Child Injury
Epidemiology and Prevention

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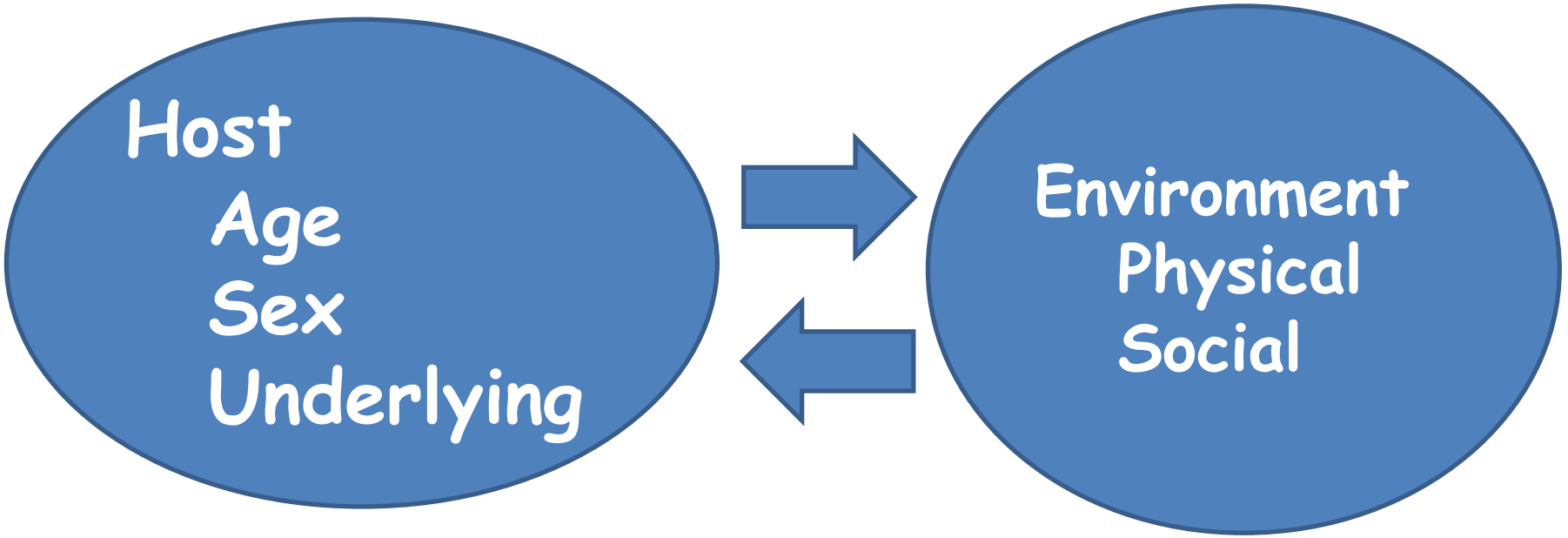
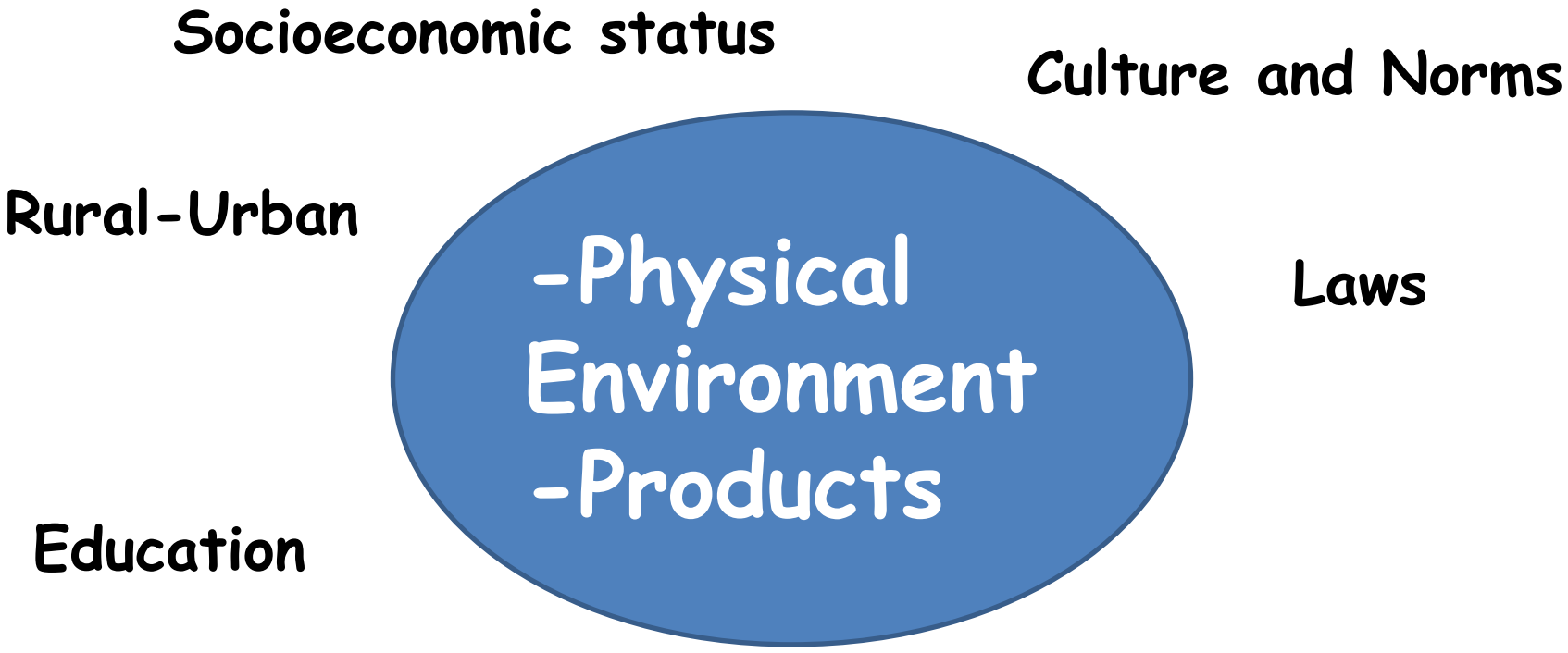
Epidemiological Model of Injuries

Injuries: interaction between host and environment



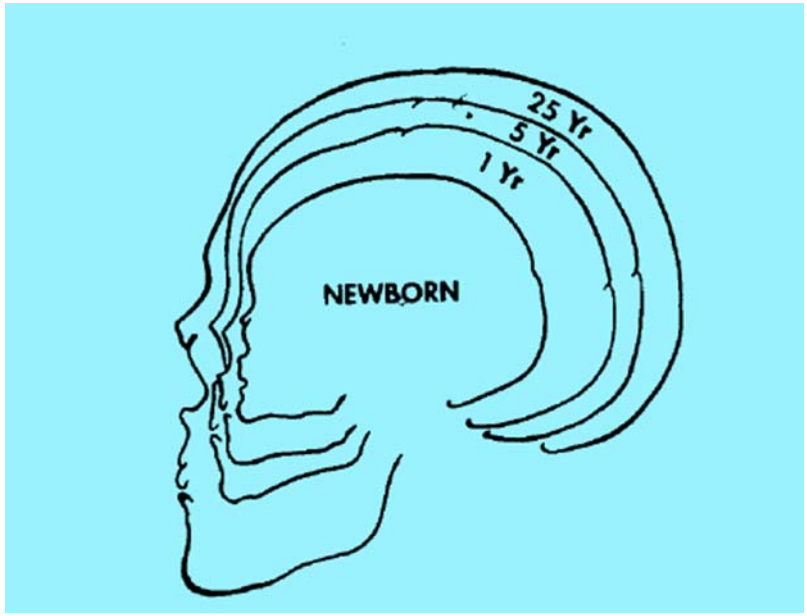
Physical and social environment



- Children are the vulnerable group and are prone to be injured
  - Immature physical and mental development
  - Dependent on supervision potential of family and society
  - Living in adult-designed environment

Physical Differences and Injury Risk in Children: Larger Head

- A major difference in anatomy between children and adults is the proportion of total mass in the head.
- At birth, the head comprises 30% of body weight while the adult head makes up only 6% of body weight.

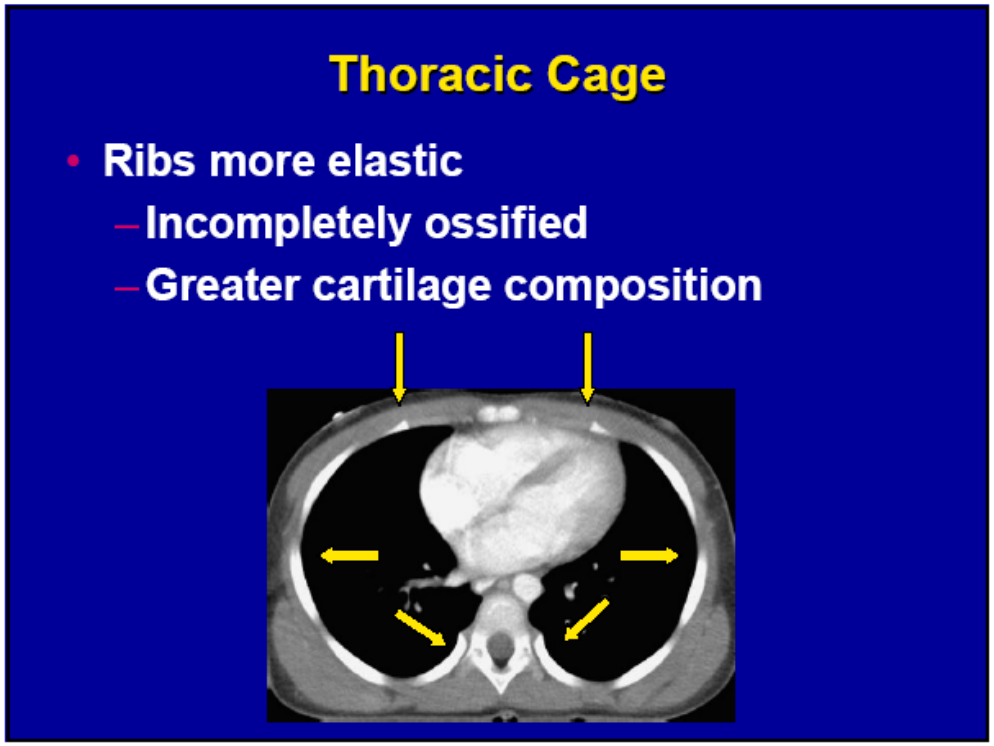


Cervical Fracture

- About 60-70% of pediatric cervical fractures occur at C1 or C2, compared to about 16% of adult cervical spine fractures.

Physical Differences in Children

- **Chest more pliable**
  - **Pulmonary contusion more likely**
  - **Rib fracture is rare**



Physical Differences in Children

- **Abdominal organs less well protected.**
  - **Liver is not covered by the rib cage.**
  - **Less muscle mass to abdominal wall.**
  - **Less subQ tissue to absorb the injury.**

Behavioral and Developmental Factors in Pediatric Injuries

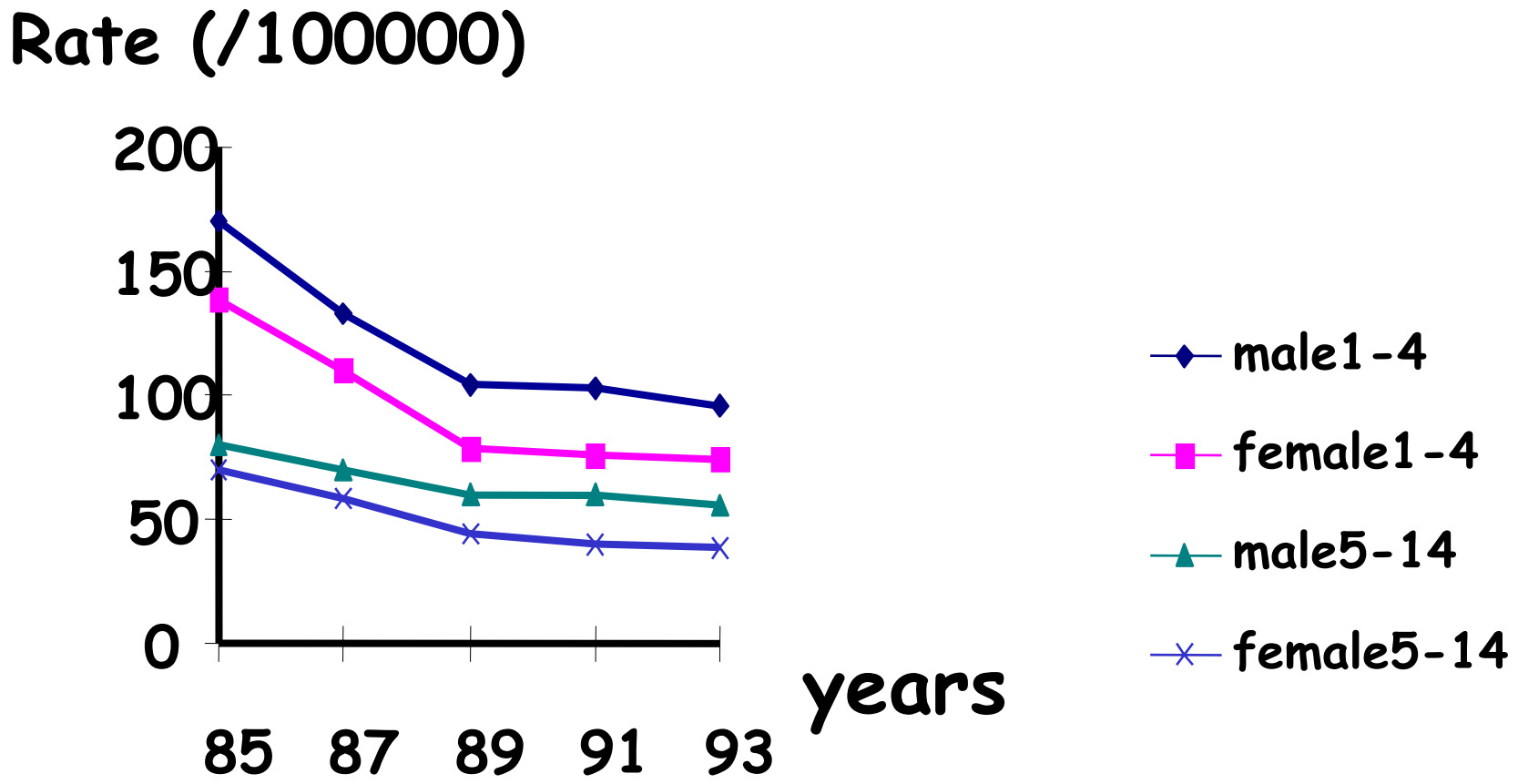
Age group	Contributing Factors	Resultant Risks
Infant	Completely dependent on parent or caregiver; requires constant supervision; unable to communicate verbally; explores by putting objects in mouth; rapid changes in motor ability and mobility	Falling; suffocation; choking on small items; child abuse; electrical burns to mouth; burn-related injuries from house fires
Toddler, preschooler	Curious and impulsive; puts objects into mouth; improved motor ability and mobility, likes to explore; high center of gravity; imitates adult behavior without knowledge of potential dangers; requires constant supervision	Falling on stairs; scald burns; drowning incidents; child abuse; poisonings; passenger in motor vehicle crashes
School-aged child	Improved motor ability and mobility; increased independence; may recognize dangerous situations but lacks judgment to make safe decisions; unable to assess speed of oncoming traffic	Pedestrian injuries; bicycle injuries; sports and playground injuries; drowning incidents
Adolescent	Dynamic emotional and physical change; increased strength and coordination; inexperienced in decision-making; greatly influenced by peers; likely to engage in risk-taking behavior, experimentation with drugs, including alcohol; increased access to fire arms; feels invulnerable; imitates behavior of older adolescents and adults; increased involvement in sports and recreational activities; increased independence; increased incidence of depression	Motor vehicle injuries; injuries from organized sports activities; injuries during outdoor recreation; drug intoxication; violence-related injuries; suicide attempts and suicide gestures

- Children at high risk for injury are likely to be relatively poorly supervised, to have disorganized or stressed families, and to live in hazardous environments

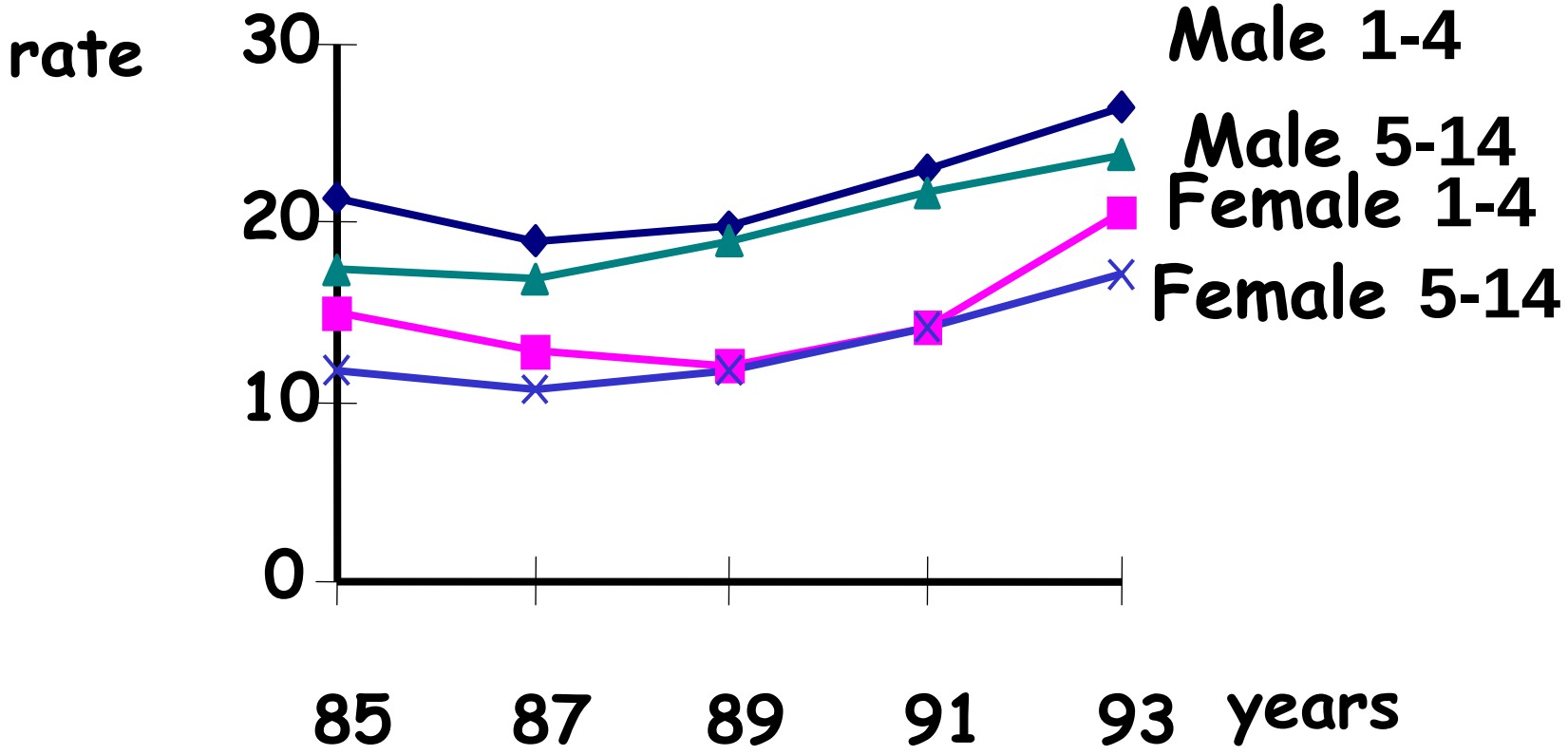
- In macro-level, safety culture and environment are depended on “socio-economic development”

- Socio-economic development is so called “Distal factors” which are also needed to be concerned.

Trend of child mortality in Thailand 1985-93



Trend of child injury mortality in Thailand 1985-93



Child injury problem: the neglected problem in developing countries

The global childhood injury mortality reviews done by Marcusson and Oehmisch in the period of 1950-1971 and Tarket in the period of 1971-1981 showed that the trends of childhood injury mortality decreased in Europe, North America, Australia and Oceania in all age-sex group of 1-14 years but increased in Asia and Latin America.

Marcusson H, Oehmisch W. Accident mortality in childhood in selected countries of different continents, 1950-1971. World Health Statistics Report. 1977; 30: 57-92.

Taket A. Accidents in children, adolescents and young adults: A major public health problem. World Health Statistics Quarterly. 1986; 39:2 32-56.

Epidemiological Transition

The epidemiological transition is defined as the long term process of complex changes in health and disease patterns which are related to changes in economic, social, and science technologies.

This theory was first presented by Omran (1971), and originally consists of three periods:

- **First phase: the era of pestilence and famine**
- **Second phase: the era of receding pandemics**
- **Third phase: the era of non-communicable diseases**

Epidemiological Transition

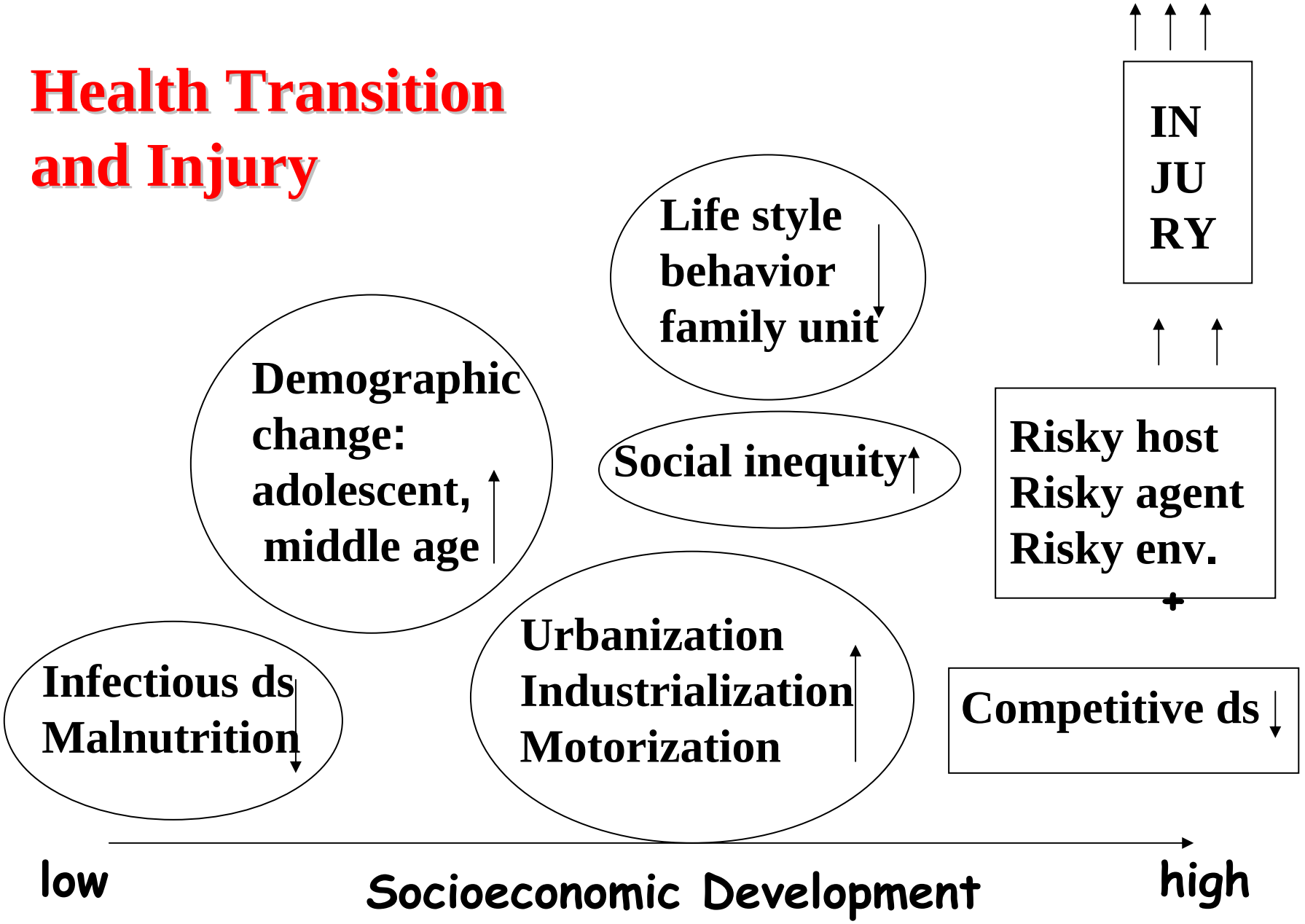
The fourth phase: the stage of delayed non-communicable diseases: described by Olshansky in 1986.

Omran AR. The epidemiologic transition theory. A preliminary update. Journal of Tropical Pediatrics 1983; 29: 305-16.
Olshansky SJ, Ault AB. The fourth stage of the epidemiologic transition: the age of delayed degenerative diseases. Milban Mem Fund Q 1986; 64: 355-91

3 TYPES OF TRANSITIONAL MODEL

- Classical model:
  - time = 150-200 years, start at 18th
  - socio-environmental driven
  - Western Europe, North America
- Accelerated model:
  - time = 50-60 years, start at the beginning of 19th
  - medical technology driven + population control
  - Eastern Europe, Japan
- Incomplete transition model
  - time = 30-40 years, start at the last half of 19th
  - medical technology driven + population over growth
  - Latin America, Asia

Health Transition and Injury



Unintentional injury mortality in children: a priority for middle income countries in the advanced stage of epidemiological transition.

Plitponkarnpim A, Andersson R, Jansson B, Svanstrom L.
Inj Prev 1999;5:98-103.

