

“How Difficult Can It Be?”: Investigating Child Seat Installation Errors

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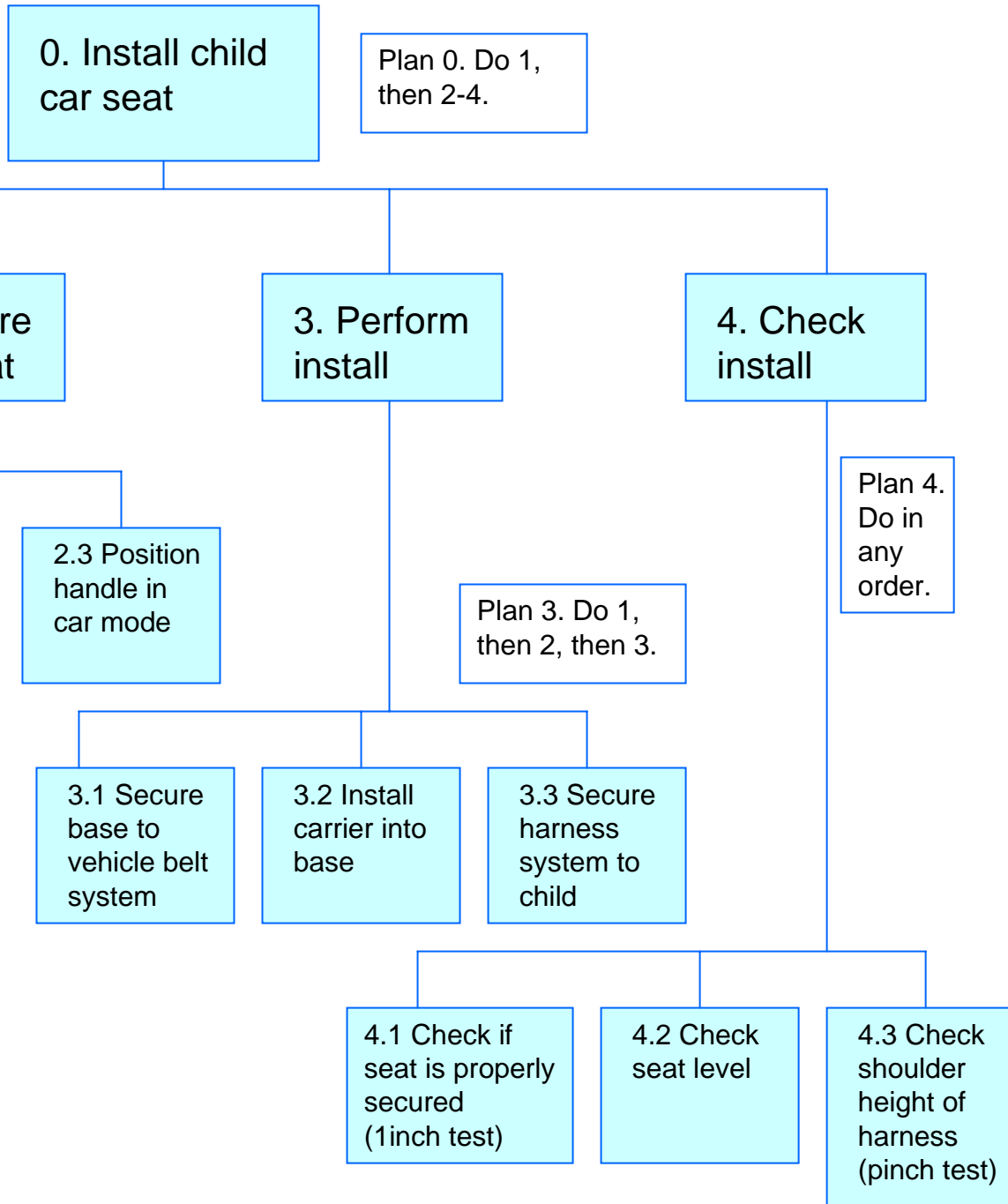


Child Seat Safety

- Incorrect use is common
- Surveyed checkup stations find 4 out of 5 error rate!
- Correctly installed CRS can reduce risk of infant death by 71%
(Taft et al., 1999)



Tasks for Proper Child Seat Installation (carrier with base)



How can errors be reduced?

Need to understand *why* errors are being made

- Decision-making process of parents

Understand characteristics of design features that can affect errors and ease of use.

