted from lack of sleep, and focused on their own needs. Doing perhaps three visits over the course of the first year would provide more information on retention of the learning, and would also allow errors to be corrected and reevaluated on the next visit.

The criterion for receiving a passing score on the observation tool for this study was to have zero errors. This is the ideal goal, but it may be too stringent. Many of the participants had just one or two errors - still less than most parents in the general population. A subsequent study could make the criterion for passing be two or less errors, as long as none of them was serious. This would increase the pass rate, and the installation would be safe enough to protect the child from all but the most severe crashes.

The errors could also be analyzed using a continuous variable rather than the nominal data in the current study. A scoring system would assign a value to each error, and a passing score would be predetermined. The scores should be weighted so that the most serious errors were given a high enough value that the installation would fail with any one serious error.

Another recommendation is to not supply a car seat, or to restrict the study seat to
only one type. Most parents use an infant seat as the first seat for the baby. If a seat is supplied, this might be the best one. It would avoid the problem of the parents saving the convertible seat until the child is older. Another option is not to supply a seat. This allows the parents to choose the seat they want to use, and still receive the teaching. This is more "real life," and trained technicians should be able to teach any parent about any car seat. The variable of the vehicle cannot be controlled, and it is not essential to control for the seat.

A recommendation that might reinforce learning for the families in the intervention group is to videotape them while they are receiving the hands-on instruction. They would then be given a DVD of the session that they could view at home. When they had a question about a specific detail of the installation, they would be able to watch the DVD to see and hear what they had experienced in the teaching session.

Recommendations for Practice

This study demonstrates the value of hands-on teaching for parents to learn how to install and use a child car seat. Everyone who transports a child in a motor vehicle should have access to this type of education. This includes not just new parents, but grandparents, foster parents, and other caretakers. Nurses, physicians, and others working with families should encourage them to seek out this kind of teaching. They should also advocate for more programs which offer this service.

On the island of Oahu there are currently eight locations where parents can go to be shown how to install their car seat. These are located at hospitals, community health centers, and military bases. Most of these sites have waiting lists for appointments, and new parents often deliver their baby before they can receive the education. More
programs at convenient locations are needed to meet the need that exists.

Everyone who works with families of young children should learn key points about what to look for in correct installation and use of a child car seat. They can help parents identify incorrect use, and refer them for more in-depth instruction from trained technicians. They can also teach them important basics, such as not putting the car seat in front of an air bag, and not placing an infant forward facing in the car. If more health care providers were trained as child passenger safety technicians, they could provide this education as part of their practice.

Health promotion and injury prevention are key components of care for children. It is more beneficial to keep them well and healthy than to try restoring them to health after an injury. Motor vehicle crashes are a leading cause of death and serious injury for children, and child and family healthcare providers are in an optimal position to prevent many of these injuries by helping parents learn to properly restrain their child.
Table 1: Parent Factors that Can Change

<table>
<thead>
<tr>
<th>Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
</tr>
<tr>
<td>Perceptions</td>
</tr>
<tr>
<td>Beliefs</td>
</tr>
<tr>
<td>Attitudes</td>
</tr>
<tr>
<td>Information Sources</td>
</tr>
<tr>
<td>Information Needs</td>
</tr>
<tr>
<td>Stress</td>
</tr>
<tr>
<td>Risk Factors in Home</td>
</tr>
<tr>
<td>External Barriers</td>
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<tr>
<td>Rules</td>
</tr>
<tr>
<td>Modeling</td>
</tr>
<tr>
<td>Feelings</td>
</tr>
<tr>
<td>Learning Needs</td>
</tr>
</tbody>
</table>

50
Table 2: Parent Factors That Cannot/Are Difficult to Change

<table>
<thead>
<tr>
<th>Educational Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socioeconomic Status</td>
</tr>
<tr>
<td>Status as Parent</td>
</tr>
<tr>
<td>Age of Child</td>
</tr>
<tr>
<td>Temperament of Child</td>
</tr>
<tr>
<td>Race</td>
</tr>
<tr>
<td>Culture</td>
</tr>
<tr>
<td>Previous Injury To Child</td>
</tr>
<tr>
<td>Home Environment</td>
</tr>
<tr>
<td>Family Chaos</td>
</tr>
</tbody>
</table>
Figure 1. Age of Participants
Figure 2. Education
Figure 3. Income
Figure 4. Correct vs. Incorrect Use
Figure 5. Correct Use
Figure 6. Number of Errors
Figure 7. Serious Errors
INFANT PASSENGER RESTRAINT EDUCATION STUDY would like to invite you to take part in a research study that is looking at better ways to teach parents about their child's car seat.