Objective: **To describe the dynamic changes in the magnitude and the relative importance of childhood injury mortality in relation to socio-economic development.**

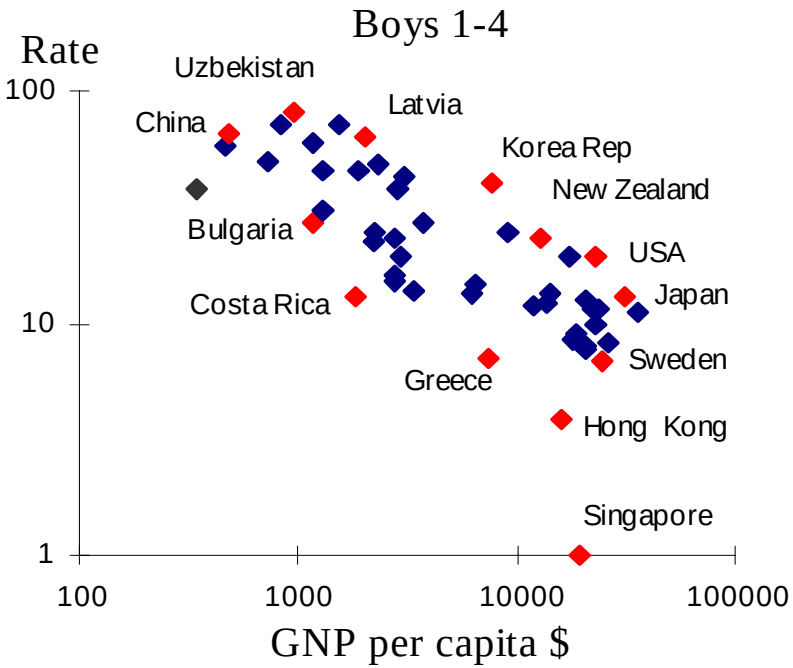
Material and Methods: **Cross-sectional data of child injury mortality by age-sex specific groups will be obtained from 51 countries. The relationship between such mortality and gross national product per capita will be examined by two methods: simple linear regression analysis and categorising the data into five income-based country groups and then comparing the differences between means by student's t test.**

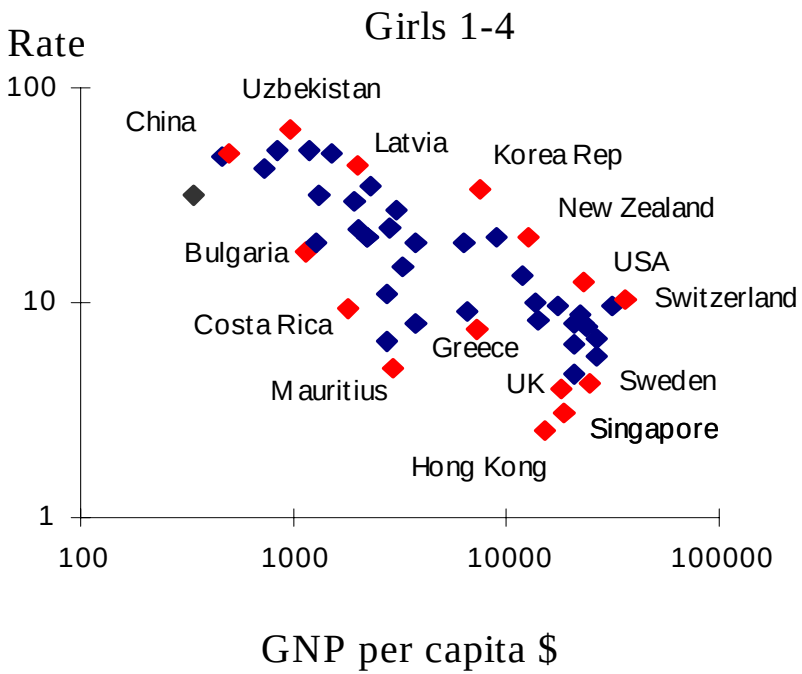
Results

Injury mortality tend to be strongly correlated to economical indices. Its absolute magnitude is generally greater in poor nations.

However its proportional importance is most conspicuous in middle income countries.

The relationship of GNP per capita and unintentional injury mortality rate (/100 000) in 51 countries by age and gender, year1993





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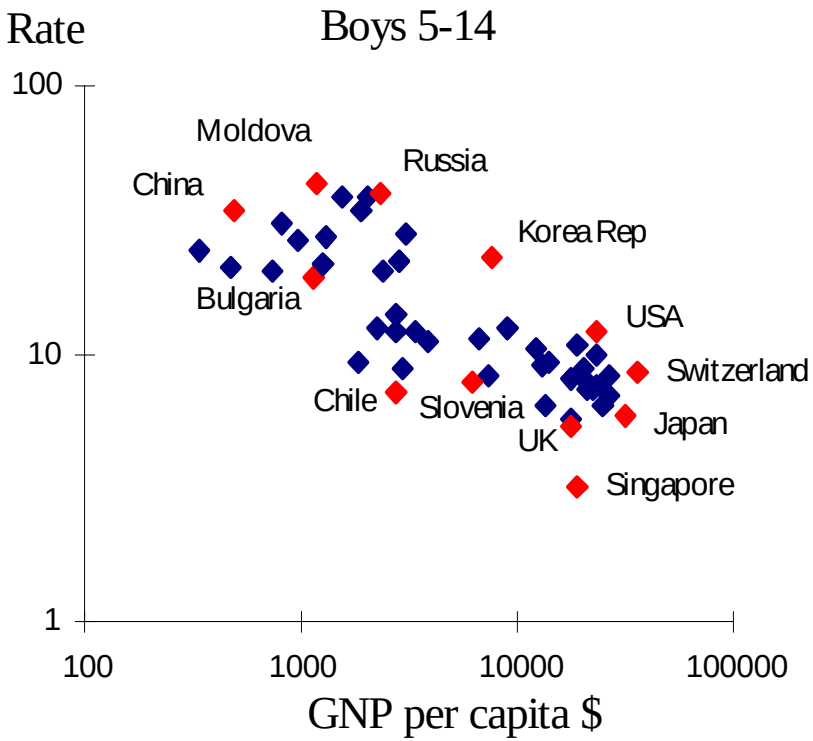
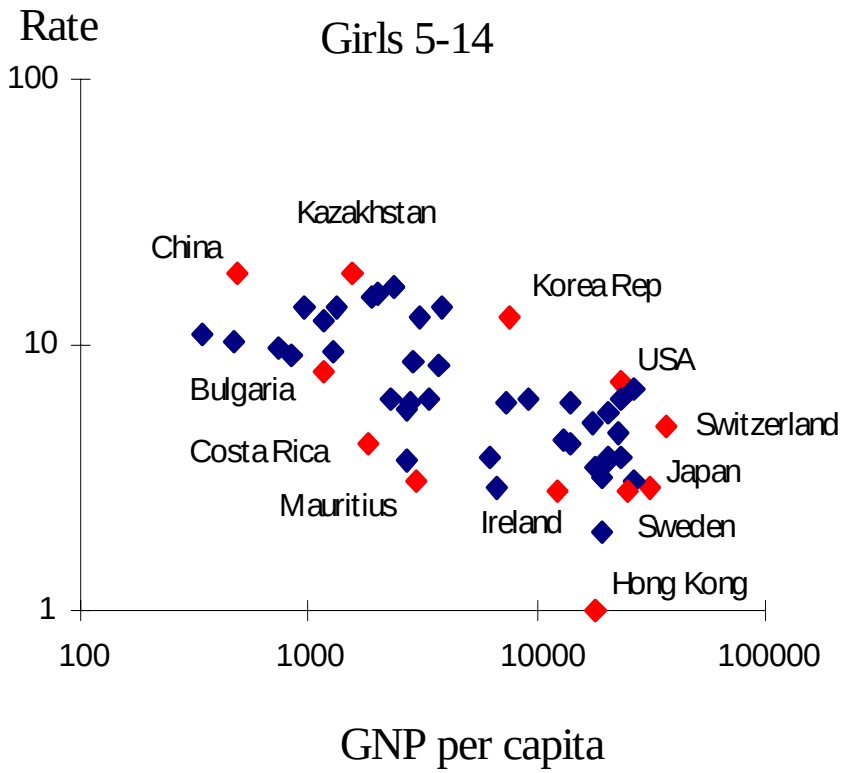
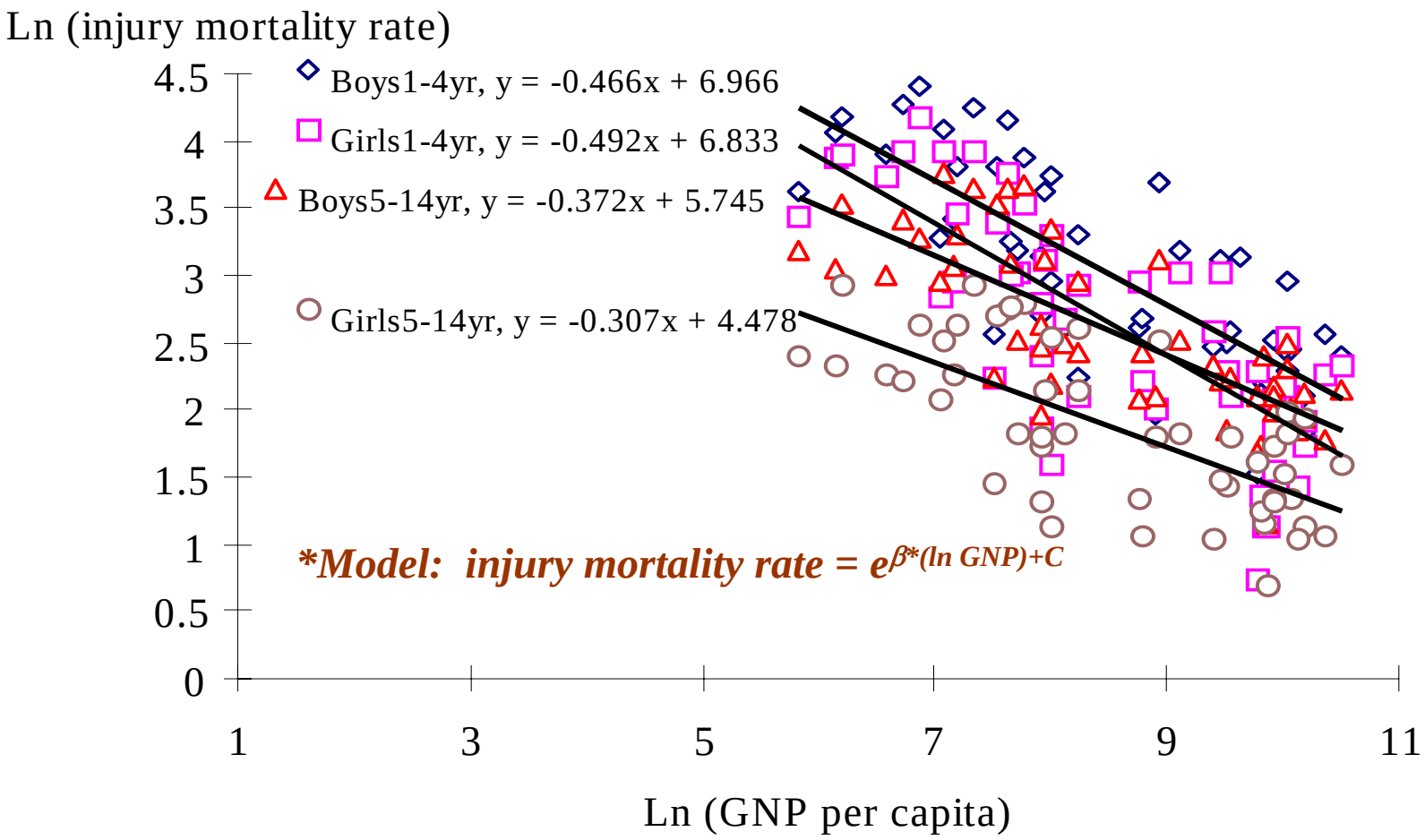
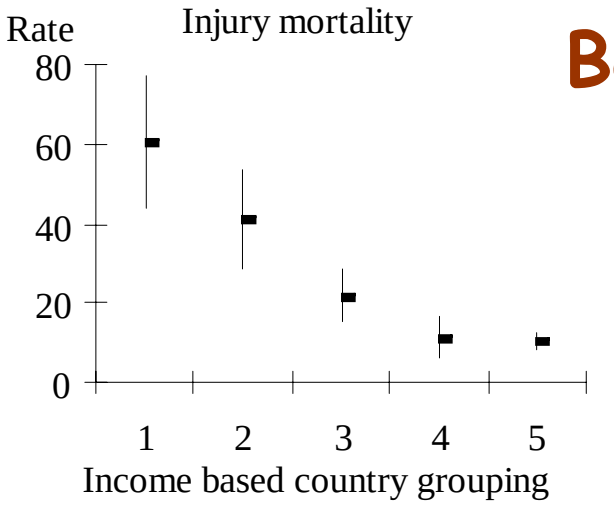




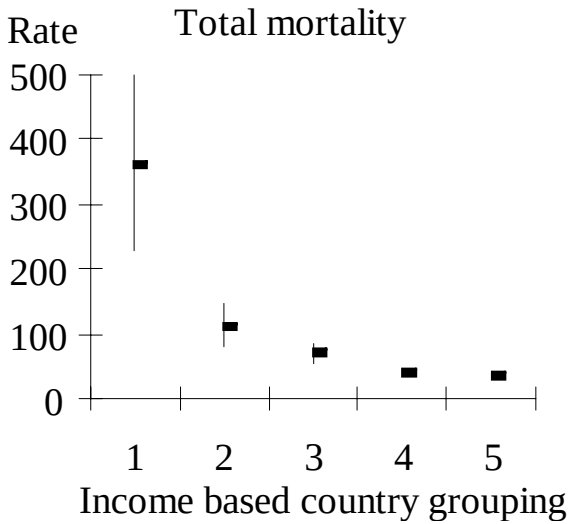
Scatterplot, trend lines and regression analysis results of injury mortality rates and GNP per capita by age-gender specific groups, year1993

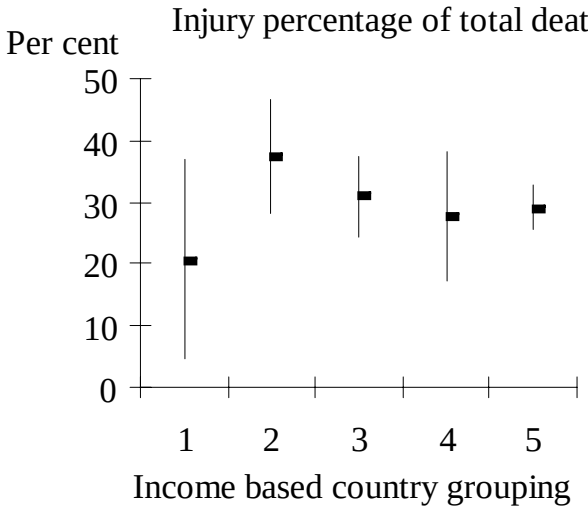


Mean and 95%CI of unintentional mortality rates (/100 000), total mortality rates and the percentage of total deaths due to injuries by income-based country groups and age-gender specific groups, year1993



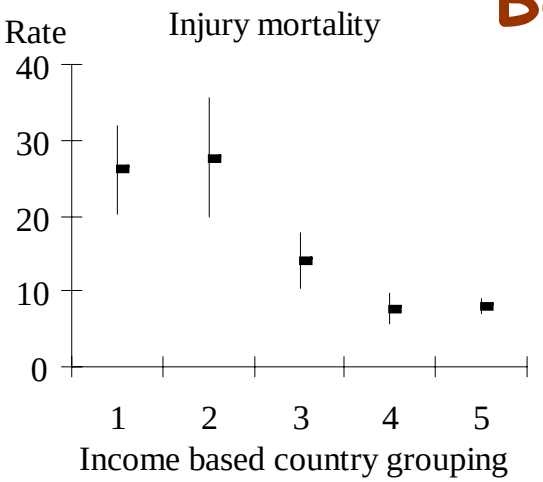
Boys 1-4

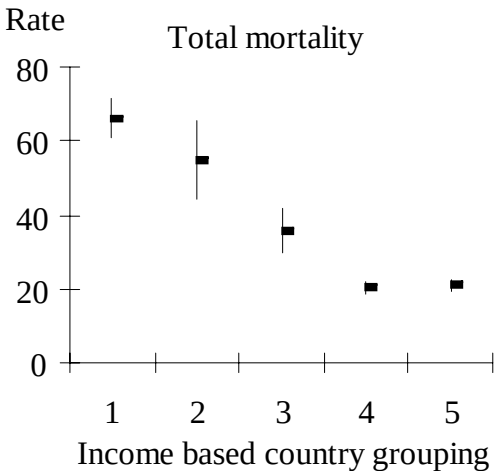


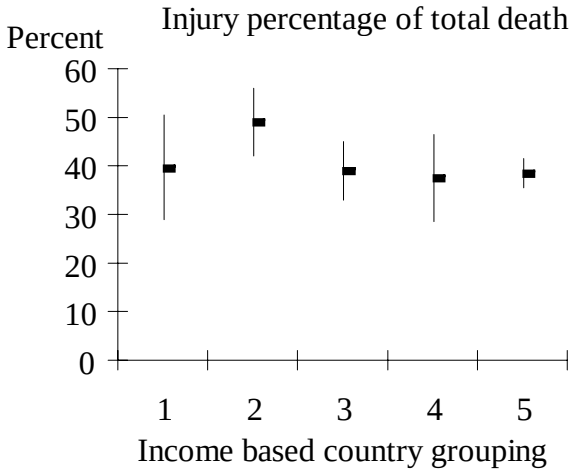


Mean and 95%CI of unintentional mortality rates (/100 000), total mortality rates and the percentage of total deaths due to injuries by income-based country groups and age-gender specific groups, year1993

Boys 5-14



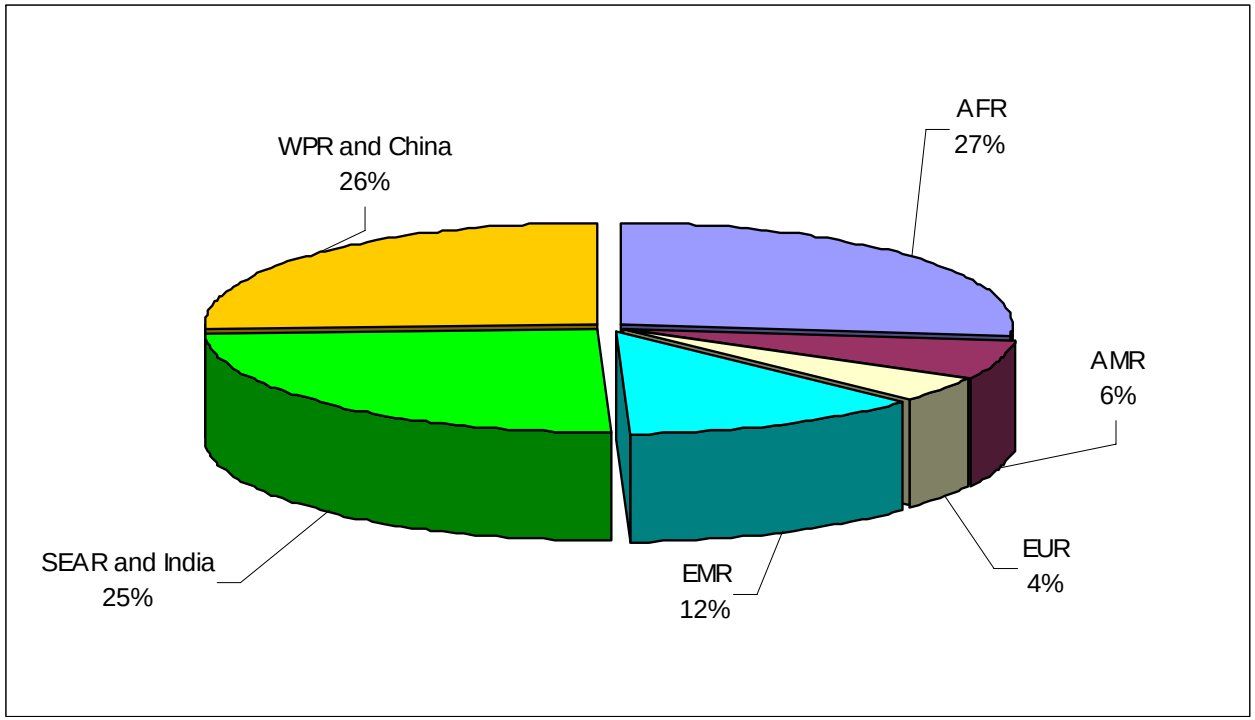




As middle-income countries transit towards industrialization and urbanization, the proportion of injury among leading causes of mortality and morbidity will continue to increase, from rates which are already much higher than in many rich countries.

This proportional increase will be partly due to a reduction of competing diseases, primarily infections, and partly because of an escalation of injurious hazards.

Regional distribution of global injury deaths in children , 2ooo



Global injury deaths
= 975,523 children

SEAR+WPR
= 510,641 children

- Taken together, South-East Asia and Western Pacific Region account for approximately one-half of injury related mortality in children worldwide.

Global injury related mortality rate (/ 100000) in children, 2000

Plitponkarnpim A. Burden of injuries in Asian children. Asian-Oceanian Journal of Pediatrics and Child Health. 2004

	0-4years		5-14years	
	male	female	male	female
WORLD	86.6	75.2	44.3	35.4
African	132	114.8	86.9	53.5
South-EastAsia and India	75.6	55.3	47.7	56.8
Western Pacific and China	101.4	96.8	37.3	23.6
Eastern Mediterranean	97.1	109.1	41.3	35
Americas	43.6	28.9	19.2	9.3
European	42.3	28	27.4	11.9

= >100

= 76-100

= 51-75

= <=50

Children in Africa have the highest injury related mortality rate. Children in Asia have twice the risk compared to those in America and Europe

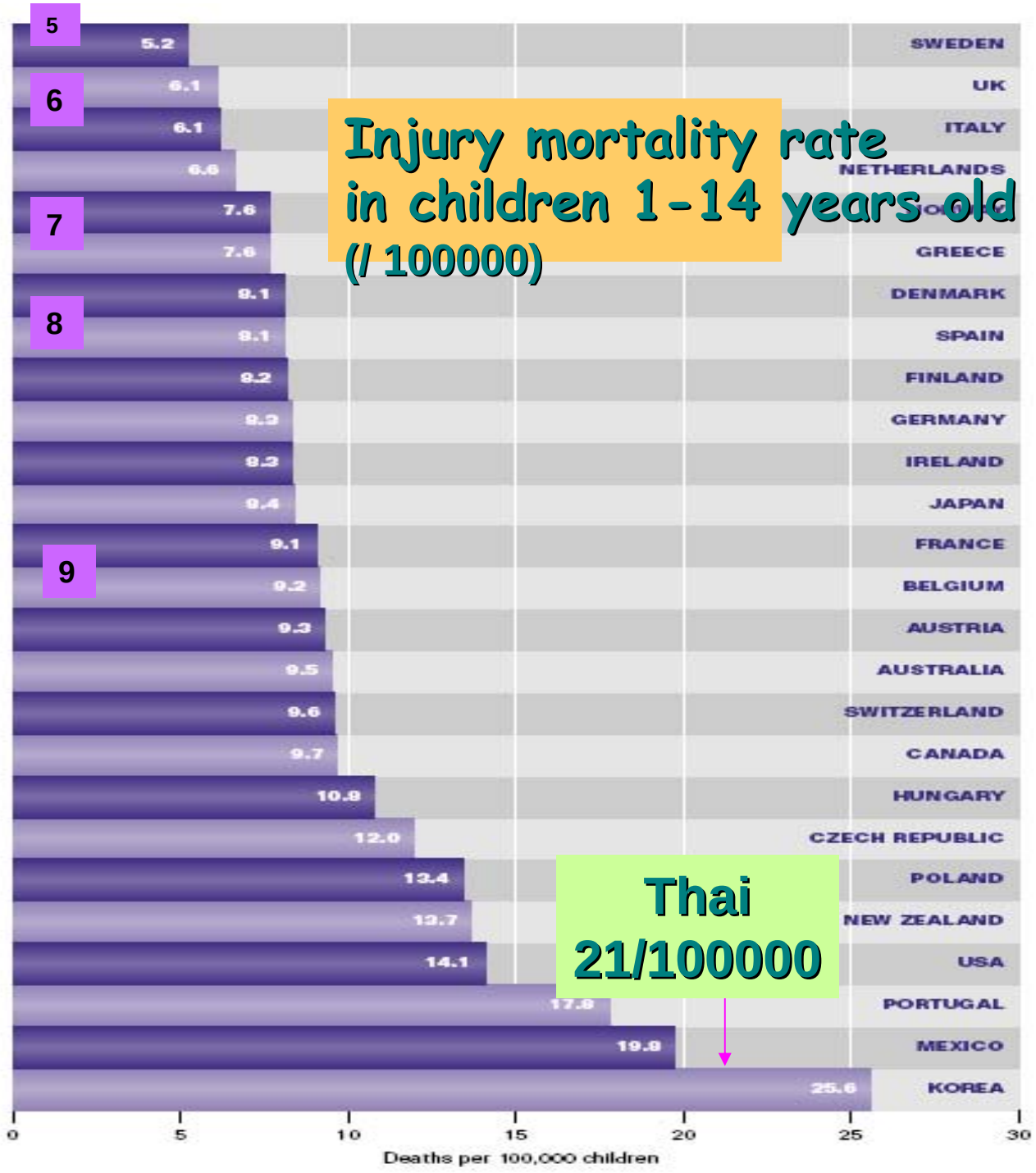
Study of Fatal Injuries among Thai Children: 1999-2007

Among children aged of 1-14 years

- 79,935 total deaths in 9 year-period, and 37.8% or 30,192 cases were injury related causes.