- Instructions
- Labels
- Seat design
- Car design

Study Objectives

- Determine what installation errors occur when installing rear facing CRS and why?
- Identify potential solutions to reduce errors

Study 1:

- Compare LATCH and non-LATCH vehicles
- Evaluate errors installing seats to cars and child in harness

Study 2:

- Evaluate LATCH-equipped vehicle

Study Design

Scenario: Subject is a new parent preparing child seat & child for upcoming trip.

- Asked to install child seat to best of ability
 - Rear-facing child seats
 - If installed via SB, asked to complete via LATCH, if equipped
- Given child seat manual and car owner's manual
- Told to "talk out loud" to describe the installation procedure and problems they were having

After each installation, errors recorded & questionnaires were completed.

Talkaloud

Okay, I put the LATCHes on. Does the SB go across also? Well, I guess it could...



I don't know why this is supposed to be there, but I guess it goes.

So I'm supposed to be finding vehicle lower anchor points. Okay, something that pulls outward. Where does it pull from, from the bottom or top?

Strange, I seem to be doing something wrong...

Study 1 Subject Demographics

- Novice child seat installers
 - N = 30, 10 for each child seat
 - Latch-equipped vehicles, N=8
- Mean age = 24.2 (SD = 4.46), 16 males, 14 females
- Recruited students from George Mason University for class credit

Child Seats Used in Study

CRS A



CRS B



CRS C



Child Seat Labels



CRS A



CRS B

CRS C



Study 1: SB Installation

Seat Belt Install	Error	%	Severity score
	Not tight installation	69.2	1-7
	SB routed incorrectly	46.2	9
	SB twisted	34.6	?

N=26

Difficulty with CSS Installation

- 67% - rated difficult to secure the seat into the vehicle

Confidence with Child Installation

- 73% - confident that they secured the test dummy to the seat correctly

SB & LATCH Installation

- Subjects that attached both systems were not satisfied with the installment of only 1 system

Study 2 Demographics

- Novices child seat installers
 - N = 39, 13 for each child seat
- Mean age = 22.1 (SD = 4.1), 11 males, 28 females
- Recruited subjects from George Mason University for class credit

