Confessions of a Car Seat Nerd:

What You Still Don't Know About Child Passenger Safety

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What Kills Kids in the U.S.?





N Engl J Med 2018; 379:2468-2475

Leading Causes of Death for Children and Youth 2012-2022

	<u>4</u>	1-4	5-9	10-14	15-19
1	Congenital Anomalies 49,414	<u>Unintentional</u> Injury 13,763	<u>Unintentional</u> Injury 8,165	<u>Unintentional</u> Injury 8,994	Unintentional Injury 44,975
2	Short Gestation 40,432	Congenital Anomalies 4,703	Malignant Neoplasms 4,513	<u>Suicide</u> 5,281	<u>Suicide</u> 23,373
3	Sids 16,177	<u>Homicide</u> 3,651	Congenital Anomalies 2,086	Malignant Neoplasms 4,787	<u>Homicide</u> 21,408
4	Maternal Pregnancy Comp. 15,079	Malignant Neoplasms 3,563	Homicide 1,632	<u>Homicide</u> 2,272	Malignant Neoplasms 6,588
5	<u>Unintentional</u> Injury 13,600	Heart Disease 1,443	Heart Disease 800	Congenital Anomalies 1,865	Heart Disease 3,273
6	Placenta Cord Membranes 9,017	Influenza & Pneumonia 1,103	Chronic Low. Respiratory Disease 706	Heart Disease 1,246	Congenital Anomalies 2,068
7	Bacterial Sepsis 6,379	Septicemia 584	Influenza & Pneumonia 604	Chronic Low. Respiratory Disease 791	Chronic Low. Respiratory Disease 719
8	Respiratory Distress 4,948	Perinatal Period 580	Cerebrovascular 424	Cerebrovascular 544	Diabetes Mellitus 714

Top 10 Causes of Death



Deaths 1-18 year 2012-2022

CDC WISQARS

Leading Causes of Death by Age Group: Unintentional Injury 2012-2022



"If a disease were killing our children in the proportions that injuries are, people would be outraged and demand that this killer be stopped." **C. Everett Koop MD** Former US Surgeon General





43 School Busses of Youth Die in Car Crashes Every Year



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Objectives

- By the end of this talk, you should be able to:
 - Discuss <u>basic principles</u> of child passenger safety (CPS) science including
 - Epidemiology
 - Physics
 - Anatomy and physiology of children
 - Crash dynamics
 - 2. List <u>5 ways</u> car safety seats help prevent injury to children
 - 3. Discuss <u>best practice</u> recommendations for appropriate child passenger restraint
 - 4. <u>Identify and access</u> CPS resources in your community, including for children with special health care needs





Bill to require booster seats for children 5-7 clears committee

Howard Fischer Capitol Media Services

Feb 3, 2012

Wednesday's action on HB 2154 could be a turning point in the multi-year battle over whether the state has a legitimate role. Prior bills have been beaten back amid arguments that parents know best what is good for their children.

But Rep. Nancy McLain, R-Bullhead City, who had been one of those foes, told colleagues she had an epiphany of sorts after speaking with a pediatrician.

She said the doctor pointed out that current law already requires anyone younger than 16 to wear a seat belt. While children younger than 5 are required to be in special car seats, McLain said, anyone 5 or older is simply strapped into a regular seat belt. "Obviously, a child is not going to fit," she said.

Moreover, McLain said she now believes that a young child wearing a seat belt designed for adults is more likely to be injured.

Sara Bode, a pediatrician at Phoenix Children's Hospital, said that's true. "If you are in an adult seat belt and you're that age, it may look OK on the outside. But when you're in a crash, it is not helping you at all."

Car Safety Seats Work!



Belt Positioning Booster Seats Work!



Belt-positioning booster (BPB) seats are effective for children through at least age 7. Using a BPB with a seat belt instead of a seat belt alone reduces a child's risk of injury by 59 percent. Once a child has outgrown her child safety seat with harness, she should be restrained in a belt-positioning booster seat until she reaches a height at which an adult seat belt fits properly, usually around 4'9".