- 13694 drowning deaths, accounted for 45.4% of all injury related deaths

- 6451deaths due to transport related injuries, accounted for 21.4% of all injury related deaths


Injury mortality rate in children 1-14 years old (/ 100000)
5
6
7
8
9
5.2
6.1
6.1
6.6
7.6
7.6
9.1
9.1
9.2
9.3
9.3
9.4
9.1
9.2
9.3
9.5
9.6
9.7
10.8
12.0
13.4
13.7
14.1
17.8
19.8
25.6
SWEDEN
UK
ITALY
NETHERLANDS
GREECE
DENMARK
SPAIN
FINLAND
GERMANY
IRELAND
JAPAN
FRANCE
BELGIUM
AUSTRIA
AUSTRALIA
SWITZERLAND
CANADA
HUNGARY
CZECH REPUBLIC
POLAND
NEW ZEALAND
USA
PORTUGAL
MEXICO
KOREA
Thai 21/100000
0
5
10
15
20
25
30
Deaths per 100,000 children

Drowning

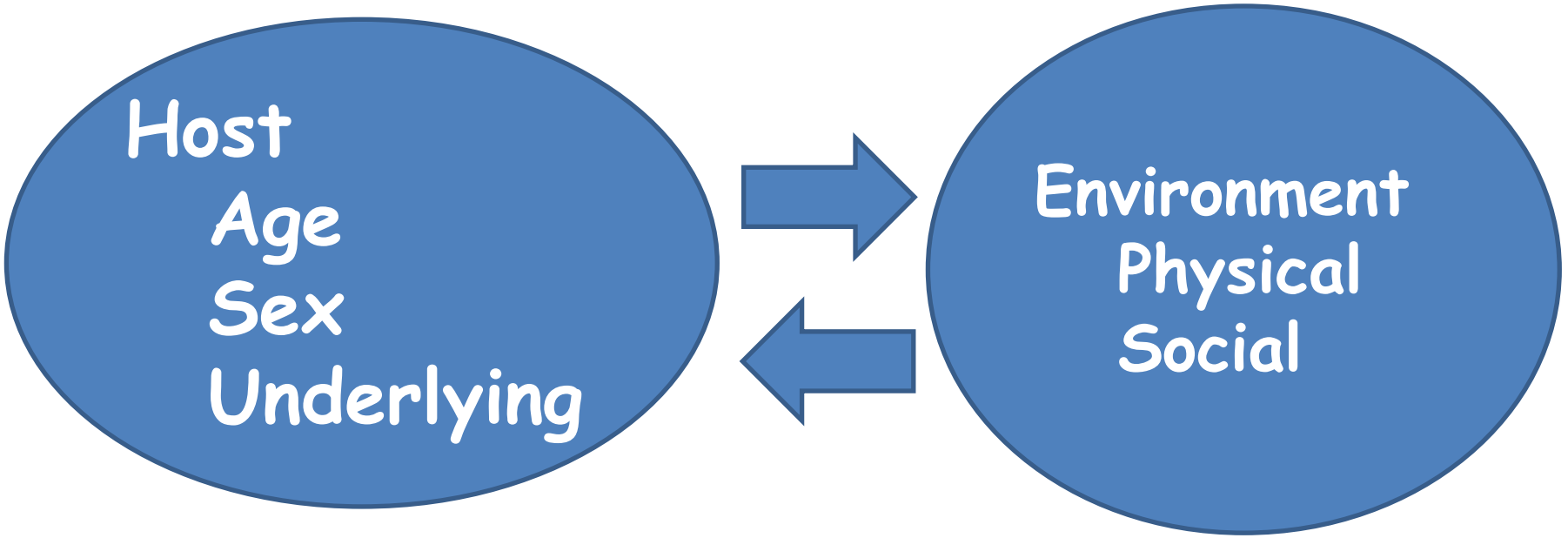
- 47% in injury deaths or 17% of total deaths
- the leading cause of injury deaths
- 1500 children per year => MR 10/100,000 per year.

Traffic Injuries

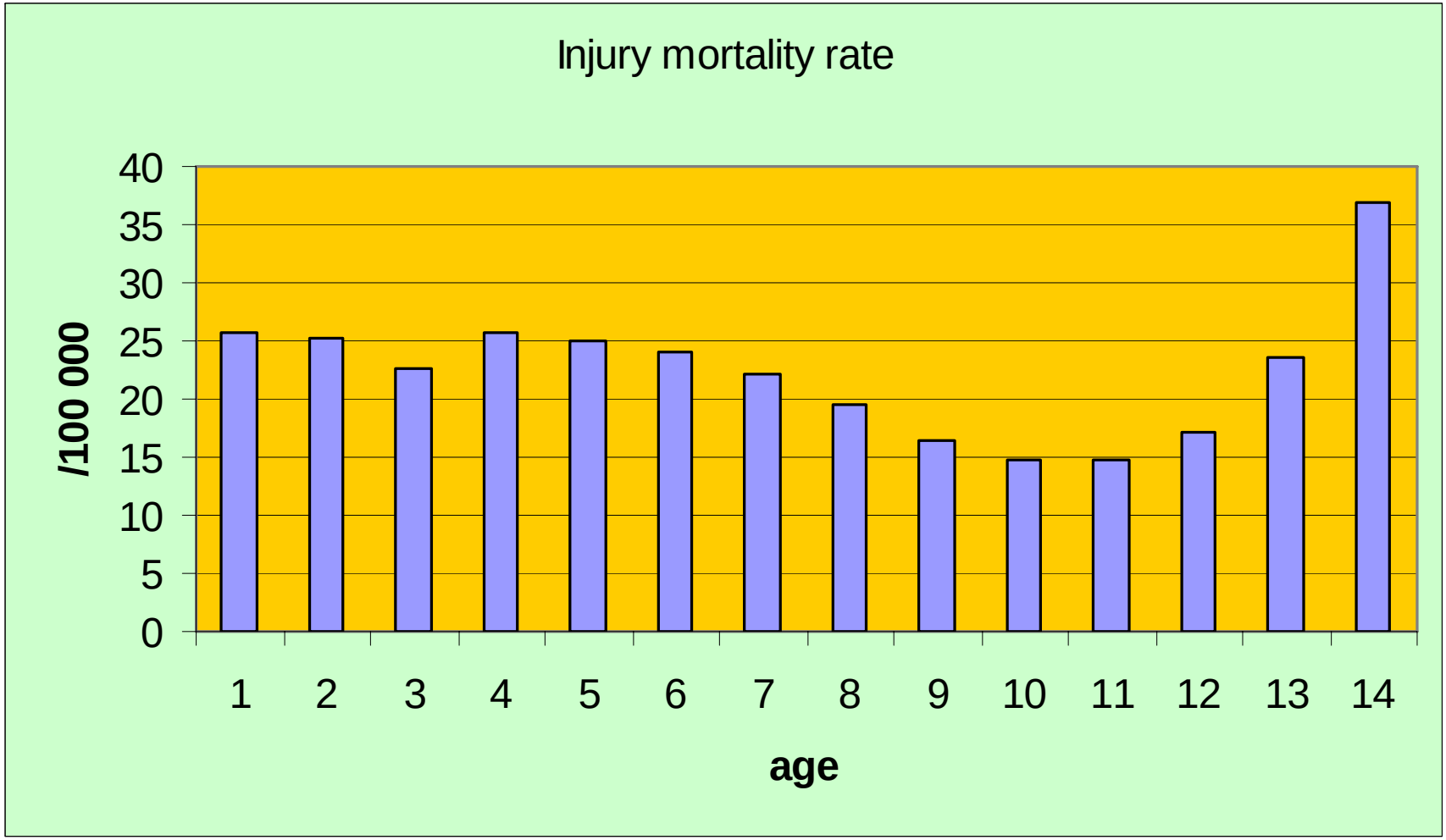
- 23% of injury deaths and 8% of total deaths.
- **the Second Leading Cause of Child Deaths**
- 750 children per year => MR 5/100,000 per year.

Epidemiological Model of Injuries

Injuries: interaction between host and environment

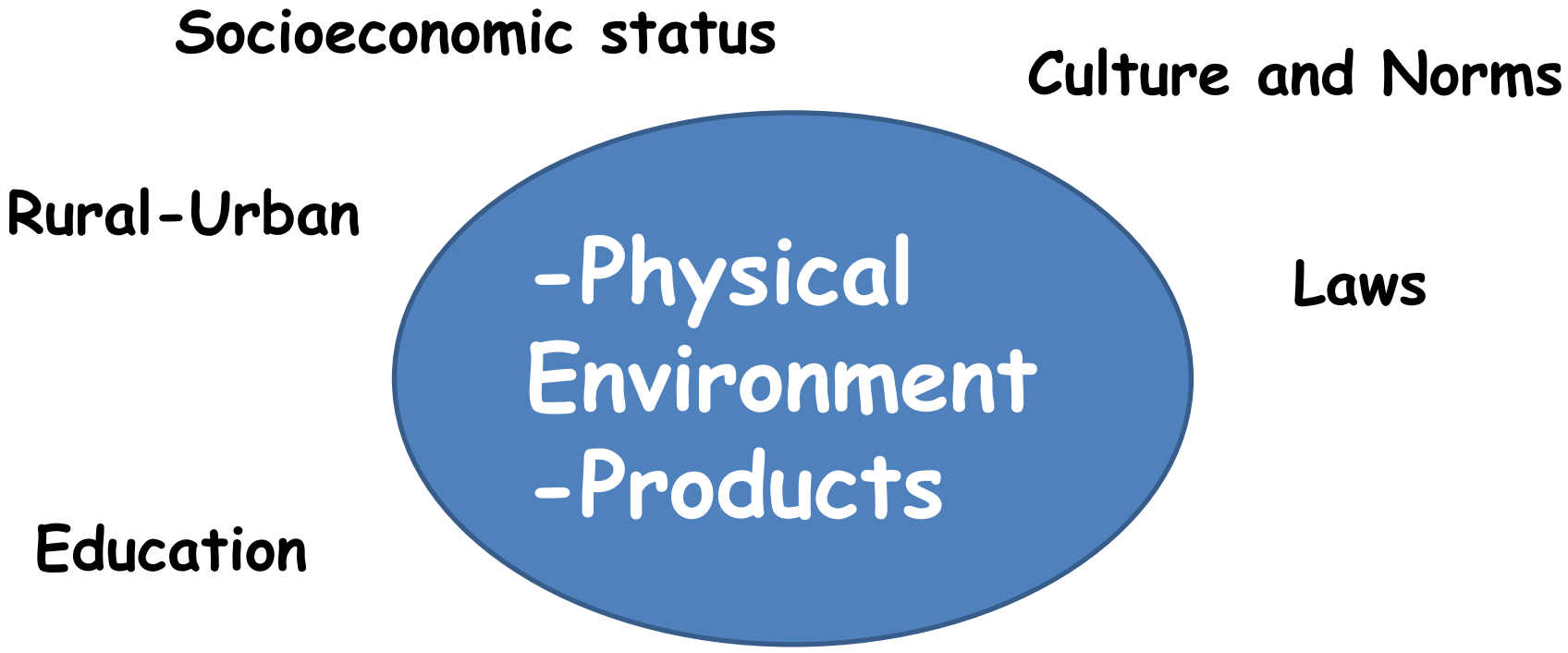


Injury Mortality Rate (/100 000) in Children 1-14 years



Risk in Injury Fatality: by Sex

Physical and social environment



- Children at high risk for injury are likely to be relatively poorly supervised, to have disorganized or stressed families, and to live in hazardous environments

- The identification of risk factors for injuries has led to the development of successful programs for prevention and control.

Countermeasures versus implementation strategies

Important to recognize the two components of an injury prevention intervention

- Countermeasures are the actual measures used to prevent injuries (e.g. seat belts, motorcycle helmets)

- Implementation strategies are the means by which the countermeasures are implemented (e.g. education, manufacturing, legislation, and enforcement)

Hospital based injury prevention programs

- **Anticipatory guidance in WBC : developmental oriented**
- **Safety Center**:
  - Kid-Safe home/ Safe Toy-Safe Play demonstration
- **Safe kids class**
  - Child birth class : ANC, postpartum
  - Parent classroom: IP course, Basic CPR course, and First aid course
  - School age and Youth safety camp
- **Home visit** – risk identification, home modification, safe home supervisor

- **High risk and vulnerable groups**: ER/ In-patients
  - Holistic approach for multidimensional risk identification: In-depth exploration, home –school visit

- **Center for advocacy**: From one case to change the root cause.
  - Policy advocacy
  - Media advocacy

Visitors can complete a Self Guided Tour to Safety Products.

- **Community based program**
  - Safe community for children: community/Tambon/ Province
  - Safe school
  - Safe daycare

Developmental oriented – Injury Prevention

- Anticipatory guidance in WBC
- Child birth class
- Parent classroom
- Risk identification

Injury Mechanisms and Prevention for infant 0-6 mo

MECHANISMS OF INJURY

Suffocation/ Choking

SIDS & Sleep Environment

- **SIDS** - Sudden infant death syndrome , the leading cause of post neonatal mortality in the US (~ 3,000 deaths per year), are found that > 50% are related to sleep environment during last sleep

- (Hauck F.R.,et al, Pediatrics, vol.111, 2003)

Prone position

- RR of 2.4 (1.4-12.5) for SIDS in the prone position as compared with other sleeping positions.

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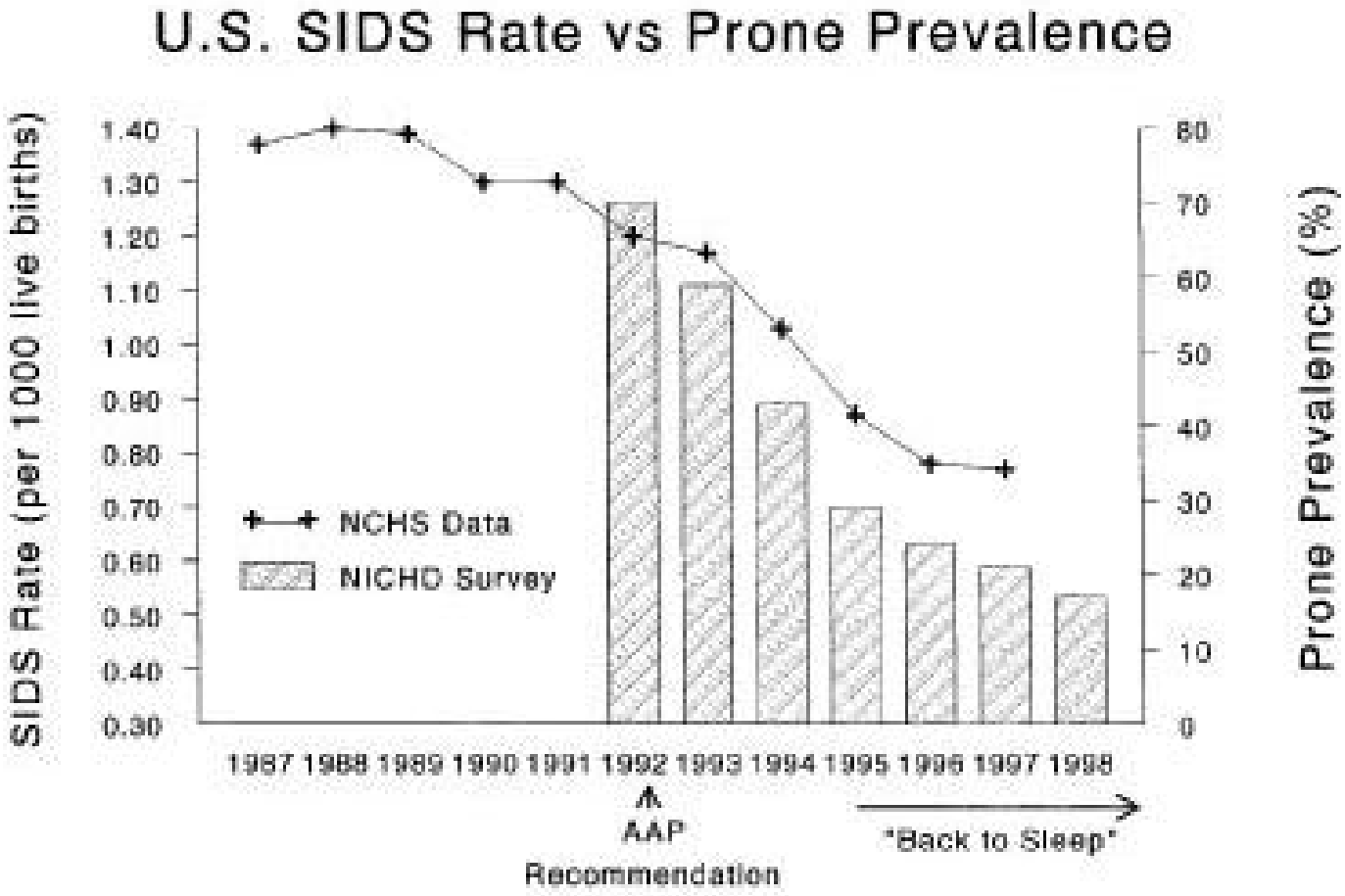

U.S. SIDS Rate vs Prone Prevalence
SIDS Rate (per 1000 live births)
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
80
70
60
50
40
30
20
10
0
Prone Prevalence (%)
NCHS Data
NICHD Survey
1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998
AAP
Recommendation
"Back to Sleep"

Positional Plagiocephaly

Putting babies to sleep in the supine position causes **positional plagiocephaly**, claims the American Academy of Pediatrics (AAP) in a report published by Pediatrics (2003;112:199-202).

According to the academy, flattening of the occiput may result from static supine positioning during the first months of life, when the skull is still soft.

- The deformation may affect as many as 48% of healthy infants less than 1 year of age, and cases have increased notably in number since 1992, after it was recognised that sleeping prone increases the risk of cot death.

- Positional plagiocephaly does not affect brain function or development and often corrects itself by 1 year of age, but some cases may persist into adulthood.

Child injury fatality review: Unsafe sleep: Suffocation

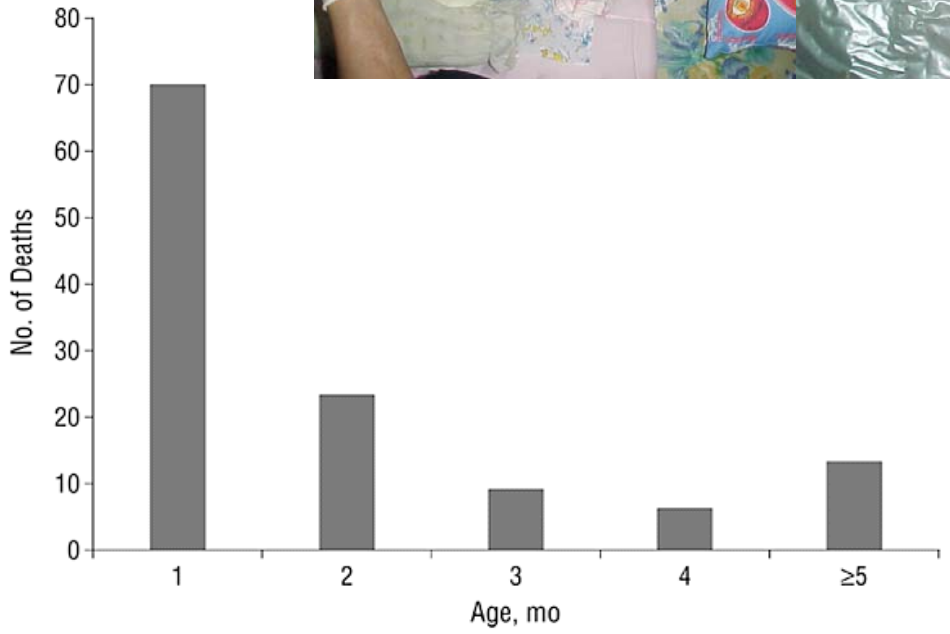
- 2 months old died of overlain by his mother
- 18 months old died of neck entrapment by hospital bed rail.

Overlay

Bed rail entrapment

Overlying: Shared bed+Adult bed

Risky Sleep-Partner
- **Obesity**
- **Child**
- **Sedative drug taker**



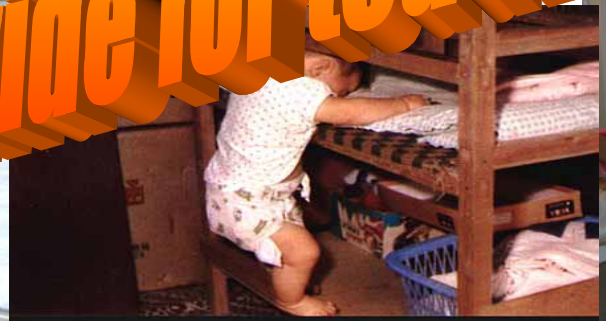
(Nakamura s. et al, Arch Pediatr Adolesc Med 1999;153:1019-1023)

Cribs

Entrapment: Risky Space

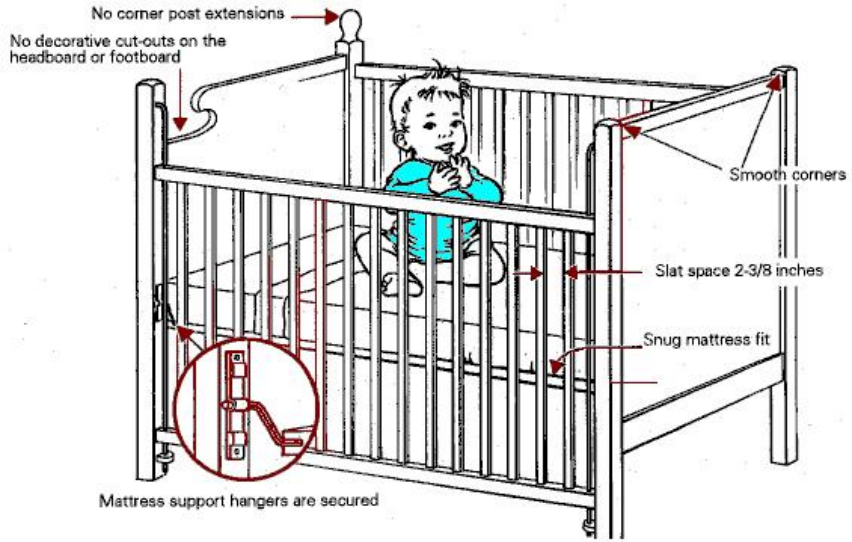
6 cm wide for infant

9 cm wide for toddler and older




Missing

General requirements



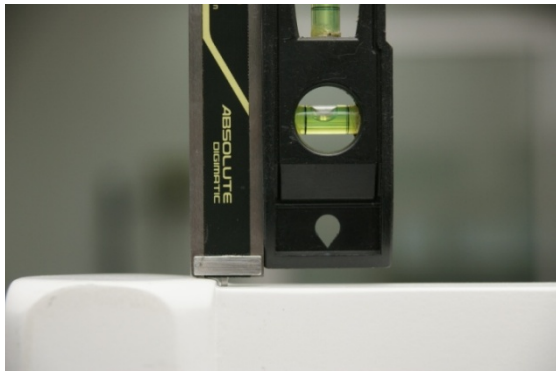
1. Wood part shall be smooth and free from of splinters.

2. The paint or coating on the product shall comply with 16 CFR 1303.

3. Shall be no small part as defined by 16 CFR 1501.

4. No corner posts assembly shall not extend more than 0.06in.

5. The distance between components shall not be greater than 2 3/8 in.



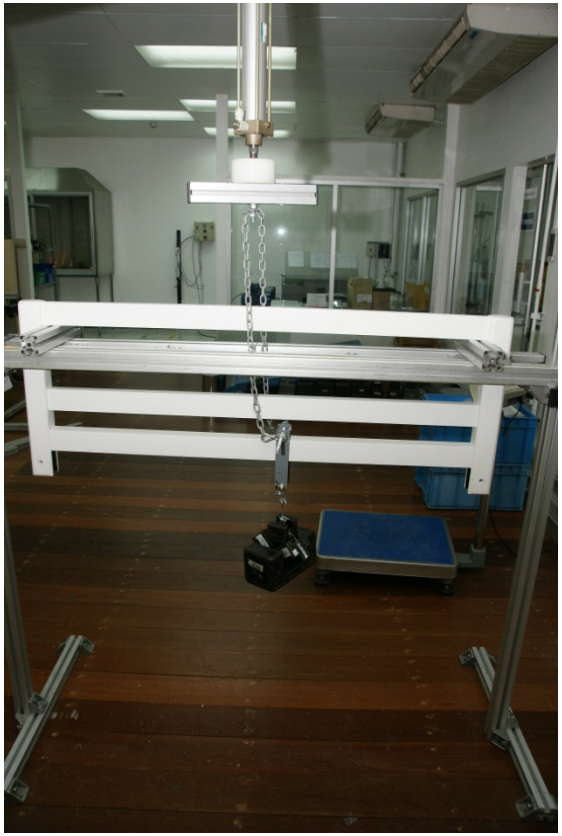
Mattress support system vertical impact test

1. 500 cycles of geometric center of the mattress area.

2. 100 cycles at each of two diagonally opposite corners, centered 9 in. from the crib sides forming the corner.

*** Weight 45 lb and circular area 1 ft^2**
Weight to free fall 6 in.

Crib side test – Drop/ Stationary side cyclic test

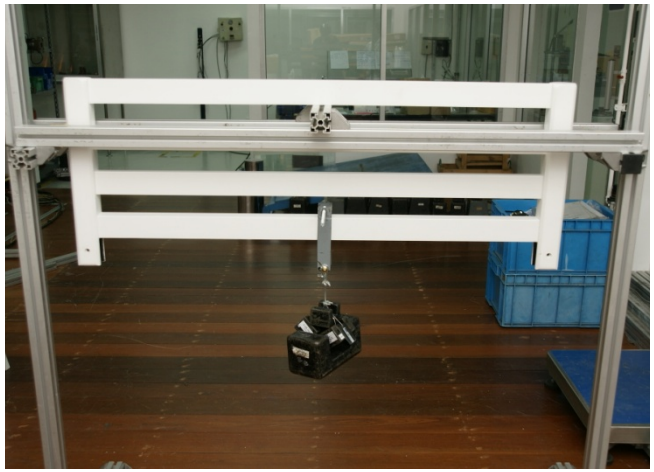


1. Support the side within 2 in. of each end of the top rail

2. 250 times at a rate of 4±1 s/cycle.

* Impactor with a width of 1 in.
  Weight 30 lb
  Weight to free fall 3 in.