LATCH Connector Variations



CRS A



CRS C

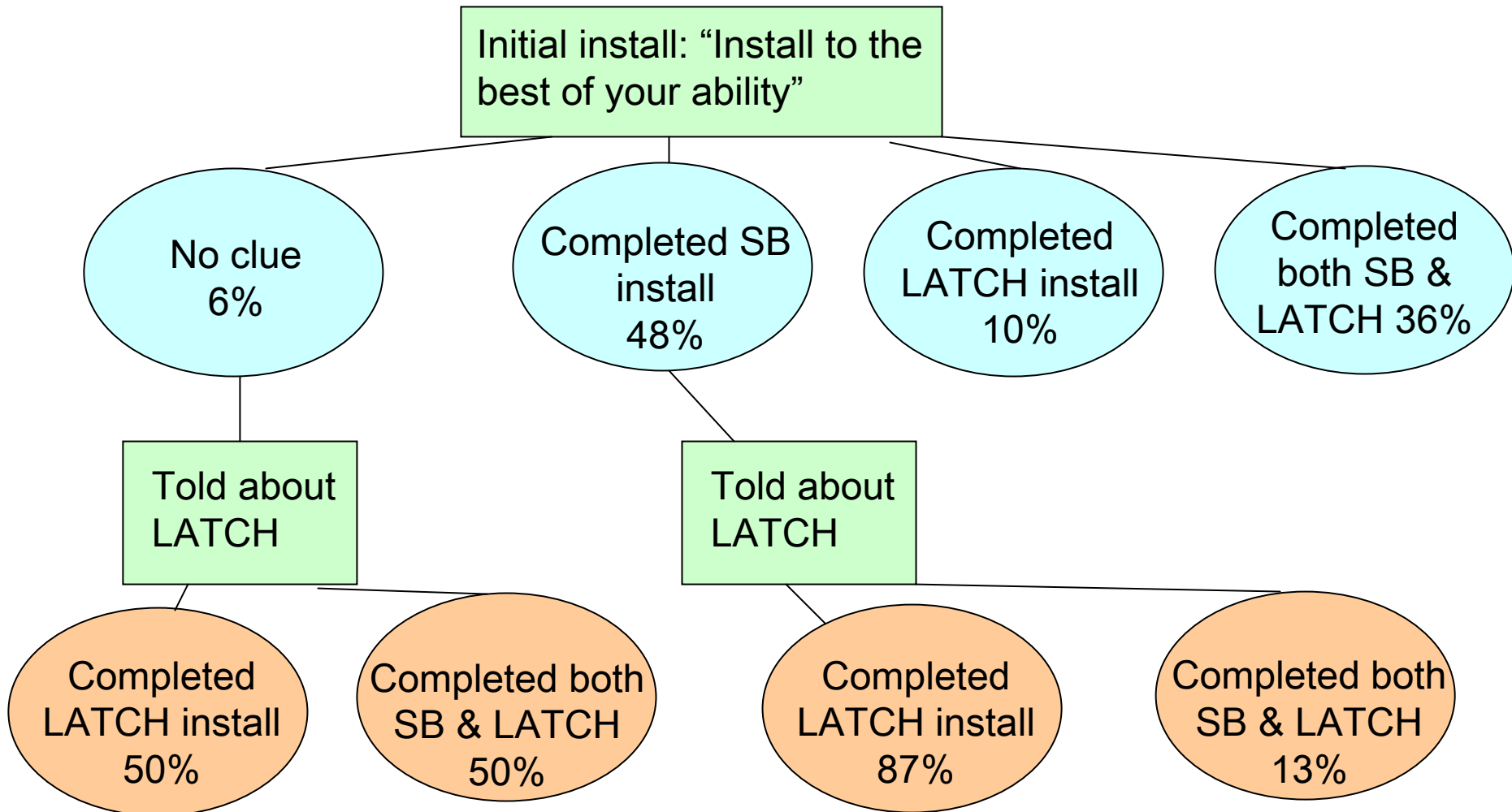


CRS B



ISOFIX

Attachment Response Tendencies



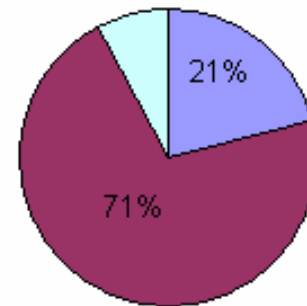
Manual Usage

Subjects were given both CRS and car manuals to use as needed

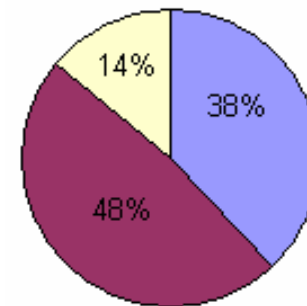
Manual use varied depending on type of install completed

- More used CRS manual for SB compared to LATCH
- A majority of combo installers used both manuals

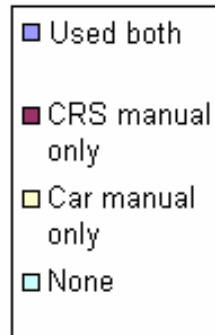
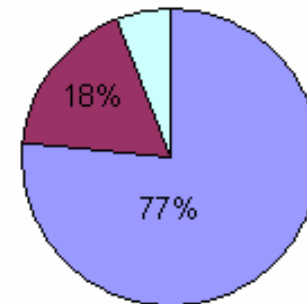
SB Install (N=38)



LATCH Install (N=21)



Combo Install (N=17)



Where are the LATCHes?



LATCH Installation Results

Lower Anchor Install	Error	%	Severity score
	Loose installation	73	1-7
	Installed SB with LATCH	45.9	?
	LATCH strap twisted	35.1	1.6
	Not attached to designated anchor	29.7	9.4
	Installed to undesignated anchors in middle seat	19	5.75
	Connector not right side up	16.2	1.6

N=37

General Install	Error	%	Severity score
	Recline position inappropriate	30.8	3
	Incorrect carrying handle position	28.2	1.3

N=39

- 72% of participants were confident that they correctly secured the CRS

SB+LATCH: Combo Installations

46% participants installed BOTH systems

- Subjects thought system installed was not tight enough
- Did not understand instructions

Only 3 combo install participants installed one of the systems tightly!

- 82% of combo installs → loose installation



Child Seat Comparison

LATCH Installation



Error	CRS A	CRS B	CRS C
Loose installation	58.3%	76.9%	100%
LATCH strap twisted	16.7	30.8	46.2