- Attend a teaching session before your baby is born about protecting your baby in your car. A car seat will be provided for your participation in this study.

- We will schedule a short follow-up visit two to three months after your baby is born.

If you are interested in joining or finding out more about this study, fill in the section below and put it in the marked box; or to schedule an appointment now, call the Clinical Research Center at 983-6242. For more information, you can call Karen Tessier, Investigator, at 956-5015.

Name

Address

Number of months pregnant now _______ Next clinic visit

Phone # ___________ Best time to call ________________

By filling out this form, I agree to be contacted by someone about this study. I understand that I do not have to be part of this study unless I choose to sign up for it.

All information you provide will be kept confidential.
This study is being sponsored by the University of Hawaii at Manoa Clinical Research Center and School of Nursing and Dental Hygiene.
Appendix D

Consent to Participate in

Infant Passenger Restraint Education Study

Principal Investigator: Rosanne Harrigan, EdD, APRN-Rx
John A. Burns School of Medicine
University of Hawaii at Manoa
1960 East-West Road, Biomed T101
Honolulu, Hawaii 96822
(808) 956-2904

Co-Investigator: Karen Tessier, RN, MS, PhD (c)
School of Nursing & Dental Hygiene
University of Hawaii at Manoa
2528 McCarthy Mall, Webster Hall
Honolulu, Hawaii 96822
(808) 956-5015

PURPOSE

This study will give information about the way people use car seats for their new baby. Two kinds of teaching have been designed to help parents learn how to properly install and use a child car seat for their baby. This study will test how well the different kinds of teaching help parents properly install and use their car seats. Information from this study will help us learn what teaching methods work best in helping parents learn how to install and use child car seats correctly. This will result in more infants riding safely and avoiding injury.

PROCEDURES

Before your baby is born, you will be given a child car seat free of charge to you. You will be randomly placed into one of two groups. Participants in both groups will receive information about the safe use of a car seat. We will ask you some brief questions about yourself, and will schedule a follow-up appointment at a location convenient to you when your baby is approximately 2-3 months old. At that time you will bring your vehicle with the car seat and the baby in it. If your seat is found to be incorrectly installed at that time, you will be shown how to make all corrections. This may take as much as one hour.

RISKS AND DISCOMFORTS

There are no known risks to you or your baby that will result from this study.

FINANCIAL COSTS
There are no extra costs to you for participating in this study.

RIGHT TO WITHDRAW OR REFUSE

Joining this study is completely voluntary. You may choose to withdraw or refuse to participate at any time. If you do choose to withdraw from the study before the completion of your participation, you must return the car seat to the investigators of this study.

CONFIDENTIALITY

All information about you obtained from this study will be kept confidential to the extent allowable by the law. Information gathered in this study may be published or shared with other interested parties, but you will not be personally identified.

If you are interested in finding out the results of this study, a summary of the findings will be sent to you when the study is completed.

If you have any questions about the study you can reach Karen Tessier at 956-5015 or ktessier@hawaii.edu. Any other questions that you have about your rights as a research participant should be directed to Raul Rudoy, M.D., Chair, Kapi'olani Health Institutional Review Board at 535-7504.

*My signature below indicates that I have read and that I understand the procedures described above, and that I give my informed and voluntary consent to participate in this study. I understand that I will receive a copy of this consent form.*

__________________________________________  ____________________________
Signature of Participant                        Date

__________________________________________  ____________________________
Print Name                                      Phone Number

__________________________________________
Address

c. Copy to participant
1. How many children do you have (not including this pregnancy)? ______
2. What is your home zip code? __________________
3. What is your age? __________________
4. Are you male or female? (Circle one).
5. Do you live (circle one)
   A. With a spouse or partner?
   B. Alone?
   C. With other family members?
      i. ______ How many?
         Who? (relationship to you)
      ii. _______________________
         _______________________
         _______________________
         _______________________
   D. With others?
      i. _How many?
         Who? (relationship to you)
      ii. _______________________
6. What is your ethnic background (circle as many as apply)?

   a. Hawaiian/Pt Hawaiian
   b. Samoan
   c. Tongan
   d. Other Pacific Islander
   e. Filipino
   f. Chinese
   g. Japanese
   h. Korean
   i. Other Asian
   j. Caucasian
   k. Black
   l. Mixed
   m. Other
   n. Unknown

7. What is your primary language? _______________________________________

8. If your primary language is not English, how comfortable are you reading and hearing English? (Circle one)

   A. Very comfortable
   B. Fairly comfortable
   C. Somewhat comfortable
   D. Not very comfortable
   E. Not at all comfortable

9. What is the highest grade you completed in school? (Circle one)

   A. 8th grade or less
   B. Some high school
   C. Graduated from high school
   D. Some college
   E. Graduated from college
10. What is your household income? (Circle one)
   A. 0 - $10,000
   J. $10,000 - 20,000
   C. $20,000 - 35,000
   D. $35,000 - 50,000
   E. over $50,000

11. Do you have experience using a car seat?
   A. None
   B. A little
   C. Some
   D. A lot
   i. If any experience, please explain when and in what capacity (for example, as a parent, family member, caretaker, etc.)