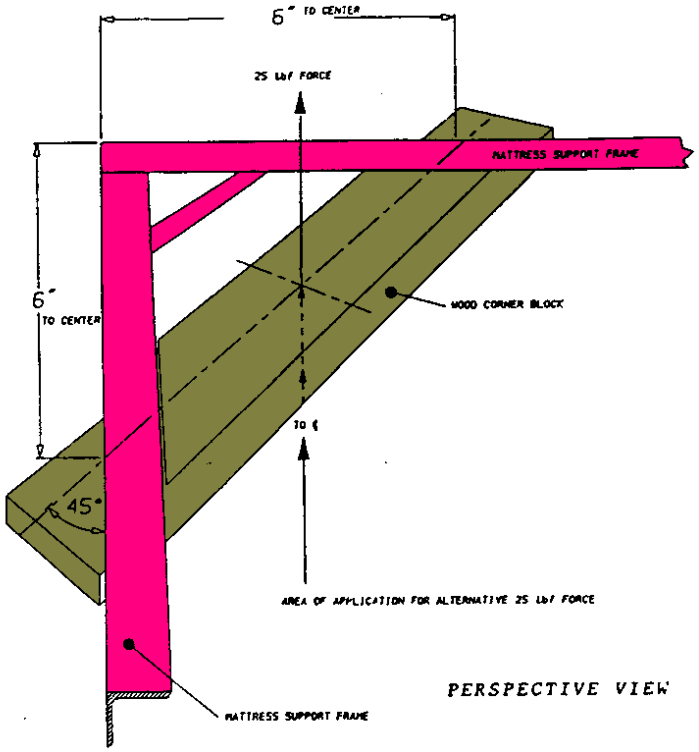
Crib side test – Drop/ Stationary side static test



1. Apply a static load at the point of impactor testing.

*** Weight 100 lb**

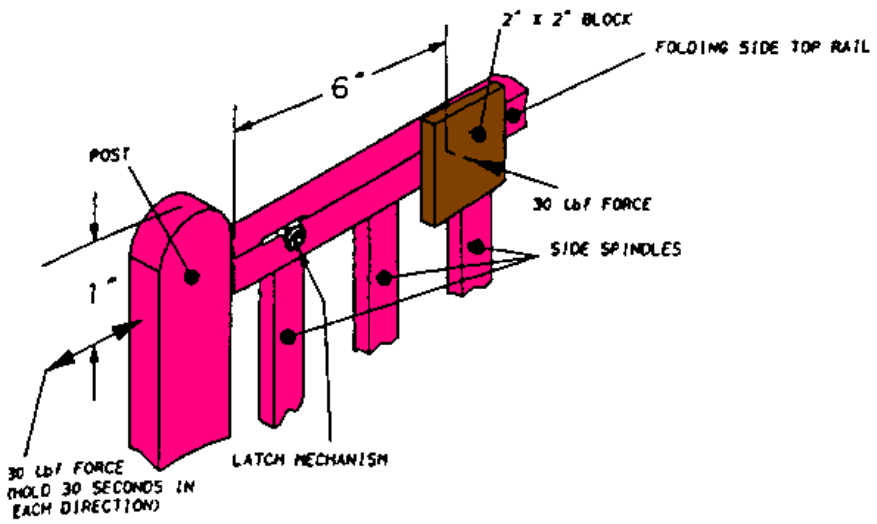
Mattress support system test



1. Apply force of 25 lbf to the mattress support through a wood corner block

*** Gradually within period of 5 s and maintain 10 s**

Crib side latch test – Folding side latch test

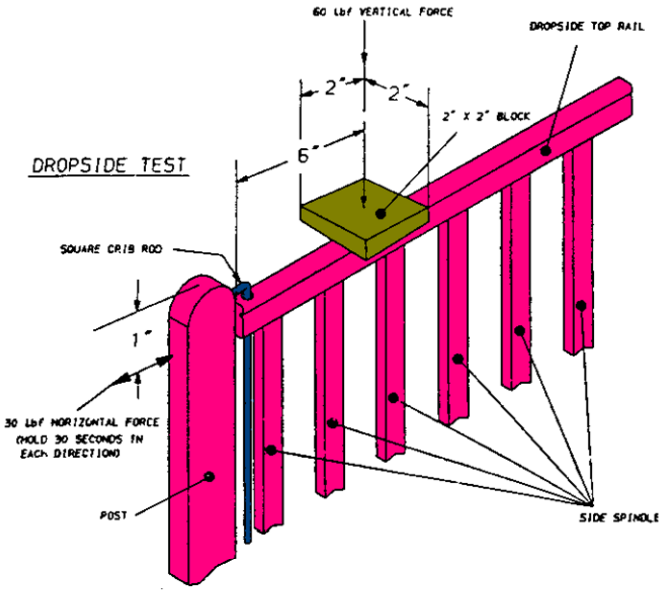


1. Apply force of 30 lbf through a hardwood to one end of the folding side upper rail.

2. Apply force of 30 lbf horizontal force in direction parallel to the folding side.

*** Hardwood block with a contract area 2 by 2 in.**

Crib side latch test – Drop side latch test

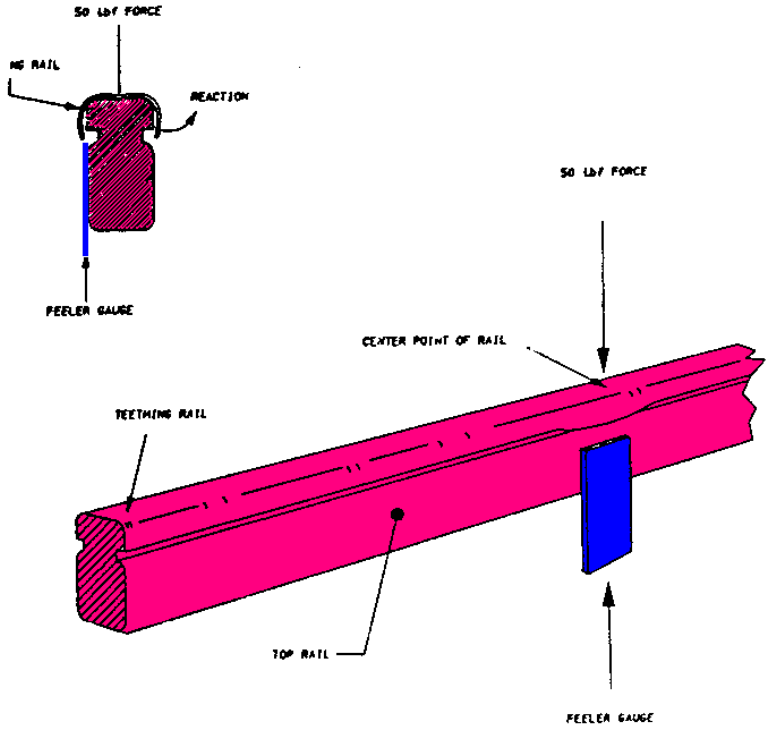


1. Apply force of 60 lbf through a hardwood to the upper horizontal rail.

2. Apply force of 30 lbf horizontal force in direction parallel to the drop side.

*** Hardwood block with a contract area 2 by 2 in.**

Plastic teething rail test



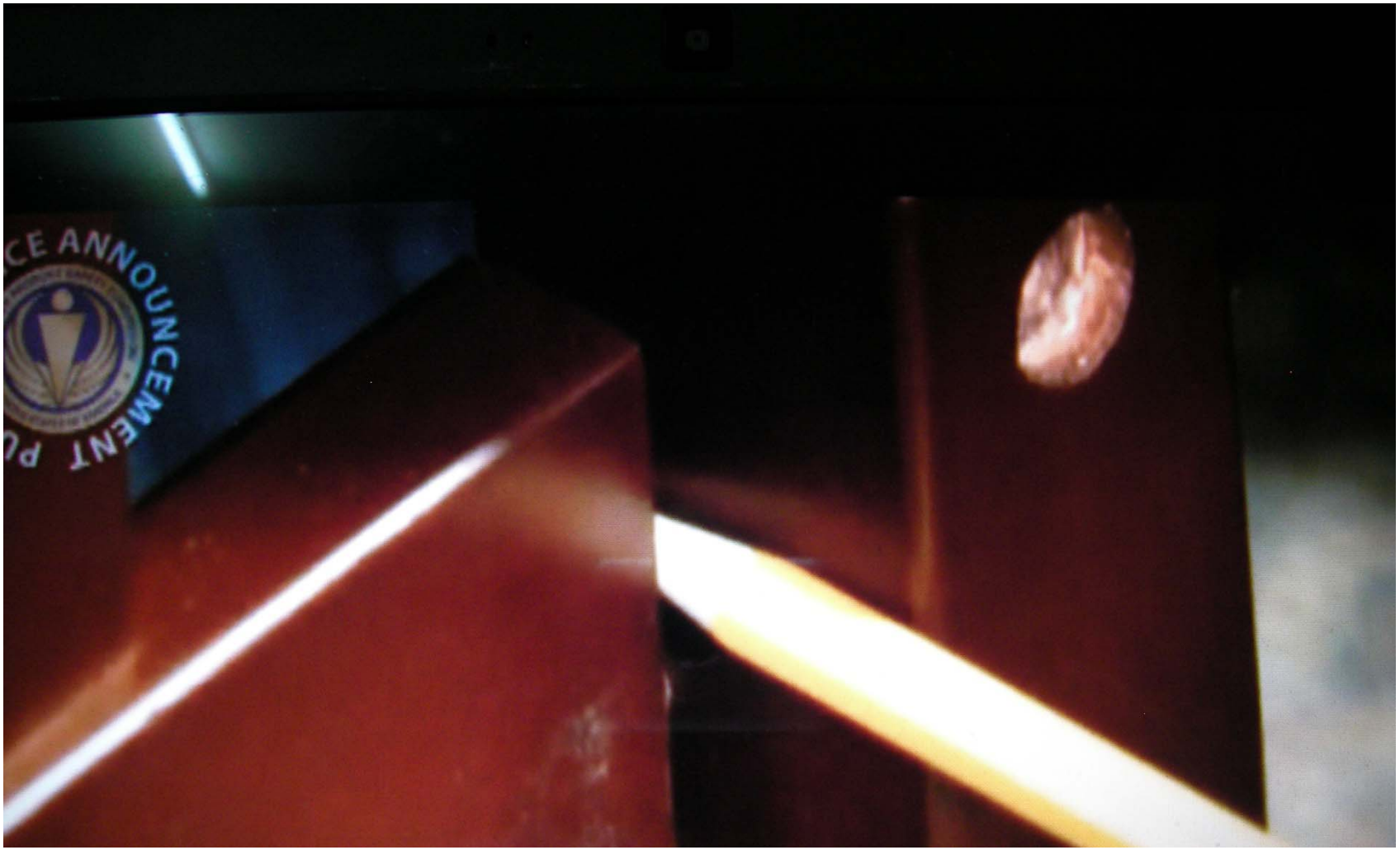
1. Apply force of 50 lbf through a hardwood to the top of the teething rail.

2. Insert the 0.04 in. feeler gage.

Case Study


PUBLIC SERVICE ANNOUNCEMENT
Many manufacturers have agreed to stop selling drop-side cribs in the U.S. as of June 1, 2010.

The recent infant death in a recalled Simplicity drop side crib raises number of fatalities to 11.


CE ANNOUNCEMENT

soft-thick blanket, soft pillow, soft mattress, toy stuff

OR = 3.1 (1.6-5.8)
The Chicago Infant Mortality Study

Specific dangers associated with infants sleeping on sofas

RW BYARD,[1] S BEAL,[2] B BLACKBOURNE,[3] JM NADEAU[4] and HF KROUS[4]

[1]*Forensic Science Centre, Adelaide,* [2]*Ambulatory Paediatrics, Women's and Children's Hospital, Adelaide, SA, Australia,* [3]*Office of the Medical Examiner, San Diego County,* [4]*Department of Pediatric Pathology, Children's Hospital-San Diego, San Diego, CA, USA*

J. Paediatr. Child Health (2001) 37, 476-

- 4 in 180 SIDS

- 10 of Sofa related deaths, 4 were reported as SIDS

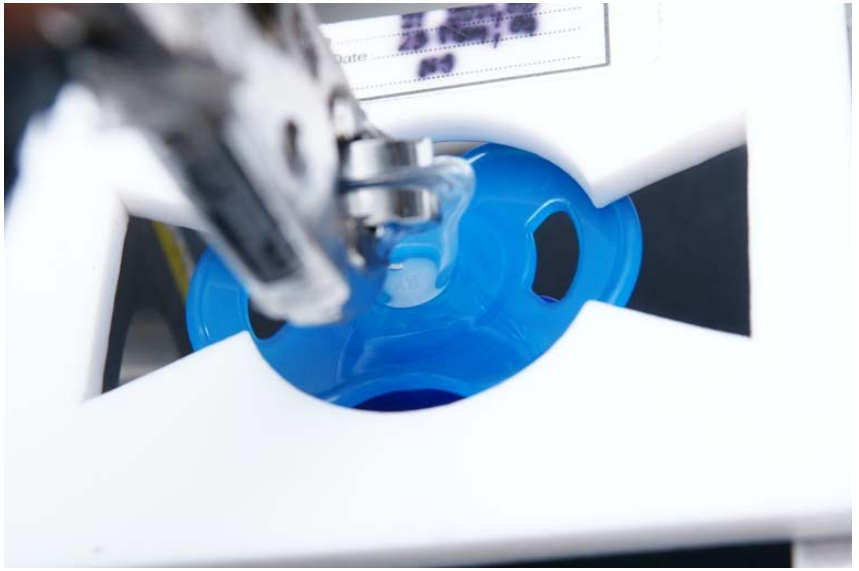
Strings, Cords, and Necklaces Can Strangle Infants

NO any cord > 15 cm for infant < 6mo and > 22 cm for infant > 6 mo

Pacifiers

Pacifiers

Shield Test (10 N)



Tension and Tear Test
(90 N)

Impact Test

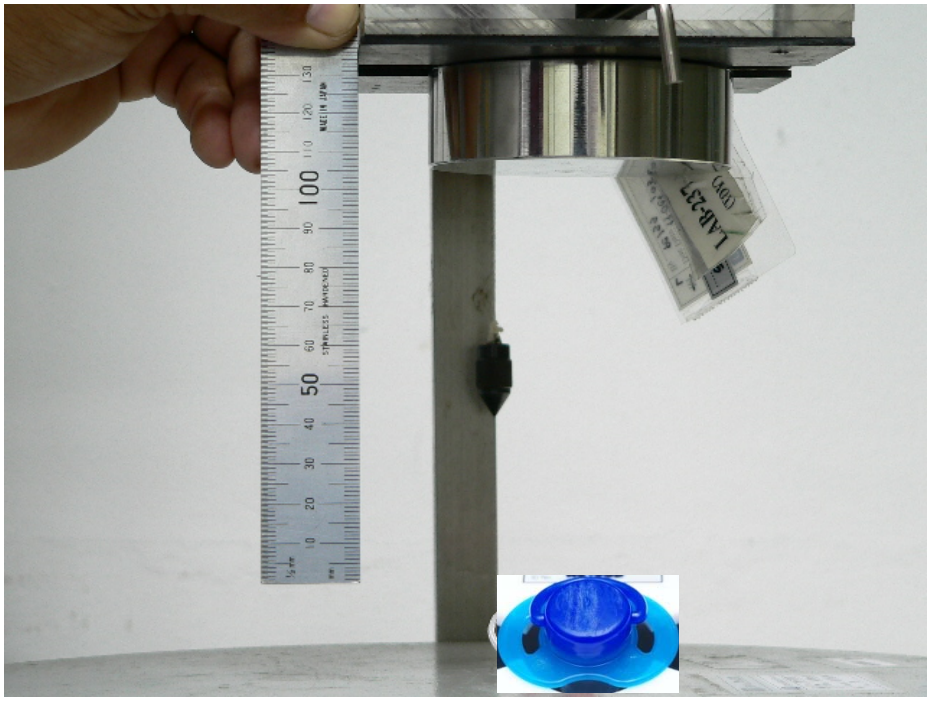


Table 2: Estimated Injuries in 2006 among Children under Age Five by Type of Nursery Product

PRODUCT CATEGORY	ESTIMATED INJURIES CY 2006
TOTAL	66,400
Infant Carriers and Car Seats (Excludes Motor Vehicle Incidents)	14,200
Cribs and Mattresses	11,300
Strollers and Carriages	11,100
High Chairs	9,900
Baby Walkers, Jumpers, and Exercisers	4,000
Changing Tables	3,800
Baby Bouncer Seats	2,100
Baby Gates and Barriers	2,000
Portable Baby Swings	1,600
Playpens and Play Yards	1,100
Baby Baths, Bath Seats, and Bathinettes	---[3]
Bassinets and Cradles	---[3]
Other[4]	5,300

Source: NEISS, CPSC.

Note: The injury estimates may not add up to the total due to rounding and because two or more nursery products are sometimes associated with a single injury.

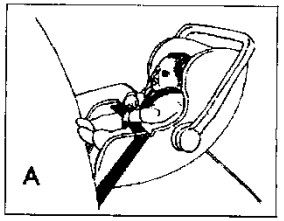
Infant Carriers


Twelve of the deaths
involved babies younger
than four months of age.

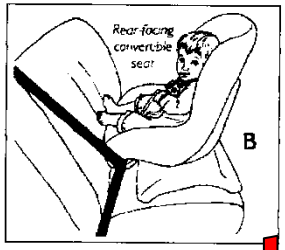
traffic safety

Tip #3

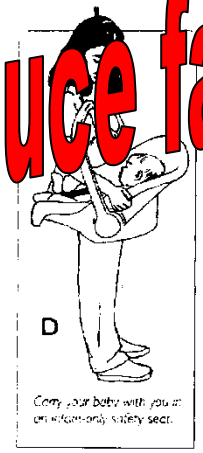
how to protect your**new baby in the car**

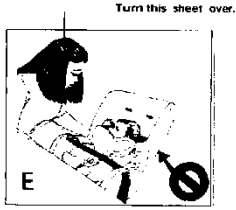


This kind of seat fits babies under 17-20 pounds only and always faces the rear.



▲ *This seat fits an infant facing the rear, and a toddler, facing*





Everybody would be safest sitting backward in a car. Babies are lucky to have seats that work this way. So, whichever kind of seat you choose, your baby should ride rear-facing until at least 20 pounds and one year of age.

Two kinds of safety seats are made for babies:

1. Small, lightweight "infant-only" safety seats are designed for use rear-facing only. This kind can be used only as long as the baby's head is enclosed by the top rim of the seat (A). The label on the seat gives the upper weight limit (17 to 20 pounds).
2. Larger "convertible" seats usually fit children from birth to four years of age and 40 pounds. This kind is used facing the rear while your baby is under a year (B). It may be turned around to face the front when the baby is about one year old and over 20 pounds (C).

Which seat is best for a new baby?

Think about these points before you decide:

- **You'll save a little money if you buy one seat to do the job from birth to 40 pounds**, but an infant-only seat may be easier for you to use and may fit your newborn baby better.
- An infant-only seat can be carried with you wherever you go. Many attach to supermarket carts. All ma[illegible] sturdy se[illegible] for use at home.
- So[illegible] infant-only se[illegible] stay [illegible] in th[illegible] se[illegible] ma[illegible] these [illegible] use a [illegible] a [illegible] chose [illegible] about a [illegible] usually do not fit small or newborn babies properly. They come up too high, often hiding the baby's face, and make proper adjustment of the harness difficult (E).

Is one seat safer than another?

Turn this sheet over...

Tip 3, Page 1

Reduce fatal risk among infants for 69%

Is this safe?

Use of Child Restraint System in Motor Vehicles.

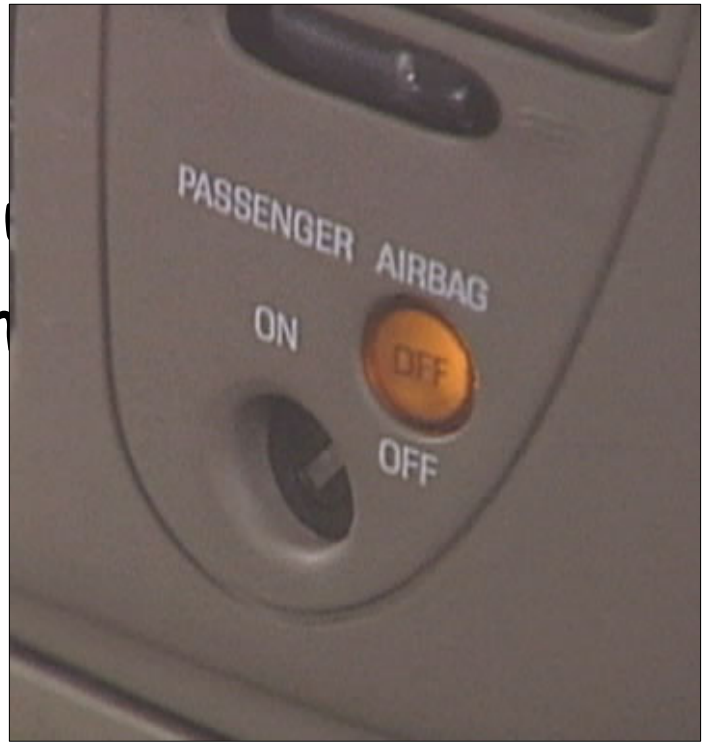
- Rear-facing infant seats for infants <9 kg and <1 year of age
- Install at rear seat

Air Bag

Airbag warning labels

ACTIVE Airbag Suppression

- Must be done manually (person must do something)
- Manual On/Off switch
  - Frontal airbags only
  - ON for older kids and ad
  - OFF for younger children



Child Passenger Restraints

- Infants: ≤ 20 lbs and ≤ 1 year

  Rear-facing, back seat

- Infant/Child: >20 to 40 lbs and > 1 yr

  Forward-facing, back seat

- > 40 lbs or exceeds height requirements for child safety seats

  Belt-positioning booster seat, back seat

- > 80 lbs or 4'9"

  Lap and shoulder straps fit

  Knees bent over seats edge

Rear facing infant seat

A

Alternate seat belt position for the rear facing infant seat depending on make and year of car and model of car seat

Forward facing child harness seat

B

Forward facing convertible harness seat

C

Low back booster seat

D

High back booster seat

E

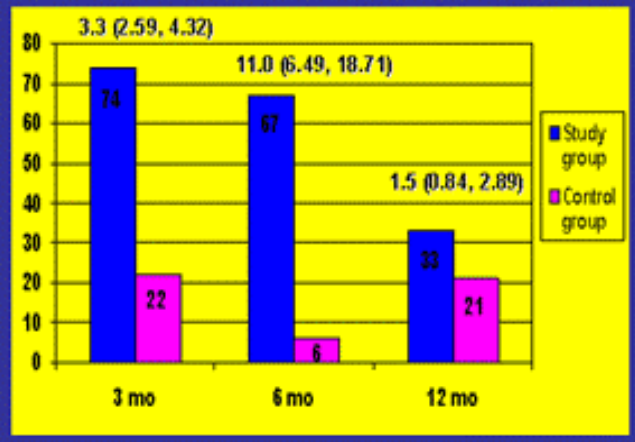
Traffic Safety

Reduce infant mortality by 69%

Effectiveness of Education and Loaning Program to Promote the Use of Child Restraint System in Motor Vehicles

Pajaree Limthongthang, MD
Adisak Plitponkarnpim, MD

Comparison between Proportion of CSS Use in Study and Control Groups



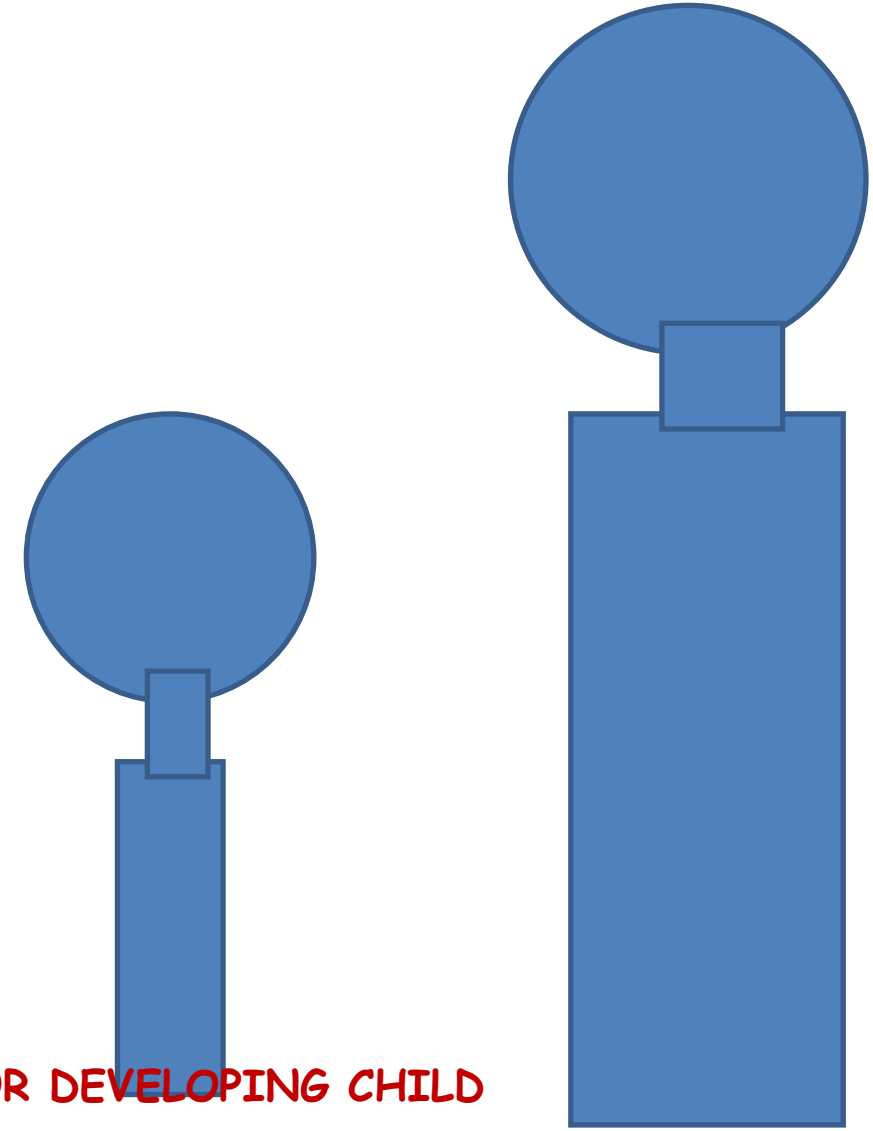
Is this safe?

Infant, toddler , and preschooler risks on motorcycle

- Children at birth to 2 years of age have been identified as ***"a head neck injury prone group"***.

Head and neck of infant and toddler

- a larger proportion of mass is being supported by a smaller structure (Klinich KD, 1996)
- This may allow more cervical spine injuries if not properly supported.



Klinich KD, S. R. (1996). TECHNIQUES FOR DEVELOPING CHILD DUMMY PROTECTION REFERENCE VALUES. Child protective team .

No child<2 years on MC!

For Thai society, is it OK?