Partners for Child Passenger Safety

Not All Kids Ride Restrained 2019-2021



Figure 5. Restraint Use for Children Under Age 1

Figure 6. Restraint Use for Children 1 to 3 Years Old



Figure 2. Restraint Use for Children 4 to 7 Years Old

Figure 8. Restraint Use for Children 8 to 12 Years Old



Black and Brown Kids Are Less Likely To Be Restrained

□Hispanic ■Black Non-Hispanic □White Non-Hispanic ■Asian Non-Hispanic □Other Non-Hispanic



Figure 15. Child Restraint Use by Race and Ethnicity

Source: NHTSA 2023

Use rates are not getting better



Figure 1. Booster Seat Use Among 4- to 7-Year Old Children, National Estimates

Source: NHTSA 2023

35% of child passenger deaths were totally unrestrained

CONTRACTOR ON

Car Safety Seats are hard to use correctly



Source: NHTSA 2004

<u>Almost every caregiver of</u> <u>newborns makes errors!</u>

95%

5% No Errors

1 Or More Misuse Errors

Source: Hoffman et al 2015



The laws of physics <u>ALWAYS</u> trump the law of the land

Phun with Physics

Would you catch a 10 pound bowling ball dropped from a 3rd story window?

F=MA

Force= 10 lbx(32feet/sec)/(.94sec)

330 lb of momentum

A car traveling at 30 MPH hits a tree... 10 pound child

Stops in 1 second

Acceleration=45 feet/sec/sec

Momentum= 10lb (45 feet/sec/sec)=450 b

It is ALL about The Force

We must learn to control the force!



Different Types of Seat Belt Pretensioners





Pyrotecnic Pretensioner





More about force

 Force per unit of area is key

2. Minimize acceleration into the impact



Kids are not little adults





Why are kids different?



Kids lack anterior superior iliac spines

Kids lack anterior superior iliac spines





Submarining


Abdominal Organs

ABDOMINAL VISCERA (ANTERIOR VIEW)



Seat Belt Syndrome

Intra-abdominal injuriesContusions

• Spinal injuries

Cervical Spine

~40% of all C-spine injuries in children





5 Ways Restraints Prevent Injury

- Prevent ejection
- Allow body to "ride down" with vehicle
- Contact the strongest body parts
- Distribute force over most extensive area
- Protect the head, neck and spinal cord

Why are kids different?

Vehicle belt systems are designed for adults!



Using the correct car seat or booster seat can be a lifesaver: make sure your child is always buckled in an age- and size-appropriate car seat or booster seat.

4 stages





REAR-FACING CAR SEAT

Birth until age 2-4

Buckle children in a rearfacing car seat until they reach the maximum weight or height limit of their car seat. Keep children rear-facing as long as possible.

FORWARD-FACING CAR SEAT

After outgrowing rearfacing seat until at least age 5

When children outgrow their rear-facing car seat, they should be buckled in a forward-facing car seat until they reach the maximum weight or height limit of their car seat.

BOOSTER SEAT

After outgrowing forwardfacing seat and until seat belts fit properly

Once children outgrow their forward-facing seat, they should be buckled in a booster seat until seat belts fit properly. Proper seat belt fit usually occurs when children are 4 feet 9 inches tall and age 9-12.

SEAT BELT

Once seat belts fit properly without a booster seat

Children no longer need to use a booster seat once seat belts fit them properly. Seat belts fit properly when the lap belt lays across the upper thighs (not the stomach) and the shoulder belt lays across the chest (not the neck).

Keep children ages 12 and under properly buckled in the back seat. Never place a rear-facing car seat in front of an active air bag.

*Recommended age ranges for each seat type vary to account for differences in child growth and height/weight limits of car seats and booster seats. Use the car seat or booster seat owner's manual to check installation and the seat height and weight limits, and proper seat use.

Child safety seat recommendations: American Academy of Pediatrics. Graphic design: adapted from National Highway Traffic Safety Administration. www.cdc.gov/motorvehiclesafety/cps



REAR FACING SEATS

Туре	Direction	Lower Weight Limit (Ib)	Weight Limit (Ib)	Length Limit (in)
Infant Carrier	Rear Only	3,4,5	22-35 (30-32)	29-35 (30-32)
Convertible/ All-in-1	Rear Then Forward	3,4,5	30-50 (40)	40-49 (Top of head >1" below top)



Most infants will outgrow rear facing only seats by length, not weight!





LENGTH

Why rear facing?

This photo illustrates how a rear facing car safety seat can cocoon and protect a child, compared to a forward facing seat, in a crash.