12. Have you ever had any classes or teaching about car seats or child passenger safety?
   A. No
   B. Yes
   i. If yes, when? ________________________________
   II. If yes, what ________________________________
13. **If you have a child, how long do you leave your child unattended in the car seat in the car?** (Circle one)

A. More than one hour  
B. 30 minutes to one hour  
C. 15 to 30 minutes  
D. 5 to 15 minutes  
E. 1 to 5 minutes  
F. Never

14. **How often do you use your seat belt?** (Circle one)

A. Every time I drive the car  
B. Most of the time  
C. Some of the time  
D. Not very often  
E. I don’t use the seat belt
### Observation of Infant Restraint Use - page 1 of 3

<table>
<thead>
<tr>
<th>Participant/Seat #</th>
<th>Observation of Infant Restraint Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Child not restrained in seat</td>
<td>X if observed</td>
</tr>
<tr>
<td>b. Seat not anchored in vehicle</td>
<td></td>
</tr>
<tr>
<td>c. Seat in front of air bag</td>
<td></td>
</tr>
<tr>
<td>d. Seat not rear facing</td>
<td></td>
</tr>
<tr>
<td>e. Inappropriate recline (more than 45 degrees/infant's head flops forward)</td>
<td></td>
</tr>
<tr>
<td>f. Harness retainer clip not at armpit level</td>
<td></td>
</tr>
<tr>
<td>g. Harness straps not snug (1 finger space between straps and collarbone)</td>
<td></td>
</tr>
<tr>
<td>h. Harness straps not at or below shoulders</td>
<td></td>
</tr>
<tr>
<td>i. Seat belt (or LATCH) not holding seat tightly in vehicle (1 inch test)</td>
<td></td>
</tr>
<tr>
<td>j. Seat belt (or LATCH) not routed correctly</td>
<td></td>
</tr>
<tr>
<td>k. Seat belt (or LATCH) not locked (with latch plate, retractor, or locking clip)</td>
<td></td>
</tr>
<tr>
<td>l. Extra padding between harness, infant, and back of seat</td>
<td></td>
</tr>
<tr>
<td>m. Carry handle not in proper position for travel</td>
<td></td>
</tr>
<tr>
<td>n. Locking clip not used correctly (if needed)</td>
<td></td>
</tr>
<tr>
<td>o. Total number of errors</td>
<td></td>
</tr>
</tbody>
</table>

p. **Comments (including other errors found; note if LATCH used):**

____ Pass (all elements in table correct; no errors found).

____ Fail (if any error is found).

Observer: ____________________________________________

Location: ____________________________________________ Date: __________
Participant/Seat #__________ Observation of Infant Restraint Use - page 2 of 3

Car Seat Information:

Type of seat
q. __________ Infant with base
r. __________ infant without base
s. __________ convertible
t. manufacturer___________________________
u. Model Name __________________________
v. Model Number _________________________
w. Date of Manufacture ___________________

Vehicle information:
x. Manufacturer___________________________
y. Make/Model_____________________________
z. Year_________________________

aa. Was parent wearing their seat belt when they arrived? Yes No Unknown
bb. Did parent fasten their own seat belt before leaving the check? Yes No

Questionnaire (Ask parent the following questions):

1. How often have you removed and reinstalled the car seat since you first installed it?
   
   A. ______ never
   
   B. ______ 1 time
   
   C. ______ 2 to 5 times
   
   D. ______ more than 5 times
2. Have you received any instruction or help installing or using your car seat since your education session when you first received the seat?
   
   A. _____yes
   B. _____no

3. If yes, what kind of help?
   
   A. _____Inspected at car seat checkup or inspection station
      
      i. Location________________________
      
      ii. Date________________________

   B. _____Friend or family member helped to install
   C. _____Friend or family member gave advice
   D. _____Other

   (specify)__________________________________________________________

4. How often do you put the baby in the car seat?
   
   A. _____Every time I drive the car
   B. _____Most of the time
   C. _____Some of the time
   D. _____Not very often
   E. _____I don’t use the car seat
References