Shaken Baby Syndrome

"We must all commit to learn methods to identify

and stop shaken baby syndrome and we must

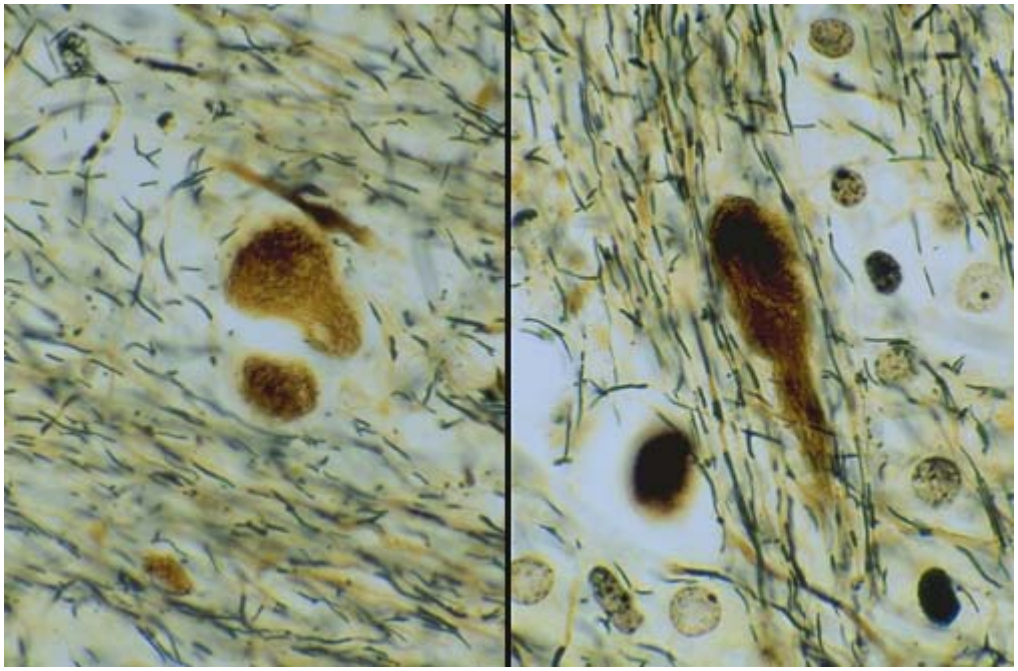
commit to teach others about this preventable form

of child abuse.

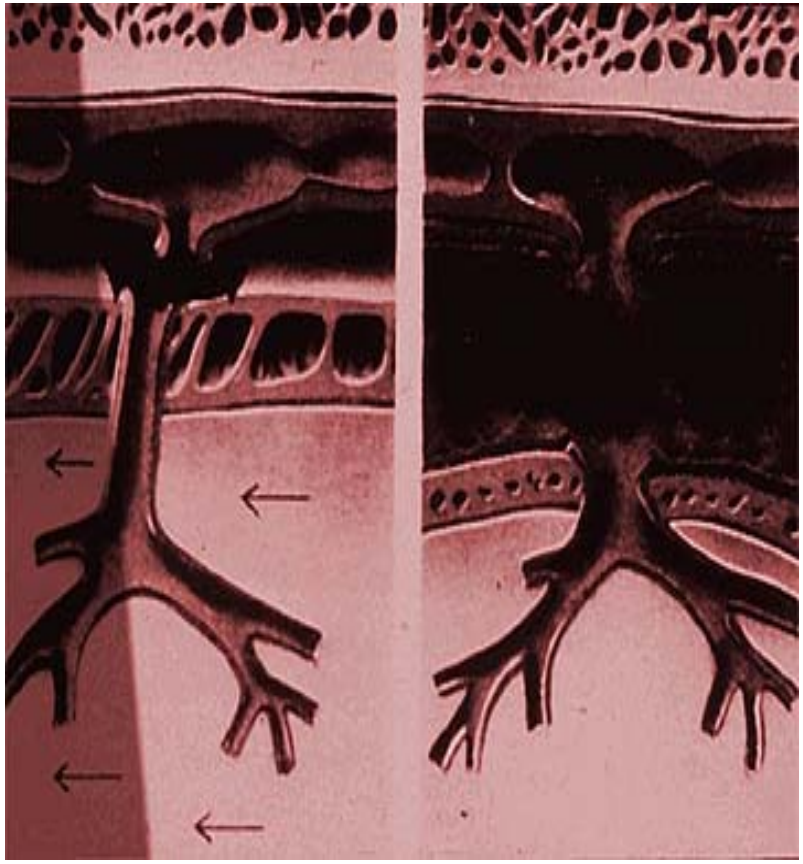
Third National Conference on SBS Rallies Diverse Crowd

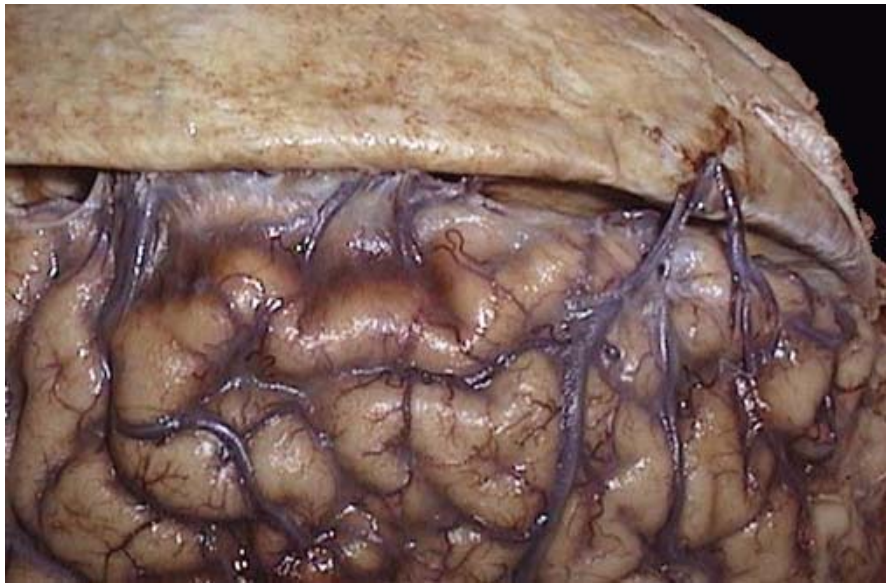
Diffuse Axonal Injury

- Violent shaking can inflict severe acceleration-deceleration **(shearing)** injury to infant brain.

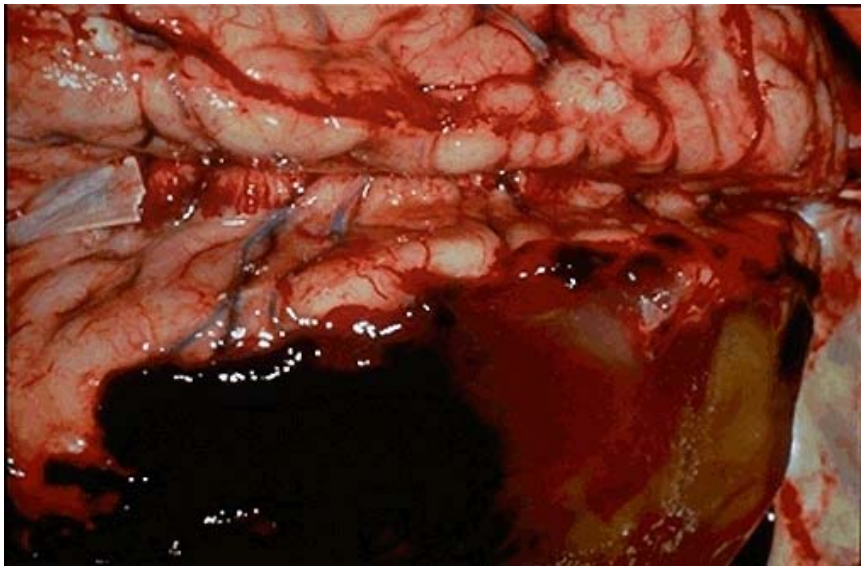


Tearing of Bridging Veins



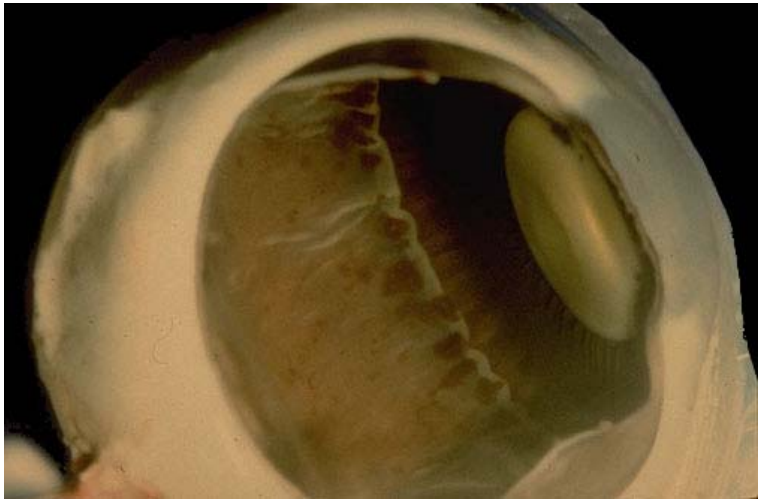


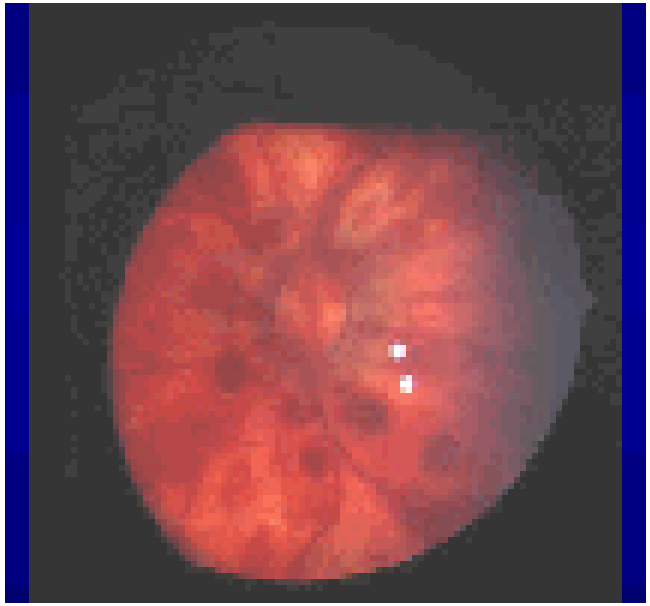
Cerebral lesions include subdural hemorrhages (often interhemispheric), subarachnoid hemorrhage, and brain edema



Retinal and Optic Nerve Sheath Hemorrhages

- Retinal and optic nerve sheath hemorrhages are very common (65-95%) ; therefore, ophthalmoscopic examination can be critically useful in distinguishing traumatic from non-traumatic causes of infant deaths.



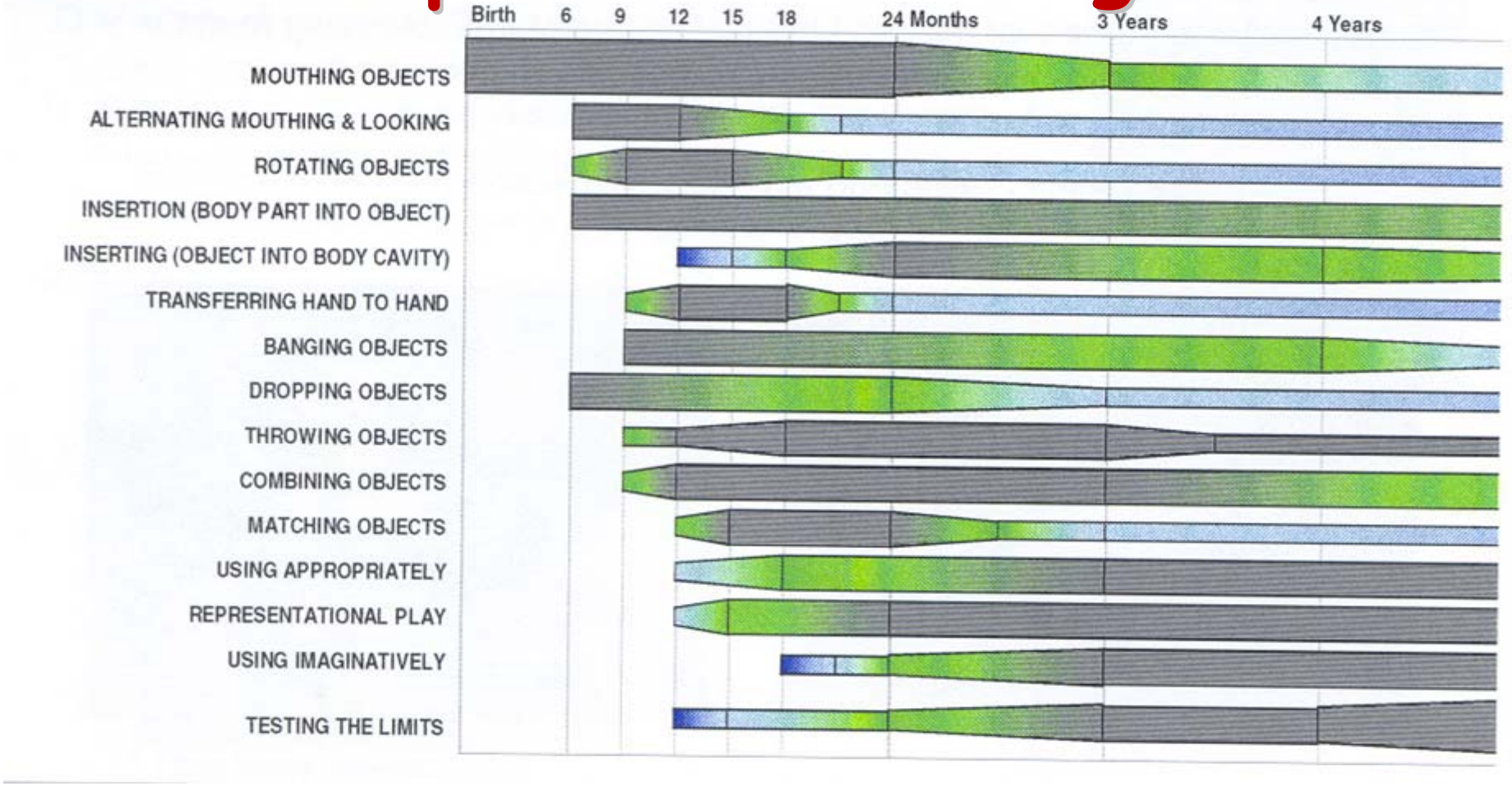


Prevention

- **Baby shaking**
  - Crying crisis: infantile colic, fever, post vaccination
  - Anger control
  - Never shake baby

Injury Mechanisms and Prevention for infant 6 mo – 3 yr

Injuries are associated to exploration strategies



Children's exploration strategies are predictable

Mouthing

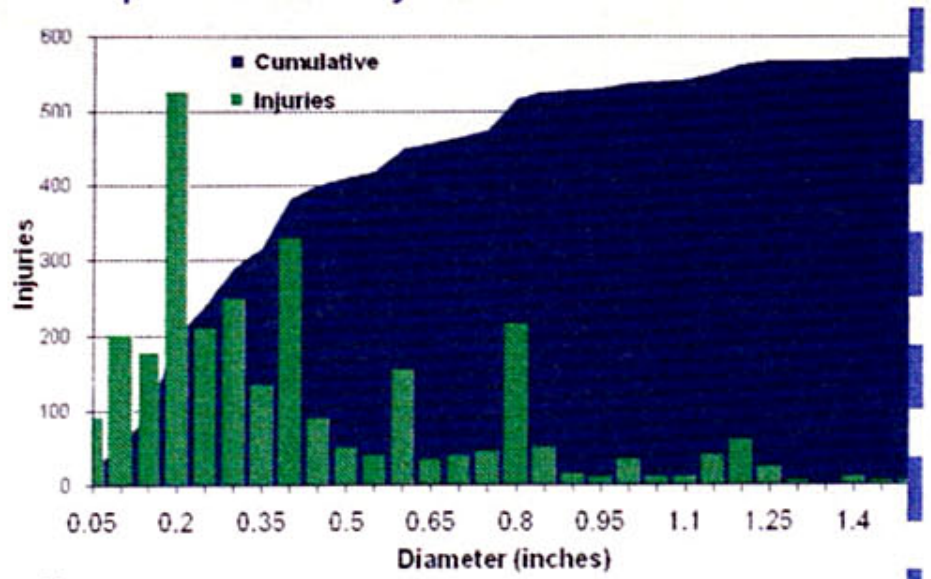
The key to understanding the world:

- Infants and toddlers will mouth anything and everything
- Three year-old children like to mouth items that remind them of food (pretend food, packaging that food came in, etc.)
- Preschool age children and older like to use their mouth and teeth to open all types of packages and food containers

Intertek Human Factors

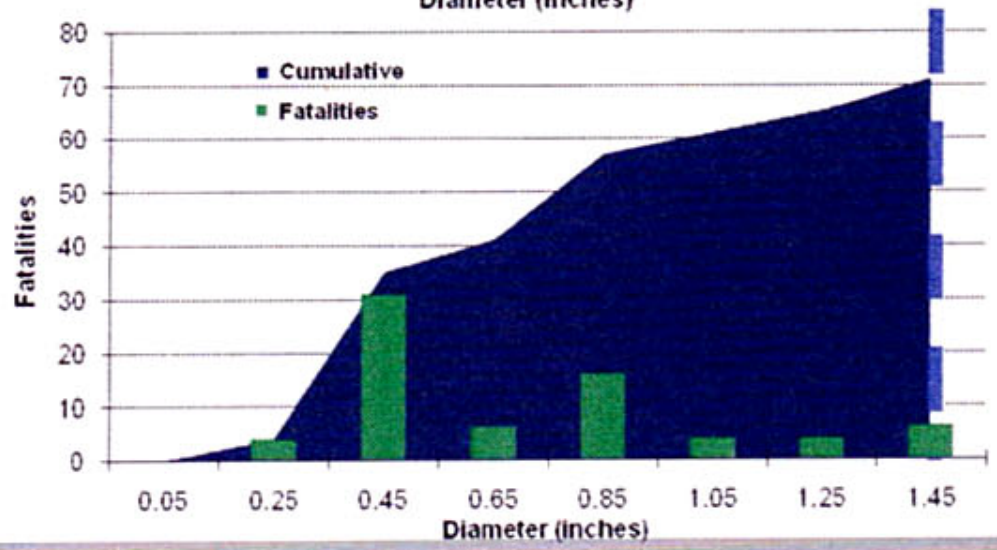
Airway Obstruction – Non-Spherical Objects

Injuries
Intertek CHD
1988-1996



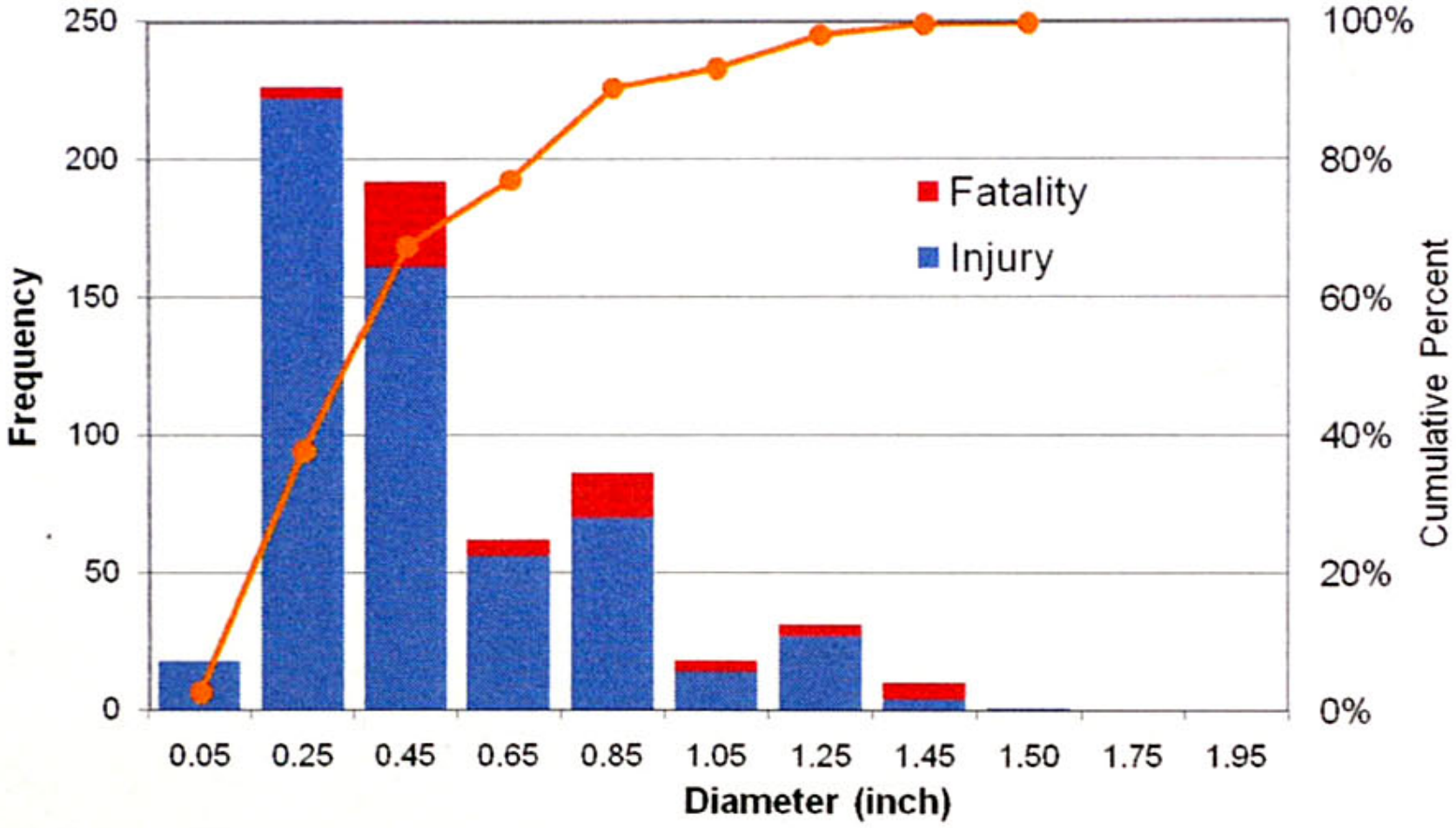
1.50-inch
Diameter

Fatalities
CPSC
1972-1992



Intertek Human Factors

Airway Obstruction – Non-Spherical Objects

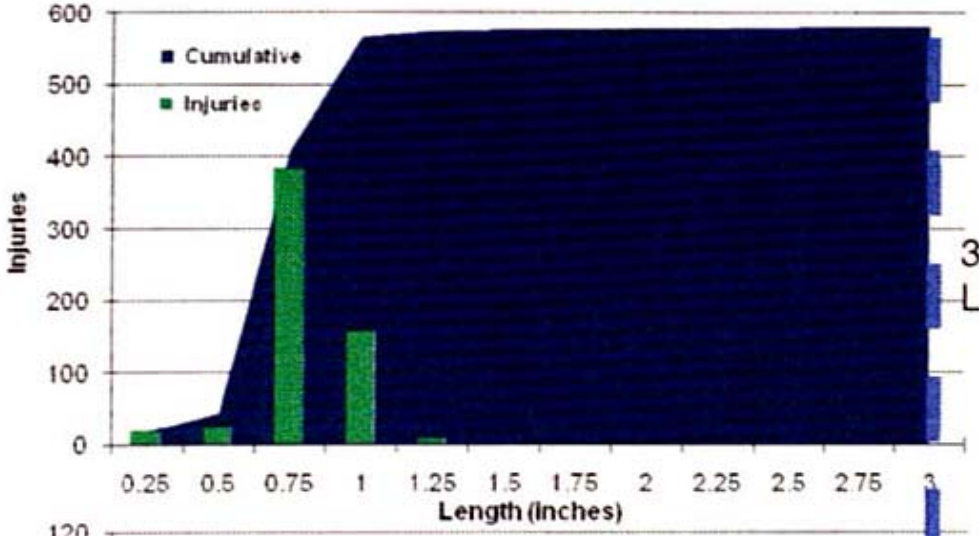


Injuries: Intertek CHD 1988-1996, Fatalities: CPSC 1972-1992

Intertek Human Factors

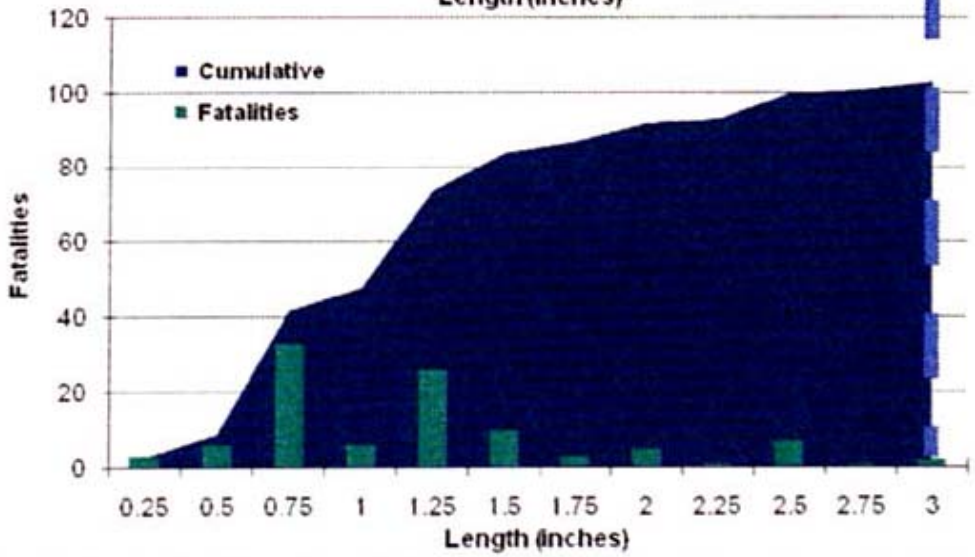
Airway Obstruction – Object Effective Length