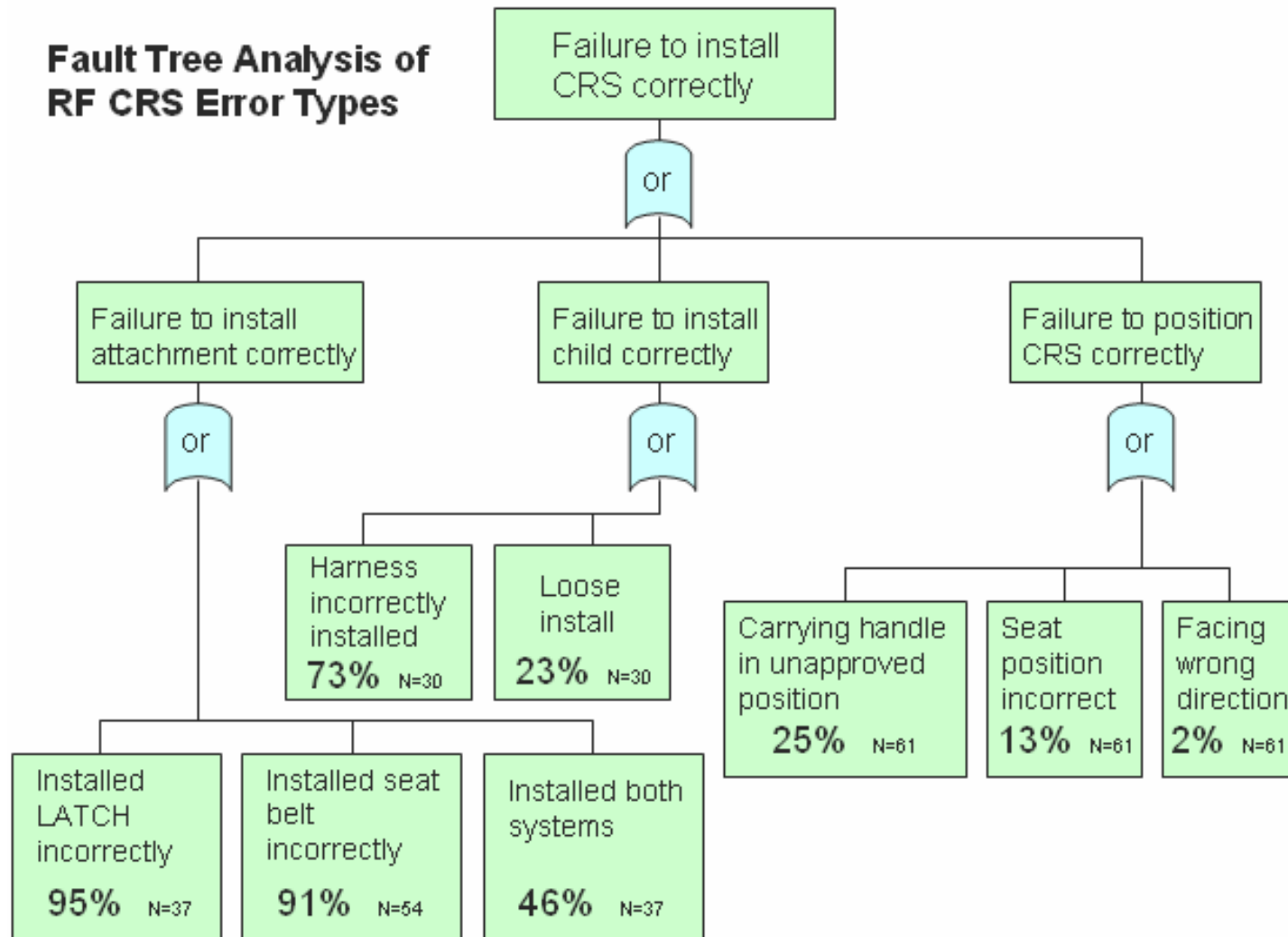
General Installation

Error	CRS A	CRS B	CRS C
Recline position inappropriate	30.8%	38.5%	23.1%
Incorrect carrying handle position	53.9%	15.4%	15.4%

N=39

Fault Tree Analysis

Fault Tree Analysis of RF CRS Error Types



Manual Confusion



Summary

Misuse errors prevalent among novice participants using SB or LATCH to install CRS

- Loose installation for both SB and LATCH
- Twisting of LATCH straps
- Combination LATCH/SB installations

Source of errors may be due to confusion about manuals, labels, CRS design, and vehicle seat design

- CRS manuals containing perplexing text or unclear diagrams
- Conflicting information in manuals
- Car manuals with generic CRS installs

Manual Recommendations

Provide cohesive labeling & manuals

- Point users to where to look
- Simple lingo, helpful pics

Both CRS & car manuals should explain about different types of SB retractors & how they lock

- Prevents loose installation
- Less confusion over locking clip

Clearly differentiate between the two types of installations

- Users install both because they believe one is not enough!



Design Recommendations

LATCH anchors should be easy to identify

- Standardize a universal symbol across car manufacturers
- Users need to recognize & identify where anchor is located

LATCH connectors should be easy to attach

- Difficult to push and hold hooks open
- Make anchors more visible