REAR-FACING



FORWARD-FACING



Arms and Legs are almost never injured when rear facing

3 years, 32 lbs., 36 in.

Rear FacingTake Home

Best Practice:

Rear facing as long as possible up to the limit of the seat

Key Time Points: Birth, 6,9 and 12-24 months

FORWARD FACING SEATS

Туре	Direction	Lower Weight (Ib)	Higher Weight (Ib)
Convertible	Rear then Forward	20	40,50, 65,85
Combination	Forward only (Booster)	20	40,50,65
3-1	Rear/Forward/ Booster	20	40,50,65





5 point harness spreads force better





Top tethers make a huge difference



When Do Kids Exceed Limits?



Best Practice: Forward facing harness as long as possible, up to the limits of the seat

Use the tether!!

AT A MINIMUM: 4-8 years

Key Time Points: 4-10 years



BELT POSITIONING BOOSTER SEAT

Туре	Lower Weight Limit (Ib)	Higher Weight Limit (Ib)
Belt Positioning Booster	30,40	80-105
Combination/3-1	30,40	80,100,120







BELT POSITIONING BOOSTER SEAT





Is There a Time That Belts Fit?



Step 4 – Seat Belt

It's all about the fit!



Misused Seat Belt



Correct Seat Belt

- 1. Sitting upright
 - Back against vehicle seat
- 2. Legs bend comfortably
- 3. Shoulder belt across clavicle and sternum
- 4. Lap belt low across hips
 - Not resting on abdomen
- 5. Child can sit that way the entire ride



Booster/Seat Belt: Take Home

Best Practice:

Booster until seat belt fits correctly

AT A MINIMUM:

8-12 years/4'9"

Key Time Points:

Back seat until 13 years

Love your kids? Make sure they're in the back seat. NHTSA.gov/TheRightSeat





The best seat:

99.99

Fits the child Fits the car Can be used correctly every ride

Installation Is hard





FIND EXPERT RESOURCES IN YOUR COMMUNITY!

Public Safety Officers MAY NOT BE CERTIFIED!

	Find a CPS Technician				New Record
Search					
				Fina	
Name 🗘	Location/Contact	\$	Languages 💠	Certification ᅌ	Extra Training 💲
Branda Brothers	Sedona Fire District		English	Technician	
	2860 Southwest Dr				
	Sedona, AZ 86336				
Carla J Dufort	Sedona Fire District		English	Technician	
	Sedona AZ 86336				
	5600ha, A2 00000				
	\boxtimes				
Stephanie Knight	Sedona Fire District		English	Technician	
	2860 Southwest Dr		-		
	Sedona, AZ 86336				
Kirk Riddell	Sedona Fire District			Technician	
	2860 Southwest Dr				
	Sedona, AZ 86336				
	920-202-0025				
County					
Postal Code					
Clear Form					Search





<u>AAP</u> <u>Car Seat Guide</u>

The following is a list of car seats. Manufacturer names are **boldfaced**. Weight is in pounds [lb] and height is in inches ['].

See Car Seats: Information for Families for information about choosing the most appropriate car seat for your child.



Rear-facing only seats

(Used rear-facing. All seats have a 5-point harness.)

	Rear-Facing Weight Limits	Height Limits		
Baby Jogger City GO AIR	435 lb	Up to 32″	\$349.99 \$289.99	
Baby Jogger City GO 2	4–35 lb	Up to 32″		
Baby Trend Ally 35	4-351b	Up to 32"	\$99.99	
Baby Trend Ally 35 Snap Tech	435 lb	Up to 32″	\$89.99	
Baby Trend EZ Flex-Loc	4–30 lb	Up to 30"	\$99.99	
			Sector and a	

THE TAKE HOME MESSAGE: Just because you can, doesn't mean you should...

Delay car safety seat transitions as long as possible!

Questions?
Take Home Messages

- Best practice based on real world physics
- Delay transitions
 - Lose relative protection every step
- Rear facing to weight/height limit of seat
 Rear facing until at least 2 years
- Forward facing until weight/height limit of seat
 Forward facing in a harness until at least age 4
- Belt positioning booster seat until seat belt fits correctly
 Generally 4 years to 8-12 years
 - Depends on child and vehicle
- Rear seat until at least 13 years of age

Thanks

@ DJJAM Photo