Injuries
Intertek CHD
1988-1996



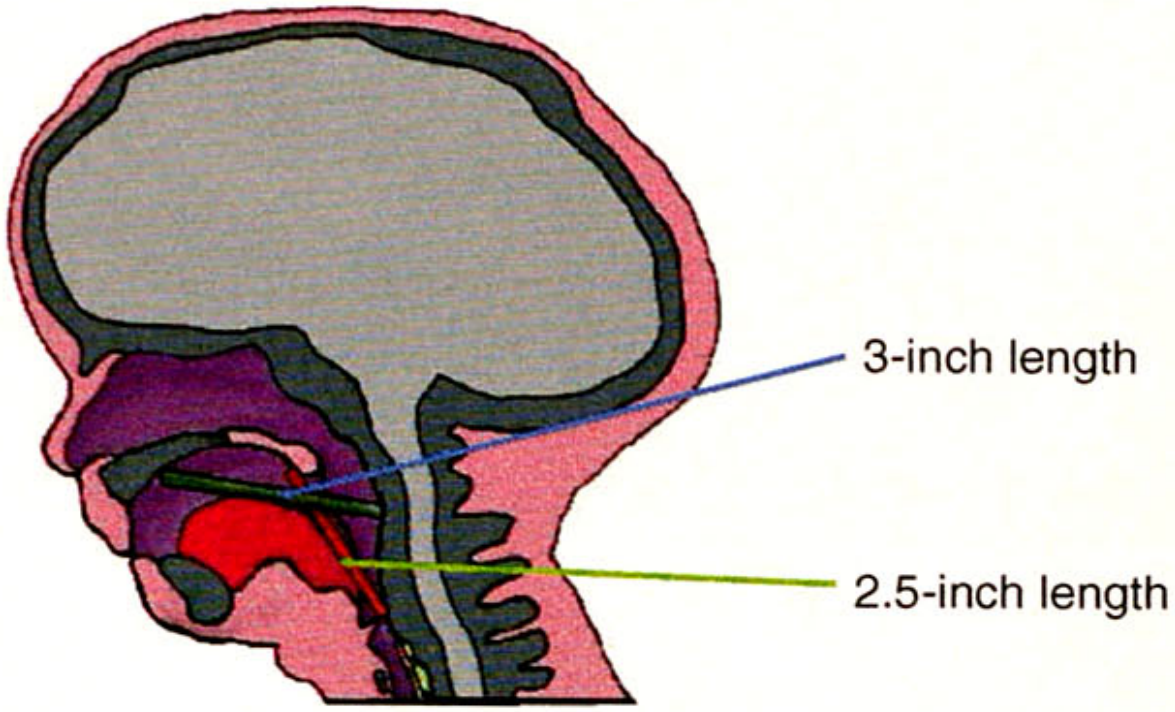
3-inch
Length

Fatalities
CPSC
1972-1992

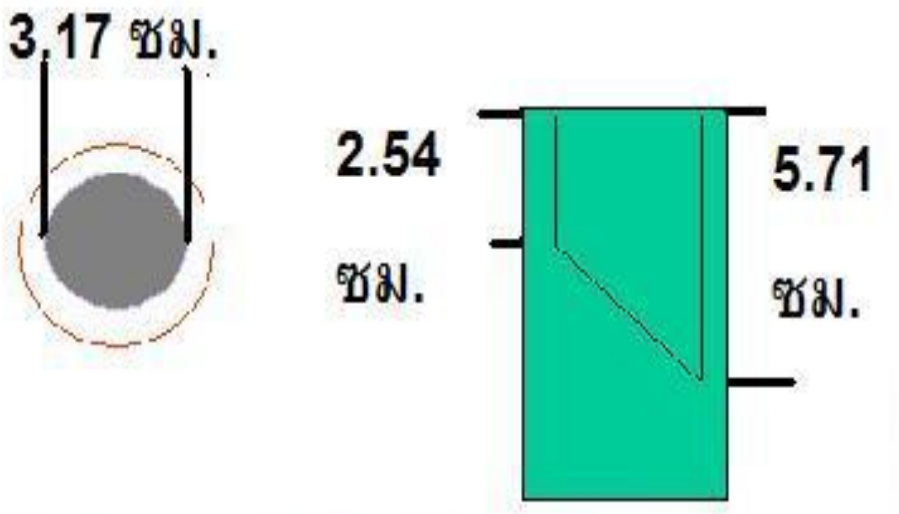


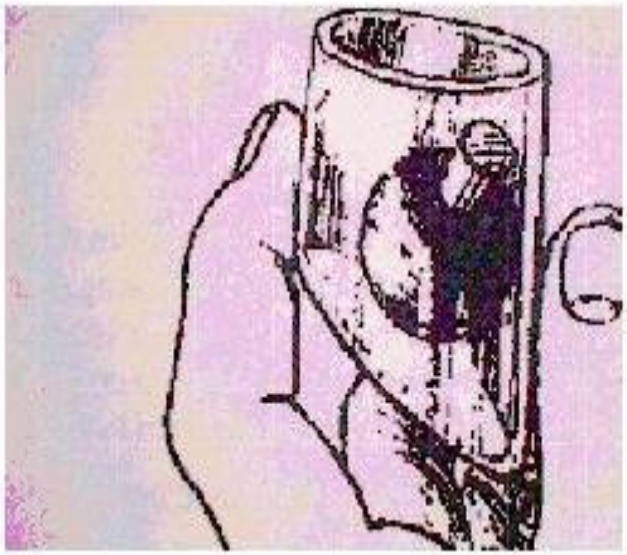
Intertek Human Factors

Airway Obstruction – Object Effective Length



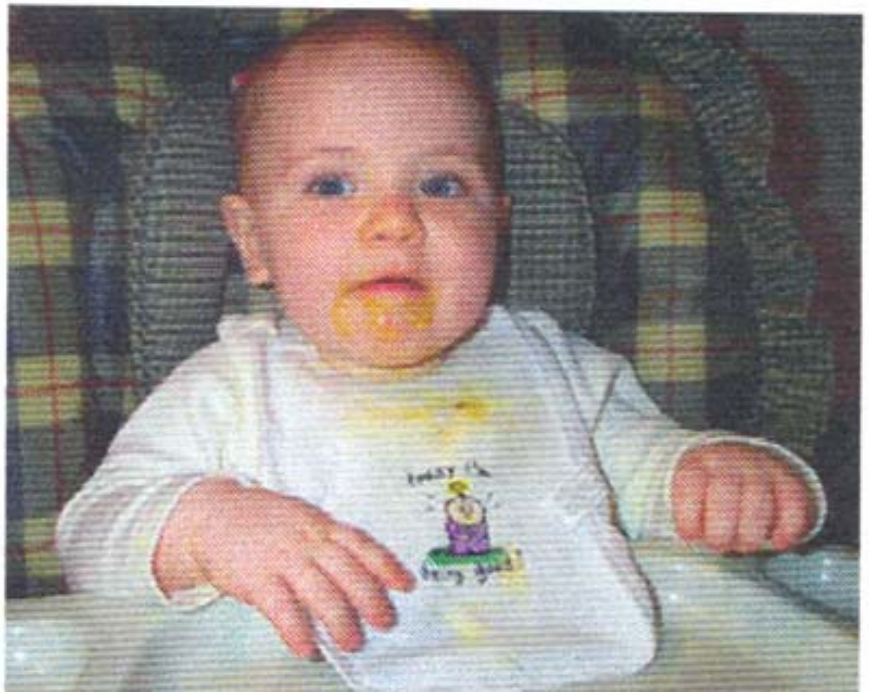
Choking: Small part





Exploration Strategies – Banging on Objects

- Provides feedback on sound and weight characteristics
- Infants and toddlers will bang anything, anytime
- Preschool and older children begin to appropriately bang objects (e.g., drum sticks, toy hammers), but will also bang objects out of frustration



Cl 4.6.2 Small Objects – Mouth Actuated toys

- Shall not release small parts after 10 alternating blowing-and-sucking cycles

Cl 4.6.3 Toy intended for children from 36 mths to <72 mths :

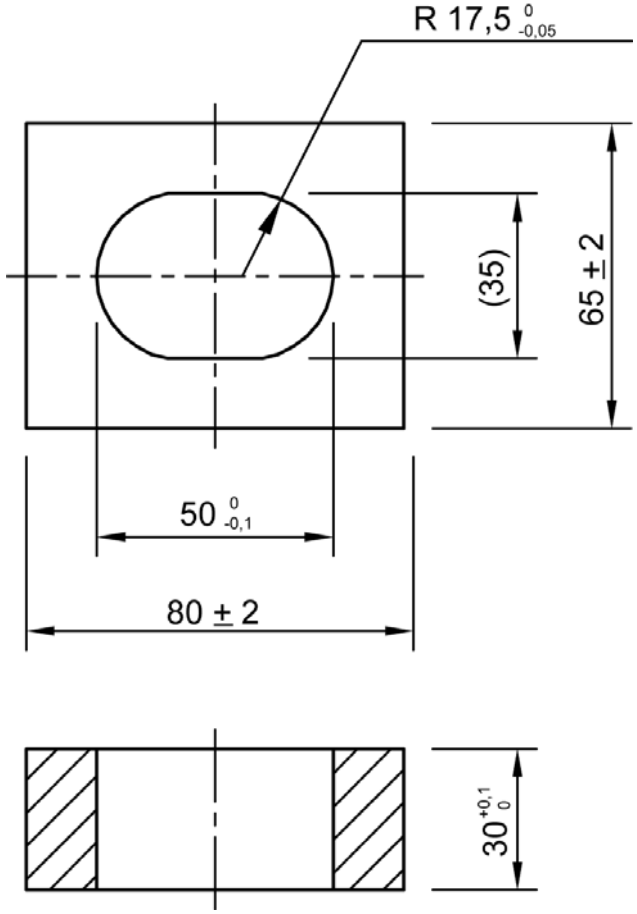
- Labelling is required for toys including small parts. Subject to the requirements of 16CFR1500.19

⚠ WARNING:
CHOKING HAZARD—Small parts.
Not for children under 3 yrs.

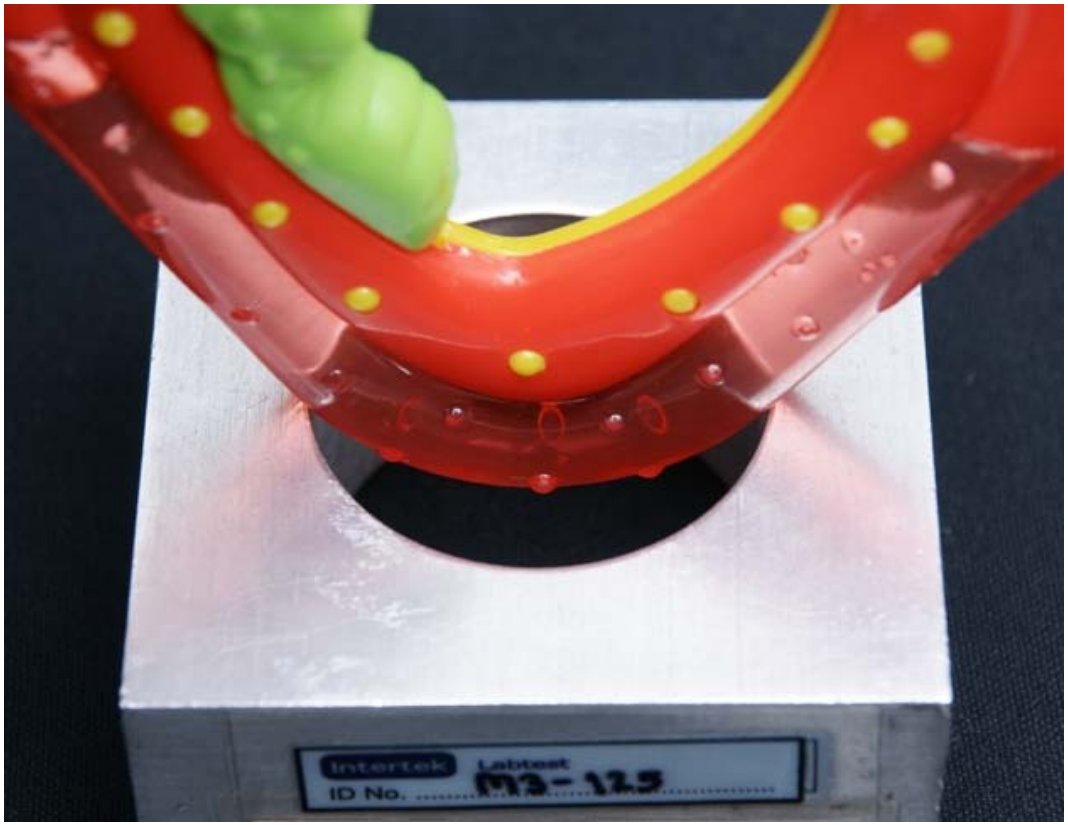

TIP
Howca
Anything that fits through the opening of a toilet paper roll is a choking hazard.

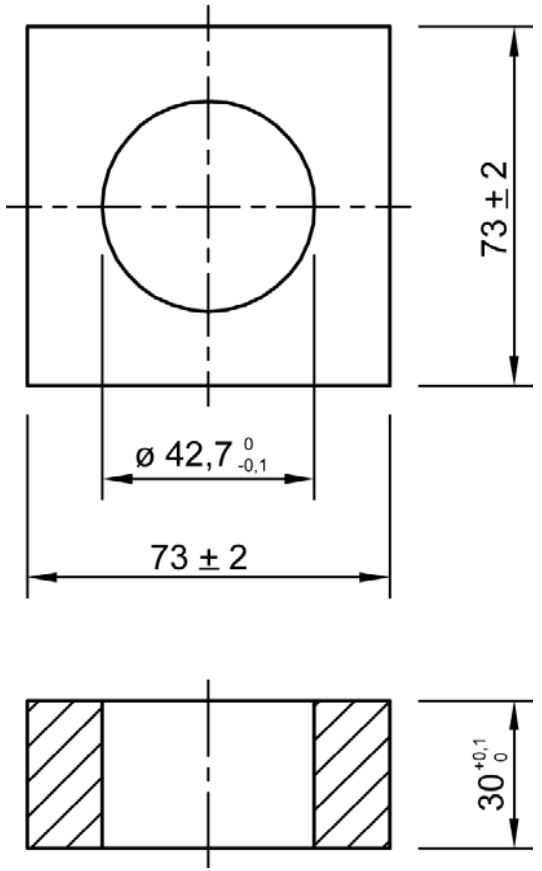
Teethers and Rattles

Shape and Size
Template A

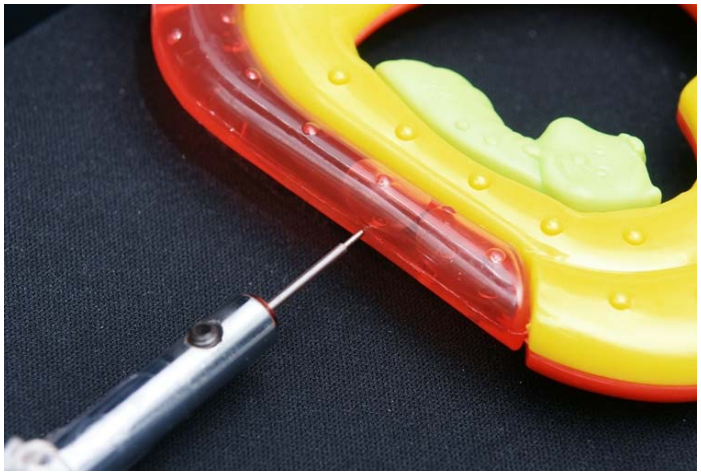


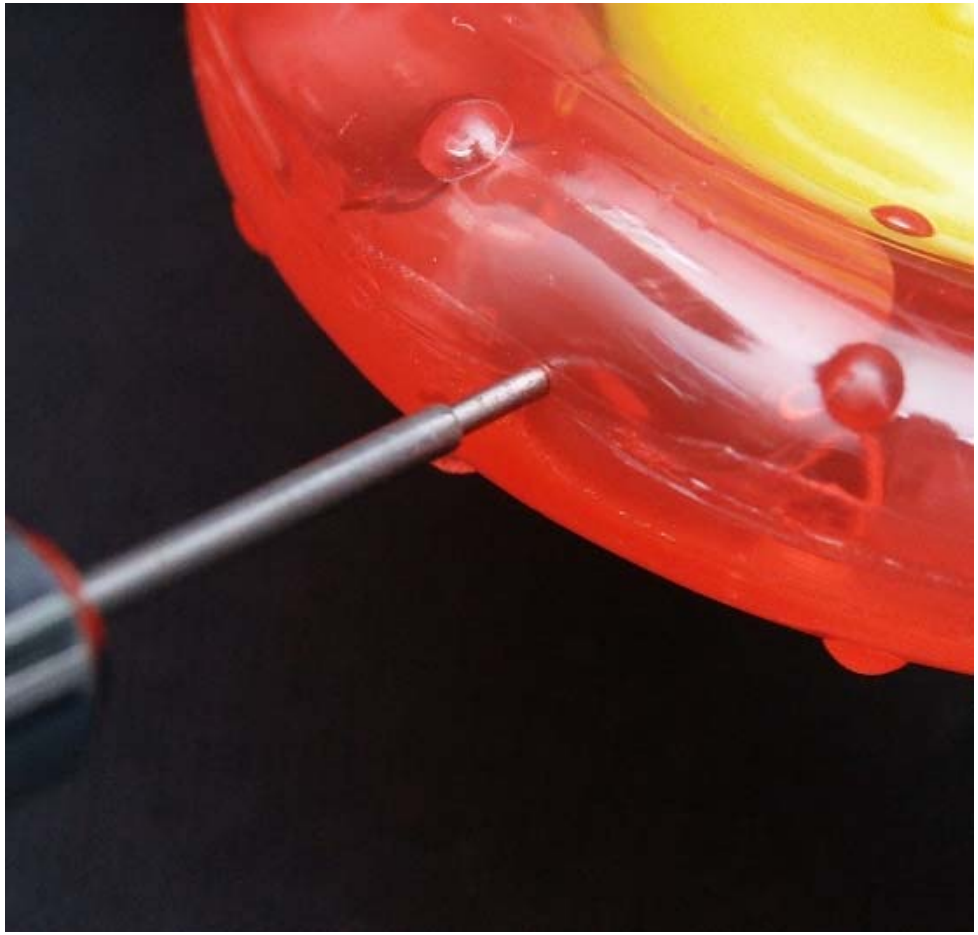
Shape and Size
Template B



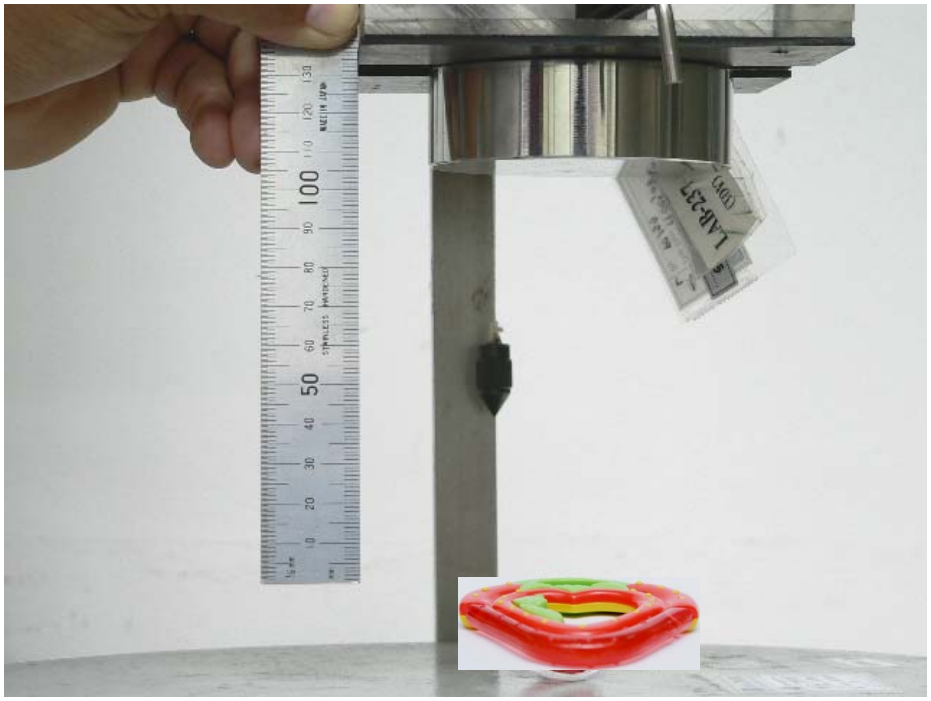


Puncture Test (5 N for 5 s. (37 ^{o}C / 5 ^{o}C for 4 hrs.))





Impact Test



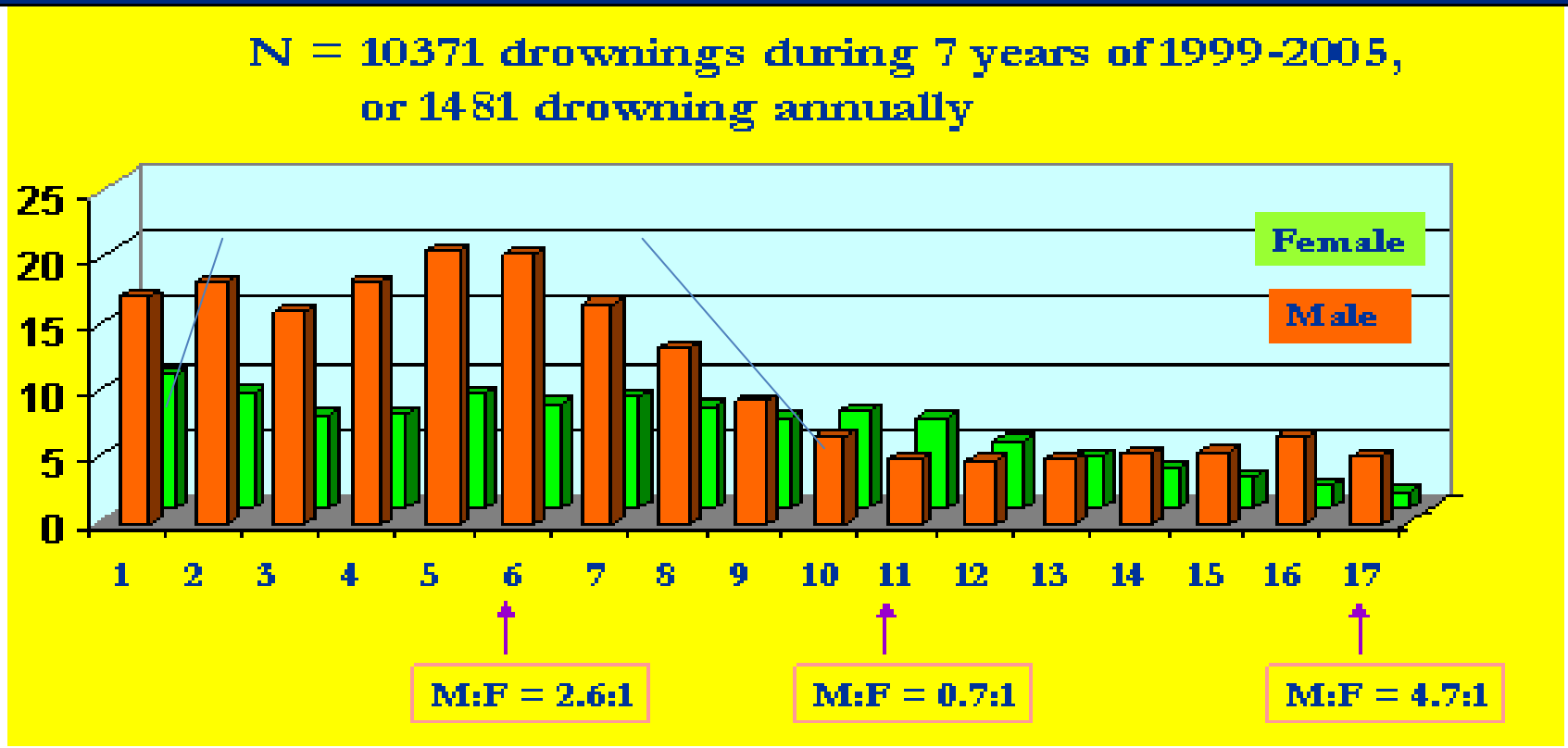
Asphyxia prevention **Recommendations**

- Non prone position sleeping
- Bed sharing may be hazardous, sleep on infant mattress 1m from cosleeper
- Standard crib for < 2 yrs,
- No space >6 cm in infant, 9-23 cm for >6 mo
- No cord > 15 cm(22 cm for 6mo and older)
- Not to sleep on sofas, soft mattresses, other soft surfaces
- Avoid soft materials in the infant's sleeping environment
- Toys , other things around child <3 yr must >3.17*5.71 cm

Exploration Strategies – Insertion (Body Part into Object)

- Isolation of one finger leads to placing the finger into or along the side of an object
- Infants usually insert fingers and hands into objects
- Toddlers enjoy inserting their feet, legs, heads, etc. into various objects

Drowning Mortality Rates among Thai Children 1-14 Years by Age, Sex



Magnitude of the problem

- **Drowning contributes at least 8% of the world's injury deaths**
- **An estimated 409 272 people drowned globally in 2000**
- **97% of drowning deaths occurred in low- and middle-income countries**
- **More than 12 million DALYs were lost due to drowning world wide in 2000**

Magnitude of the problem

Global drowning deaths by gender in each WHO region 2000

Region	World	AFRO	AMRO	EMRO	EURO	SEARO	WPRO
Males	281,717	67,654	20,181	20,712	30,322	55,258	87,600
Females	127,554	23,311	4,408	6,904	7,196	36,520	49,216
Total	409,272	90,956	24,589	27,616	37,518	91,778	136,816
M:F ratio	2.2:1	2.9:1	4.6:1	3:1	4.2:1	1.5:1	1.8:1
Percent	100	22	6	7	9	22	33
Rate *	6.8	14.2	3	5.7	4.3	6	8.1

* Rate per 100,000 people

AFRO = African Region of WHO
AMRO = American Region
EMRO = Eastern Mediterranean Region
EURO = European Region
SEARO = South East Asian Region
WPRO = Western Pacific Region

*Source: **World Health Organization**. Evidence and Information for Policy section web site. Global Burden of Disease 2000 Version 2.*

Magnitude of the problem

Global drowning DALY by gender in each WHO region 2000 [1]

Region	World	AFRO	AMRO	EMRO	EURO	SEARO	WPRO
Males	8343448	2187056	578275	652957	725940	1534468	2664753
Females	3696529	772833	137597	215082	166090	1034277	1370651
Total	12,039,977	2,959,889	715,872	868,039	829,030	2,568,745	4,035,404
M:F ratio	2.3:1	2.8:1	4.2:1	3:1	4.4:1	1.5:1	1.9:1
Percent	100	25	6	7	7	21	34

Source: **World Health Organization**. Evidence and Information for Policy section web site. Global Burden of Disease 2000 Version 2.

Classification of drowning mortality and morbidity

Code	ICD 9	Code	ICD 10
E910	Accidental drowning & submersion	**W65-74**	Accidental drowning & submersion (excluding drowning by cataclysm, transport accident & water transport accident
E908	Cataclysmic storms & floods resulting after storms	**X36-X39**	Forces of nature Victim of avalanche, landslide or other earth movement (X36) Victim of cataclysmic storm (X37) Victim of storm (X38) Exposure to other and unspecified forces of nature (X39)
E909	Cataclysmic earth surface movement & eruption		
E830	Accident to watercraft causing submersion	**V90**	Accident to water craft causing drowning and submersion
E832	Other accidental submersion or drowning in water transport accident	**V92**	Water transport related drowning and submersion without accident to water craft
E954	Suicide & self inflicted injury by submersion	**X71**	Intentional self harm by drowning & submersion
E964	Assault by submersion (drowning)	**X92**	Assault by drowning and submersion
E984	Submersion (drowning) undetermined whether accidental or purposely inflicted	**Y21**	Drowning & submersion undetermined intent

Source: International Classification of Diseases (ICD) versions 9 and 10

Exposure

- **Exposure data for drowning is currently not available**
- **These figures do not take into account the number of persons exposed**
- **Observational studies are required to determine exposure**
- **Exposure measures are important for strategic intervention**

Drowning exposure and event Classifications: Type 1

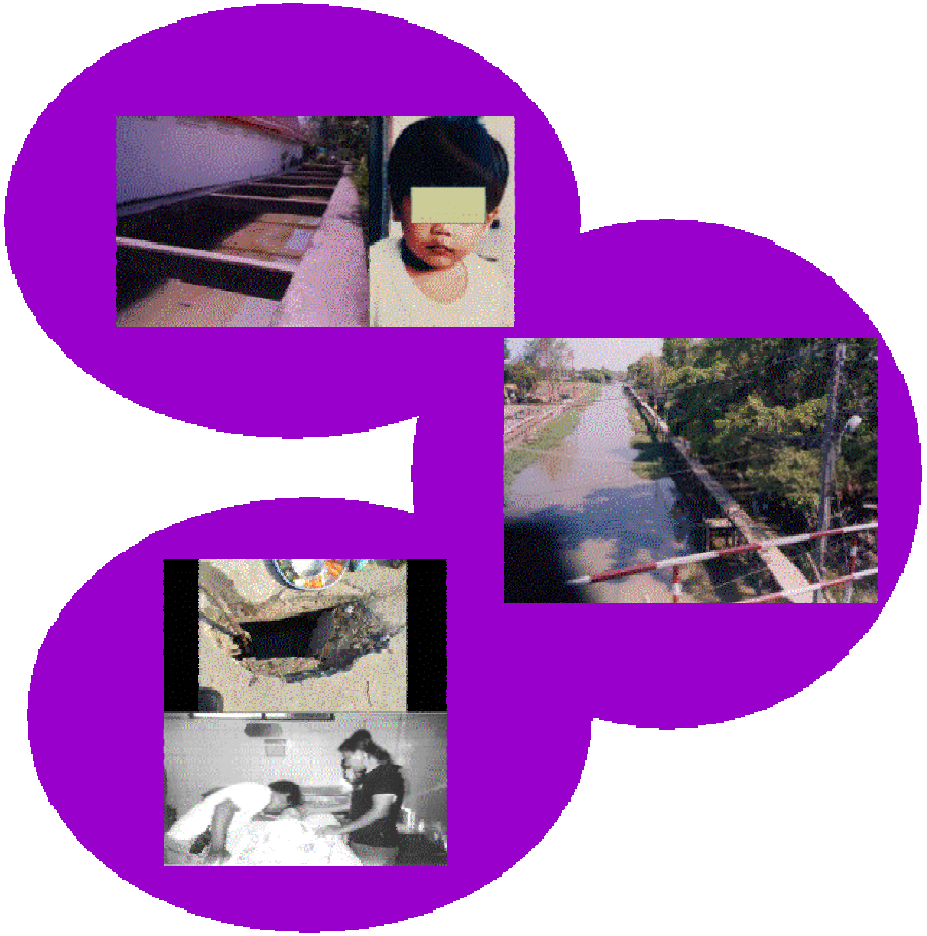
- Among younger children, drowning usually occurs within the home, often during brief lapses in adult supervision.

- Infants drown in bucket, bathtubs, or other domestic water containers, either when they are left unattended or as the result of abusive injury.

- <4 yr 38%

Drowning exposure and event Classifications: Type 2

- Toddlers, preschoolers typically drown because of fall into pools, ponds, dams or natural water sources in neighborhood area.
- 47% 4-9 yr



Drowning exposure and event Classifications: Type 3

school age and adolescent (15%)

- School aged child frequently drowns in natural bodies of water and swimming pools while swimming with their peers and is associated with risk-taking behavior.

- Adolescent drowning frequently occurs in natural bodies of water and is associated with risk-taking behavior and intoxication.

Drowning Morbidity

- There is less information concerning morbidity.
- It is estimated that for each drowning death, there are one to four nonfatal drowning events requiring hospitalization.

Drowning prevention

- Remove the hazard
- Create barriers
- Protect those at risk
- Counter the damage

Prevention

- Adult supervision of infants and young children around water is a major focus of preventive efforts, but a child can enter the water during a brief lapse in the supervisor's attention.

- **Therefore, multiple layers of prevention, with barriers between the child and water, are recommended.**

- Proper fencing can reduce the incidence of drowning.

Prevention

- Prevention for school age child and adolescent should focus on water safety education, including the dangers of intoxication while in and around the water.

- Although swimming lessons are presumed to improve water safety, no data demonstrate that they actually decrease the risk of drowning.

- In addition, swimming programs are not developmentally appropriate for children younger than 4 years of age

Challenging Intervention

- Parental education in well child care
  - Putting the message in WCBook
  - Introducing some special materials
- Home visit for risk identification and environmental modification
- Safe community


โครงการอันเนื่องมาจากพระราชดำริ

First aid for Drowning

- Don't waste time trying to remove water from the victim.
- Start CPR by opening the airway and giving 2 *effective* breaths followed by chest compressions; if you are alone, continue with 5 cycles (about 2 minutes) of compressions and ventilations before activating EMS
- If 2 rescuers are present, send the second rescuer to activate the EMS system immediately.

Basic Life Support

- If you are the only rescuer, perform cycles of 30 chest compressions followed by 2 effective ventilations with as short a pause in chest compressions as possible.
- For 2-rescuer CPR, one provider should perform chest compressions while the other maintains the airway and performs ventilations at a ratio of 15:2 with as short a pause in compressions as possible.

Fall Injuries

- Accidental falls are a common cause of trauma found in the pediatric population, accounting for 30 % of hospital admission and 5% of deaths, among pediatric injury cases of the referral center hospitals.

Fall Injuries

- Most common in ER (40%)
- Most events occur at home
- Supervision with home environmental and product modified are essential intervention
- Child abuse should be considered if inappropriate history.

Falls: Infant Walker

- Delay walking
- 50% of users experienced injuries
- Severe injuries including skull fracture, concussion, intracranial hemorrhage, full-thickness burns, c-spine fracture, and death

Falls

- Safety gate
- Barriers on stair, balcony
- Guard rails <9 cm wide

Deaths from Falls in Children: How Far is Fatal?

- Short falls (<4')

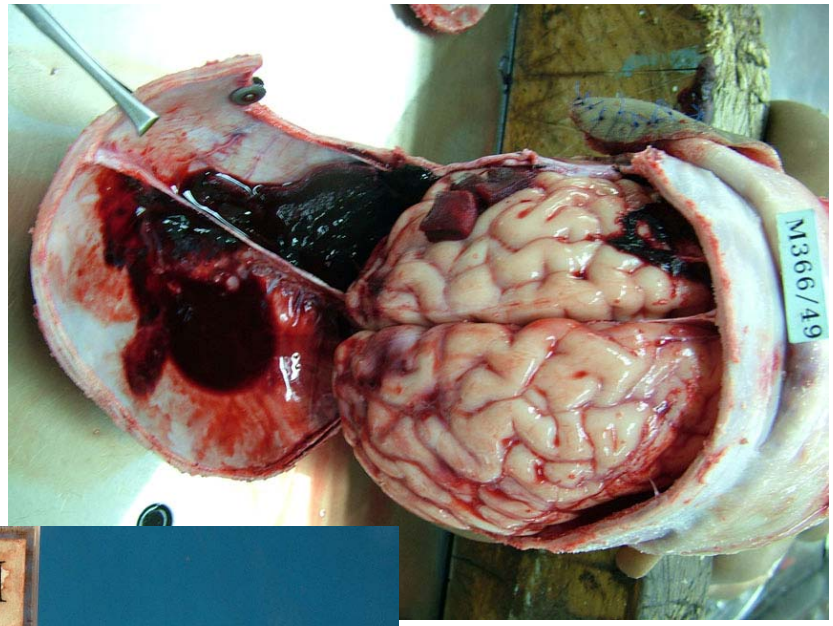
Falls out of bed	0%
Falls from bunk beds	1.5%
Falls in baby walkers	1%
Falls down stairs/walkers	0%
Falls down stairs	1.5%
Falls from shopping carts	0%

- High falls: critical height (>10')

Short Falls Death = Suspected Child Abuse

1 yr old child was reported as fall death form stair , 1 m height

Autopsy = Shaken baby syndrome



Other common home injuries

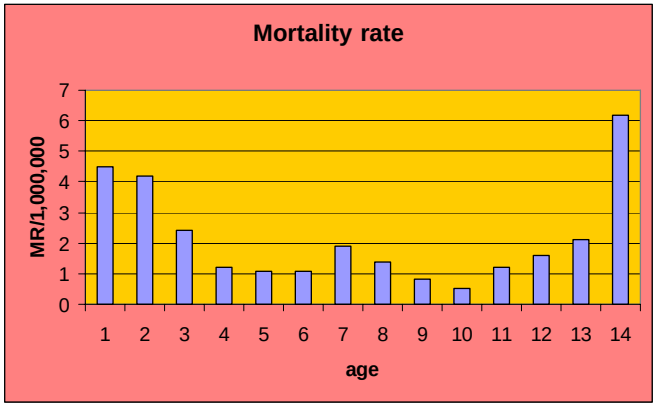
- Poison
- Scald burn
- Electrocution

Environmental modification is a preventive key for young children

1.5 m !

Poison

- Small mass of child affects size of toxic dose
- Crawling infants access agents at, or near, floor level (eg rodenticides)
- After 12 months, serious exposures most often involve pharmaceuticals in high income countries
- Children ingest agents that are readily accessible
- Older siblings may administer medications to younger children



Attractive appearance of medicines

Poisoning

- Common drug: paracetamol, iron, cold remedy, antidiabetic, antihypertensive drug
- Corrosive agents
- Insecticide, Herbicide

Prevention

- Safe storage, Child resistant storage
  - cabinet
  - child proof cap
- Poison control center

ติดต่อ ศูนย์พิษวิทยา
02-201-1033
02-246-8282

Chronic Poison

- One of the common problem is lead poisoning.

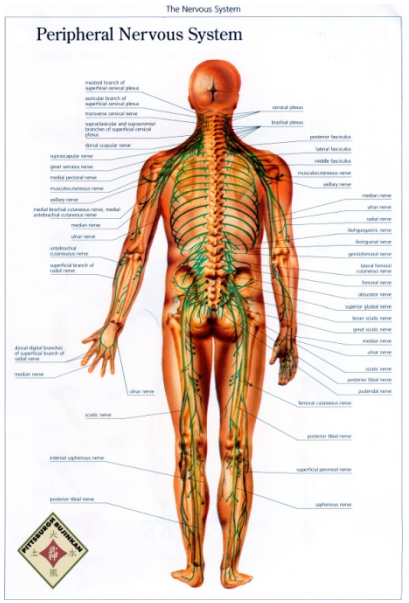
Routes of Exposure to Lead

- Eating (Ingestion)
  - Lead particles on hands transferred to food, drinks and children sucking on their fingers
  - 20% absorbed in adults
  - 70% absorbed in children and pregnant women

  - Breathing (Inhalation), Lead particles in the air

Inhalation Poisoning

Effects of Lead



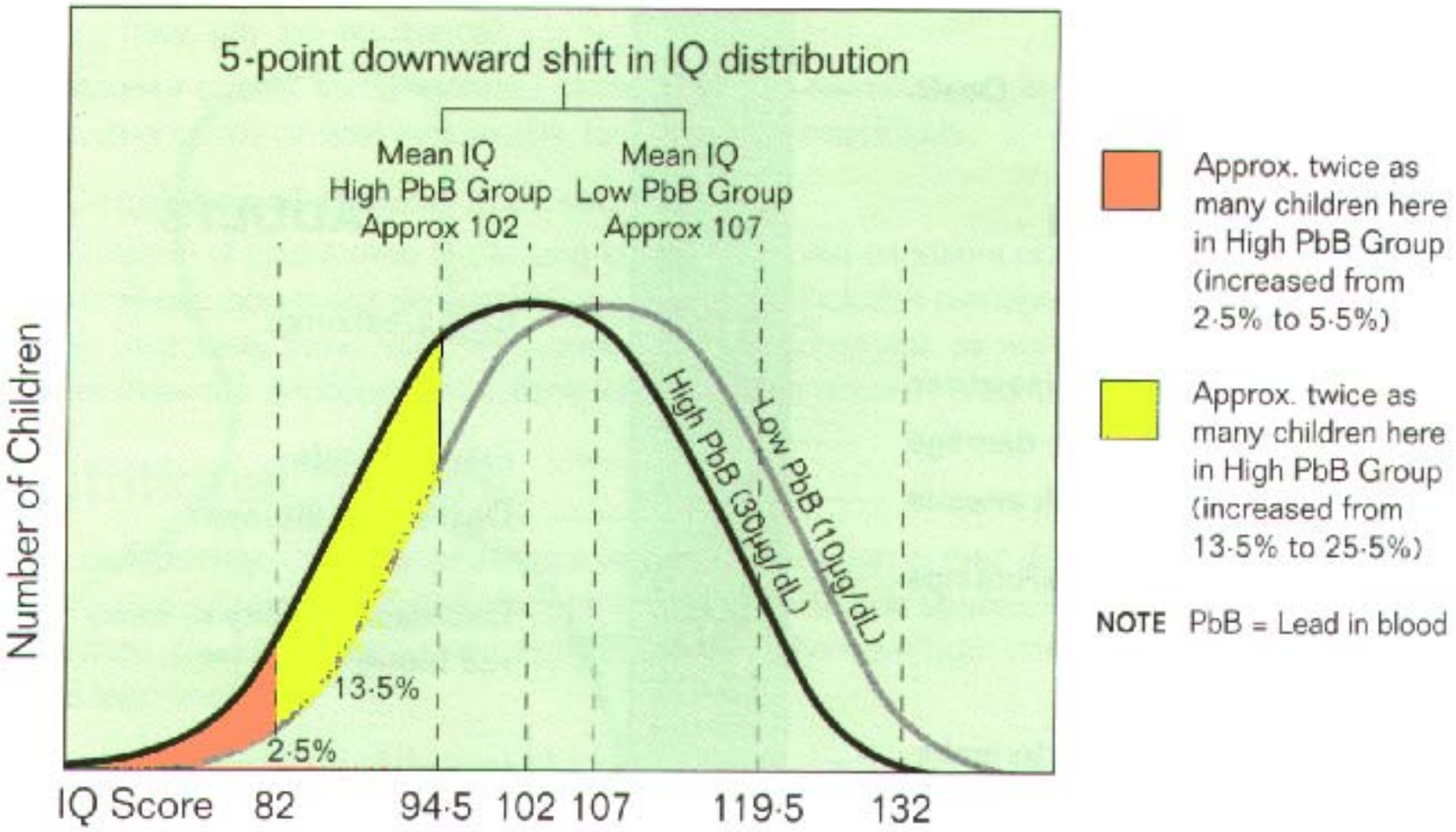
- Nervous System
  - Most affected by lead
  - Damage can be permanent
  - Lead can damage the brain and destroy brain cells
  - Damage can result in depression, irritability, forgetfulness, clumsiness, learning disability
  - High exposure can result in hallucinations, coma, and even death

Studies on lead toxicity and learning

- Canfield *et al* measured BLL in children at 6,12,18,24,36,48 and 60 months of age
- Administered the Stanford-Binet intelligence test at 3 and 5 years of age:
  - Decrease in IQ by 4.6 point with BLL>10μg/dL
  - Decrease in IQ by 7.4 points with BLL< 10μg/dL

Results adjusted for confounders

Lead and IQ


5-point downward shift in IQ distribution
Mean IQ
High PbB Group
Approx 102
Mean IQ
Low PbB Group
Approx 107
Number of Children
High PbB (30µg/dL)
Low PbB (10µg/dL)
13·5%
2·5%
IQ Score
82
94·5
102
107
119·5
132
Approx. twice as many children here in High PbB Group (increased from 2·5% to 5·5%)
Approx. twice as many children here in High PbB Group (increased from 13·5% to 25·5%)
NOTE PbB = Lead in blood

Findings and conclusions

Increased blood lead levels is inversely and significantly associated with IQ

Model: SUPER CHARIOTEER Made in: China TIS nark: found
Lab: Intertek

	ITEM NO. 131	LIMIT (PPM)
TOTAL LEAD	1404*	600
SOL. BARIUM	-	1000
SOL. LEAD	-	90
SOL. CADMIUM	-	75
SOL. ANTIMONY	-	60
SOL. SELENIUM	-	500
SOL. CHROMIUM	-	60
SOL. MERCURY	-	60
SOL. ARSENIC	-	25

Model: MINI CAR Made in: China TIS nark: found
Lab: Intertek

	ITEM NO. 998-6	LIMIT (PPM)
TOTAL LEAD	**15200***	600
SOL. BARIUM	83	1000
SOL. LEAD	**3568***	90
SOL. CADMIUM	<5	75
SOL. ANTIMONY	15	60
SOL. SELENIUM	<5	500
SOL. CHROMIUM	**421***	60
SOL. MERCURY	<5	60
SOL. ARSENIC	9	25

Model: CROSS COUNTRY Made in: China TIS nark: found
Lab: Intertek

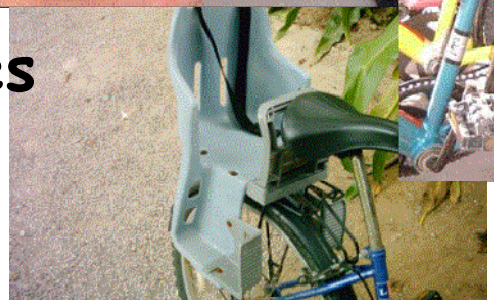
	ITEM NO. 20708	LIMIT (PPM)
TOTAL LEAD	**11230***	600
SOL. BARIUM	21	1000
SOL. LEAD	**4792***	90
SOL. CADMIUM	<5	75
SOL. ANTIMONY	<5	60
SOL. SELENIUM	<5	500
SOL. CHROMIUM	**1229***	60
SOL. MERCURY	<5	60
SOL. ARSENIC	<3	25

Model: JOKER INTERNATIONAL RACING TEAM Made in: Thailand TIS nark: found Lab: Intertek

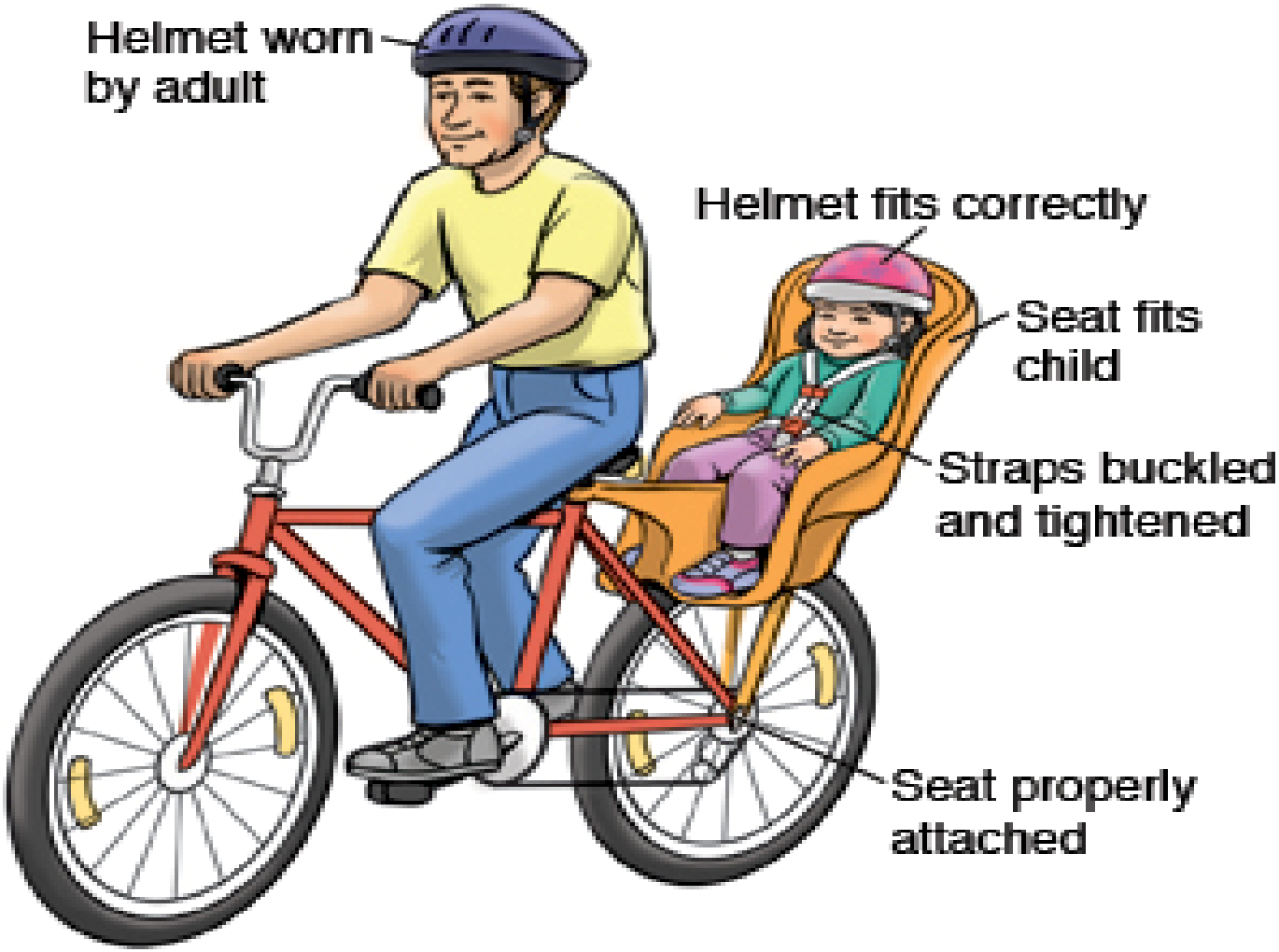
	ITEM NO. --	LIMIT (PPM)
TOTAL LEAD	**5395***	600
SOL. BARIUM	77	1000
SOL. LEAD	**1649***	90
SOL. CADMIUM	8	75
SOL. ANTIMONY	<5	60
SOL. SELENIUM	<5	500
SOL. CHROMIUM	**232***	60
SOL. MERCURY	<5	60
SOL. ARSENIC	5	25

Bike injuries

Bicycle spoke injuries



- Head injuries is the most common of death.
- Bike helmets can reduce the severity of head injuries by >80%


Helmet worn by adult
Helmet fits correctly
Seat fits child
Straps buckled and tightened
Seat properly attached

Infant?: Learning from bicycle safety recommendation

- Learning from bicycle safety recommendation in several developed countries, infants are not allowed to be carried on by the two main reasons.

Why not?

- First, even bike seats for children have been developed, but it is not recommended for infants because infants are just learning to sit unsupported at about 9 months of age and they have not developed sufficient bone mass and muscle tone to enable them to sit unsupported with their backs straight.

Why not?

- Second, even helmets have been proved to prevent or lessen the severity of brain injury during a bicycle crash and produced in soft shell-light-small sizes for correctly placing and securing on the infants' head, but increasing head mass by helmet would increase risks for cervical spine fracture because of relatively large heads and poorly developed neck and upper body musculature of infants, compounded by incomplete growth of their cervical vertebrae.

Recommendation

- For bicycle safety, the American Academy of Pediatrics recommended that children under age 1 should not be passengers on a bicycle under any circumstance. (AAP, TIPP-The injury prevention program: about bicycle helmet, 1994)
- The U.S. Consumer Product Safety Commission agrees that children under 1 year of age should not be on bicycles. (CPSC, 1998)

Toddlers and preschoolers need a child seat on bike

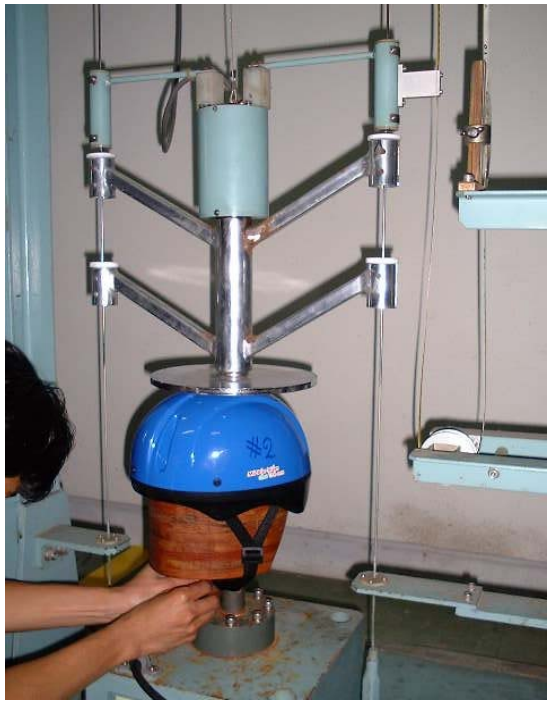
- For EU recommendation, children should not be carried unless they are within the weight range for the seat and they can sit up unaided for at least the length of the cycle journey.
- EU standard applies to seats for the transport of children, weighing from 9 up to 22 kg.
- This more or less corresponds to the age group of 9 months up to 5 years, provided that the child is capable of sitting unaided. They should no longer be carried in the seat when they are above the maximum weight. (ETRA, 2009)

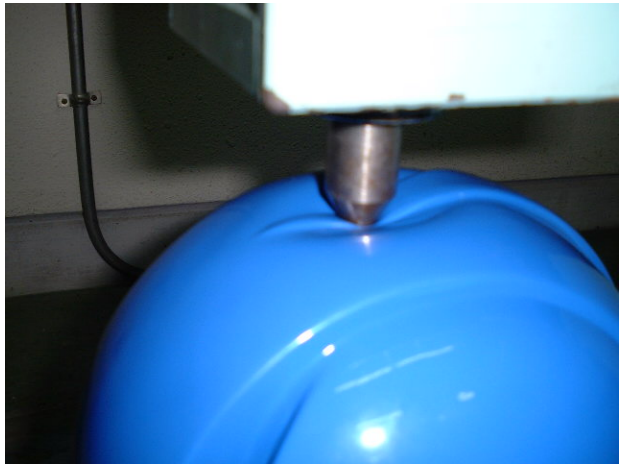
WHAT IS THE MINIMUM AGE FOR A CHILD TO RIDE AS A PILLION PASSENGER ON A MOTORCYCLE?

Should infant, toddlers, and preschoolers are carried on motorcycle as a pillion?

- The child who is decided to be on motorcycle should be
  - old enough to maintain body control and body support while on the motorcycle => 1 years for special seat with back
  - However, they should be large enough to wear all of the required protective gear => 2 years for helmet
  - If they have to sit behind the driver without other adult- passengers behind them, they need to be able to understand the basic concepts required when riding as a passenger. => 6 years old

Helmet for kids



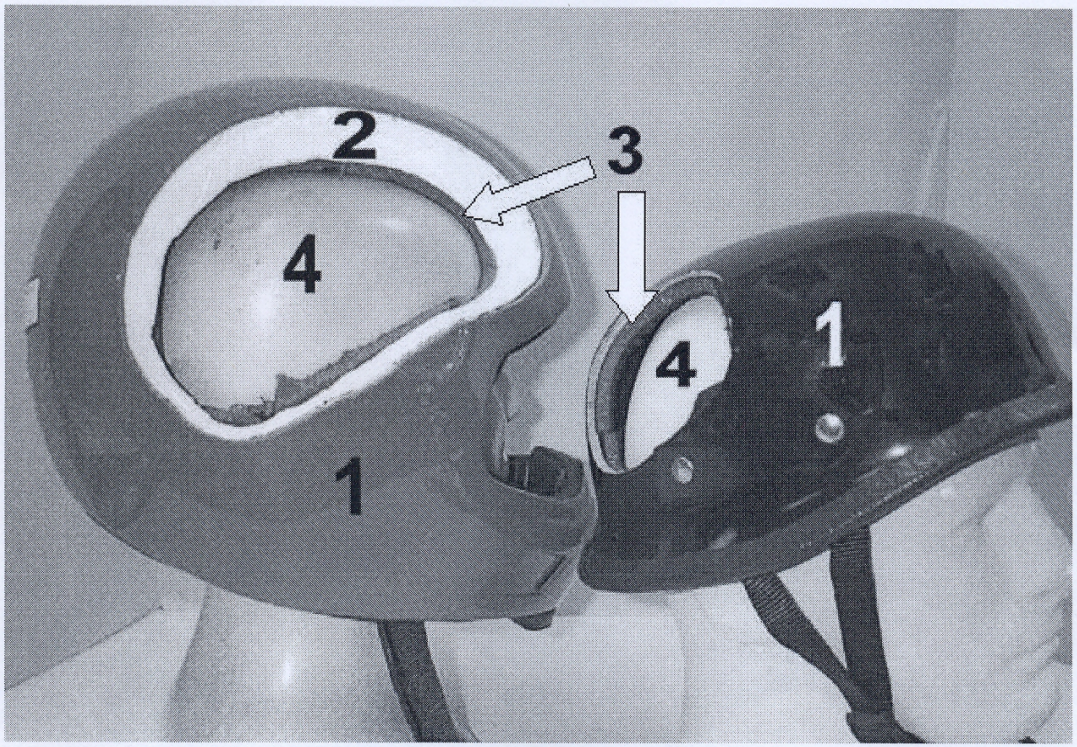


Crashed test helmet for children

- Brain, as a mass, will accelerate when a force is applied to it.
- During impact accelerations may be linear or rotational.
- Rotational force is much more dangerous than translation force and likely causes diffuse brain injuries.

- To minimize brain injury, the basic aim of head protection is to reduce the transferred forces to brain by absorbing the kinetic energy or distributing of impact loads.

Figure 8: Cut-away view compares construction of a DOT-qualified helmet (left) and unqualified "beanie" headgear lacking the protective capability of energy absorbing liner. (1) Hard outer shell (2) Energy-absorbing protective liner (3) Soft comfort/sizing pads (4) Dummy headform



- These are done by an inner padding and a hard outer shell of the protective helmet
- A hard outer shell serves to distribute the impact load over a large area
- An inner padding, an absorbing mechanism , reduces transferred energy from rotational force

Child helmet design: Anthropometric and biomechanical differences

- An important consideration in helmet standard development is that the facial structure and head size of children is vastly different from those of adults.
- Children's heads are smaller in vertical height than adults'.
- Consequently, adult-sized helmets can not fit properly on their heads.

Effectiveness of Helmet promotion program in preschool children on safe behavior

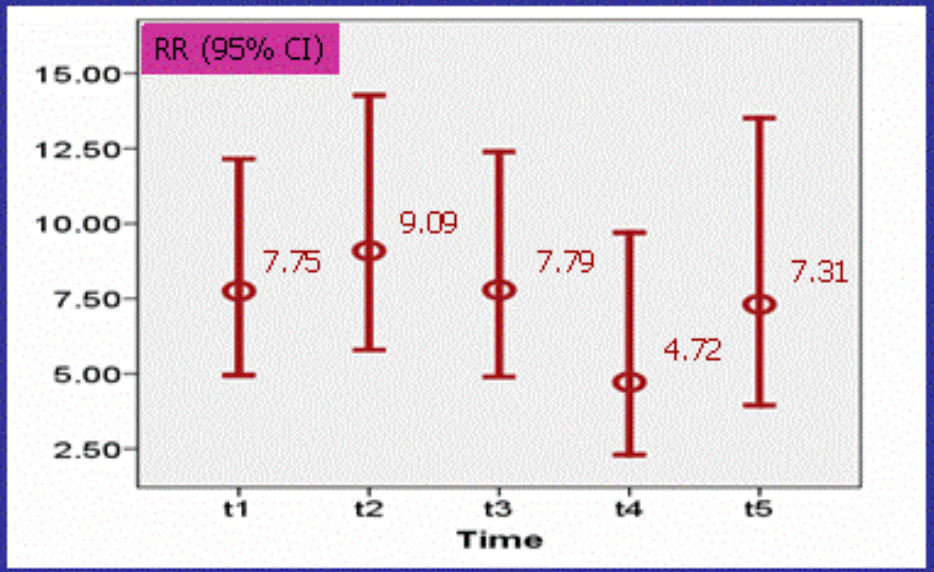
Yuvaluck Thammagasorn, MD

Adisak Plitponkarnpim, MD, MPH

Interventions

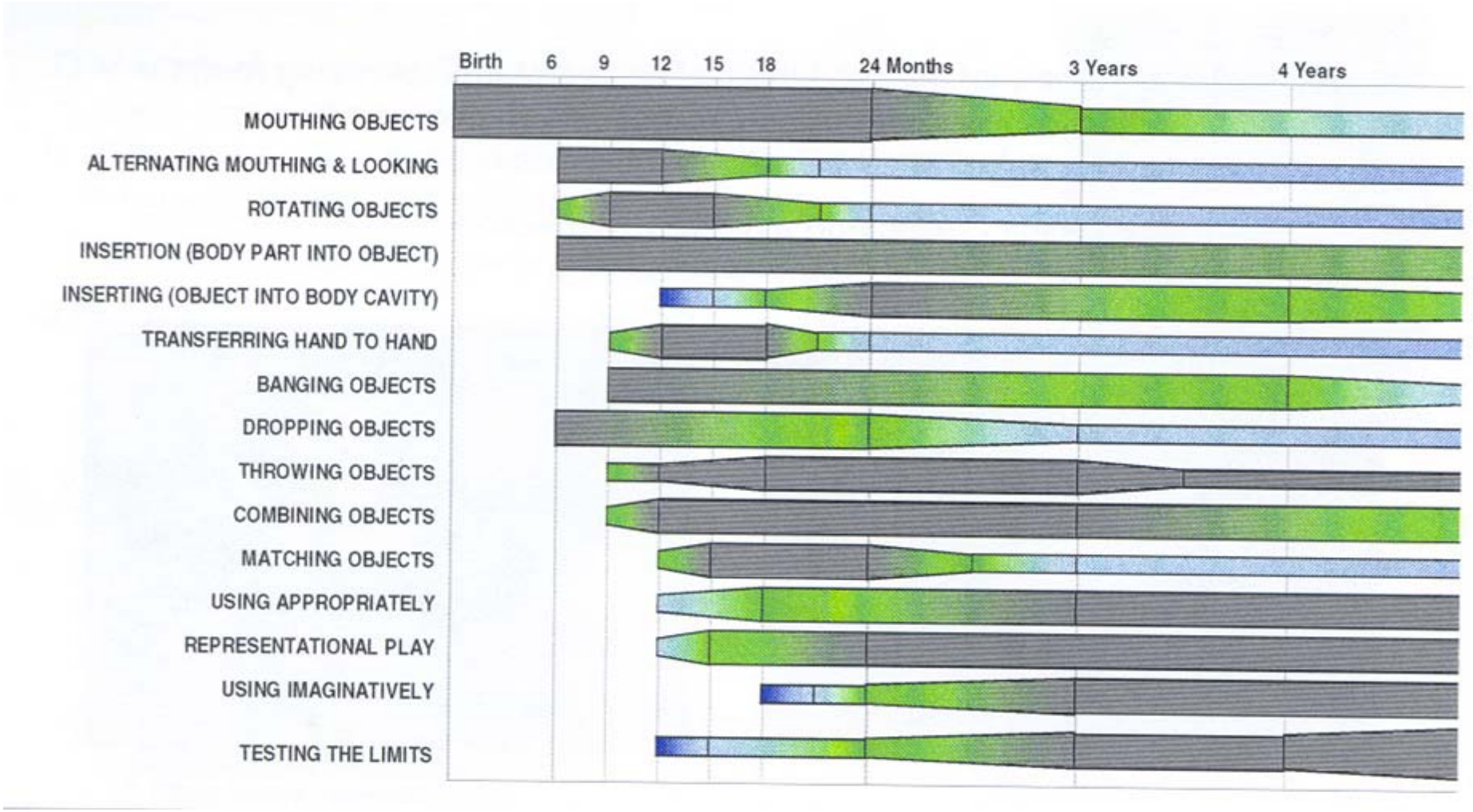
- **Primary Target = Day-care center**
  - Head injury prevention training course for day care administrators, caretakers
  - Head injury prevention policy
  - Helmet rental program

Comparison of Motorcycle helmet use proportion between control and intervention groups: Day-care coordinator and researcher observation

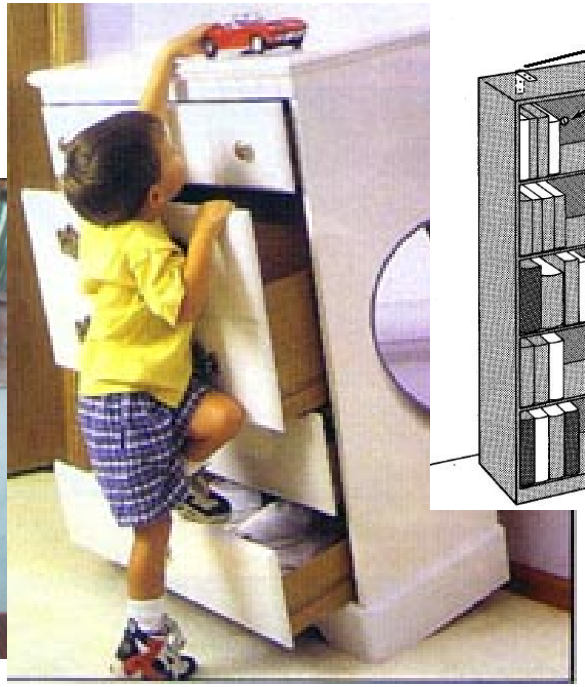


Injury Mechanisms and Prevention for >3 yrs

Exploration strategies



Struck



4 year-old boy
fell from 4th floor

Emergency medicine in developing countries

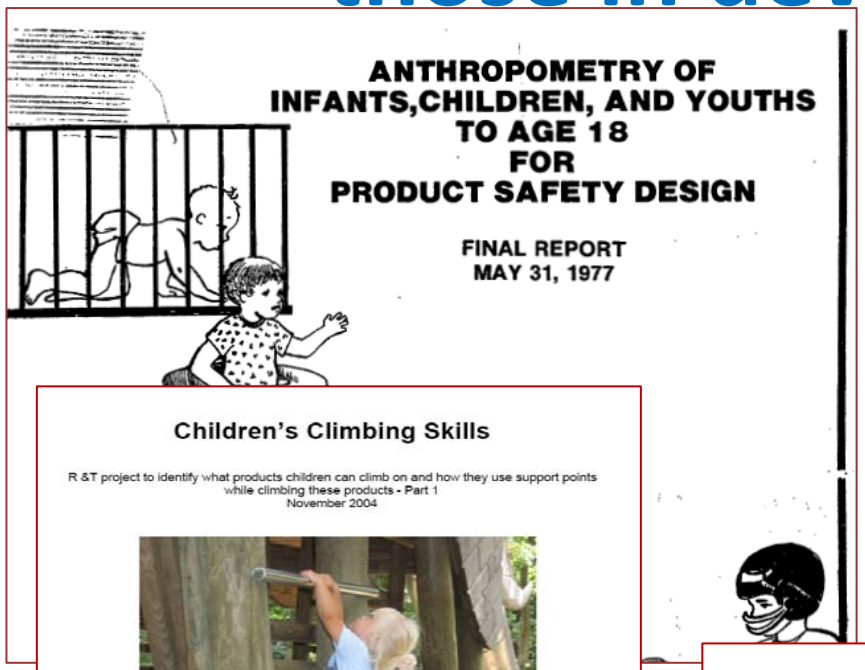
- In developing countries, we have faced the problems of EM system:
  - Bystanders
  - First responders
  - EMS
  - ER


Balcony barrier designed with horizontal bars
NO any regulation!
Balcony barrier space> 20 cms

One of orphanage home

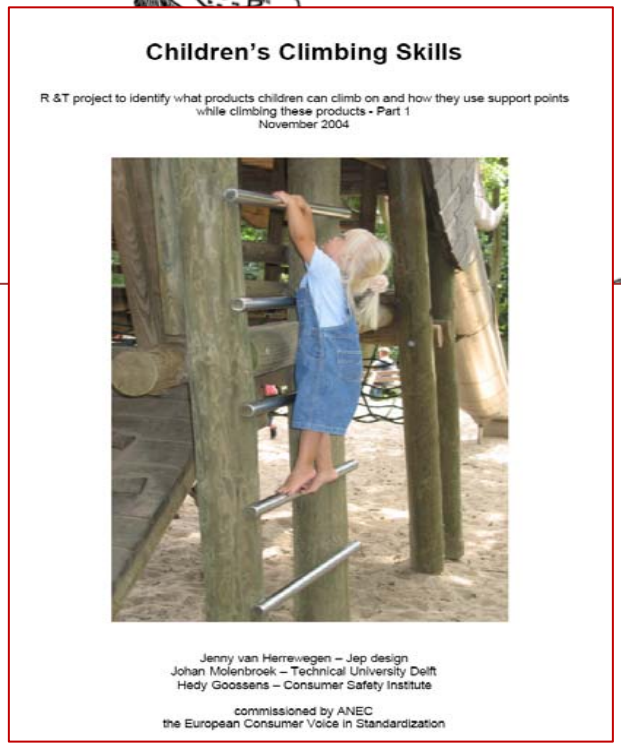
จนท.ชันสูตร ศพ ด.ญ.คัทลียา หรือน้องมิ้ว สมผลึก วัย 6 ขวบ ลูกสาวนายยศพล สมผลึก หนายความส่วนตัว ของอดีต ส.ว.ปทุมธานี หลังพลัดตก จากหน้าต่างห้องพักชั้น 10 เอกธานีคอนโดหาวน์อ.เมืองปทุมธานี

Why our children live differently from those in developed world?



ANTHROPOMETRY OF INFANTS,CHILDREN, AND YOUTHS TO AGE 18 FOR PRODUCT SAFETY DESIGN

FINAL REPORT
MAY 31, 1977

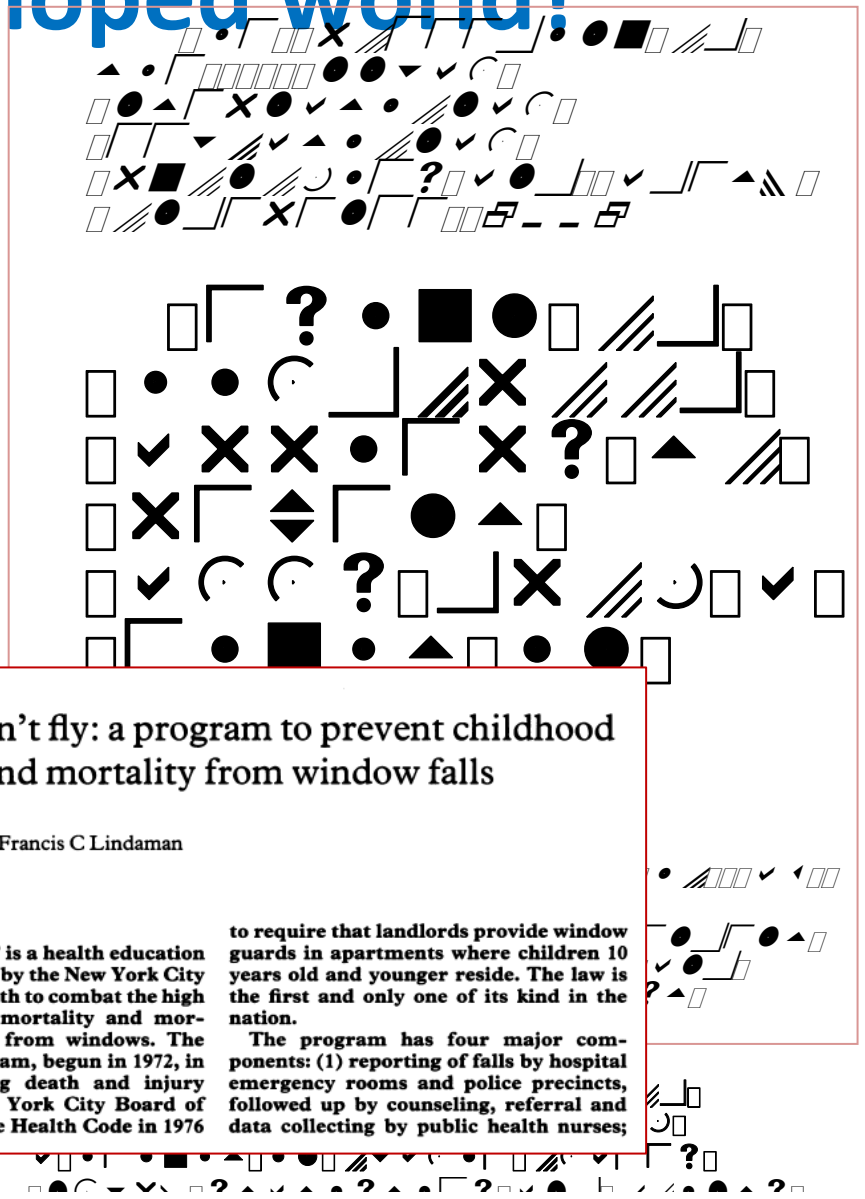


Children's Climbing Skills

R &T project to identify what products children can climb on and how they use support points while climbing these products - Part 1
November 2004

Jenny van Herrewegen – Jep design
Johan Molenbroek – Technical University Delft
Hedy Goossens – Consumer Safety Institute

commissioned by ANEC
the European Consumer Voice in Standardization



Children can't fly: a program to prevent childhood morbidity and mortality from window falls

Charlotte N Spiegel, Francis C Lindaman

Abstract
'Children Can't Fly' is a health education program developed by the New York City Department of Health to combat the high incidence of child mortality and morbidity due to falls from windows. The success of the program, begun in 1972, in drastically reducing death and injury persuaded the New York City Board of Health to amend the Health Code in 1976 to require that landlords provide window guards in apartments where children 10 years old and younger reside. The law is the first and only one of its kind in the nation.

The program has four major components: (1) reporting of falls by hospital emergency rooms and police precincts, followed up by counseling, referral and data collecting by public health nurses;

Struck by playground equipment

- A 4 year-old-child climbed outside of this equipment while three children were sitting inside and some children on the outside forcefully turned it around.
- The PGE tipped over on his abdomen causing intra-abdominal injuries and shock, leading to the child's death.

Playground Safety

- Playground
  - Fixed base
  - Energy absorbable surface (sand 30 cm deep, synthetic rubber)
  - Limited height (<180cm)
  - Fall zone (1.5 m)
  - Barriers (2/3 of height)

Safe playground

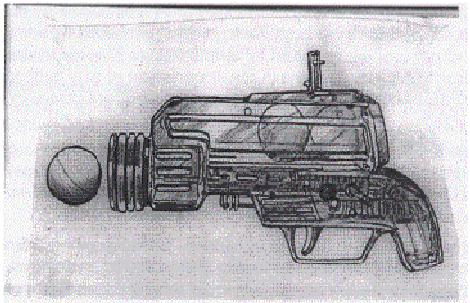
Child injury fatality review: Struck by playground equipment

- A 4 year old child climbed outside of this equipment while three children were sitting inside and some children on the outside. Seesaw fully turned it around.
- The child tripped over on his abdomen causing internal abdominal injuries and shock leading to the child's death.

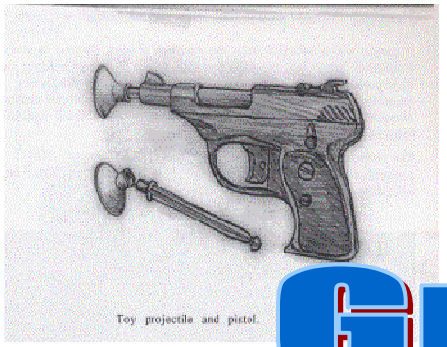
Ride-on Toys

- Ride on toys
  - >5 yrs
  - Safety equipments
  - Appropriate runway

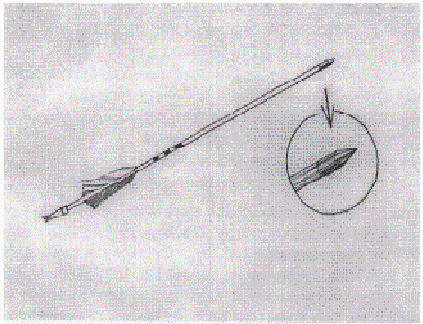
Gun toys



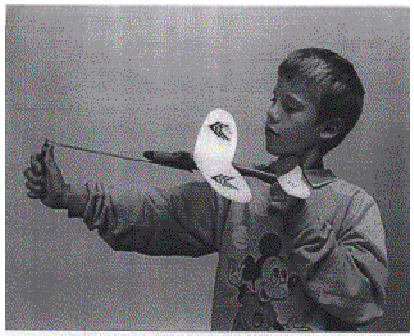
An example of a toy which fires blunt projectiles.



Toy projectile and pistol.



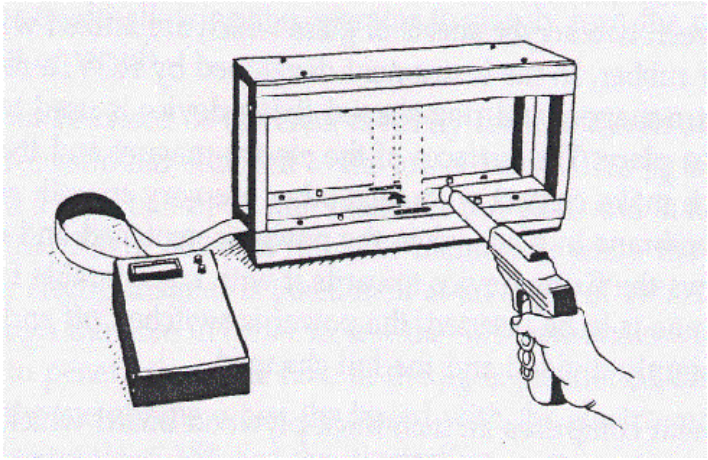
An example of a sharp projectile.



Projectile toy (catapult toy).

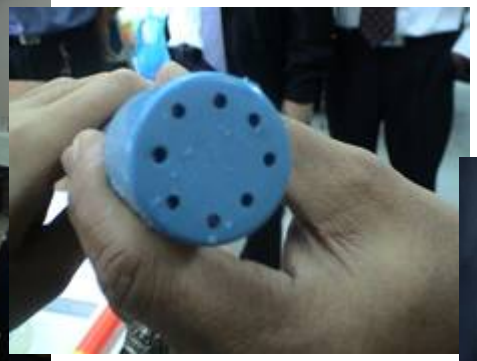
EN-standard:
the projectile's kinetic energy test

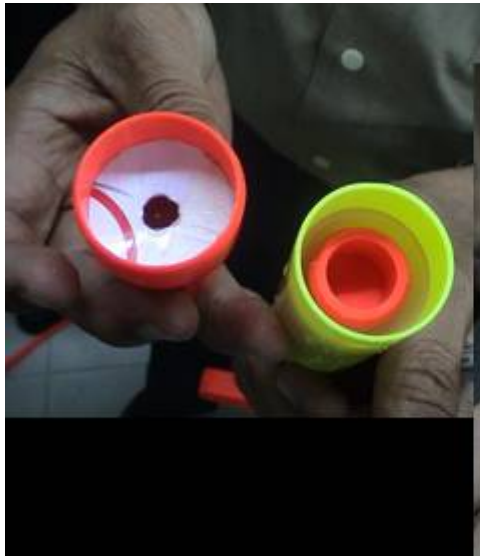
- 0.08 J for rigid projectiles without impact surface
- 0.5 J for resilient projectiles or projectiles with resilient impact surfaces.

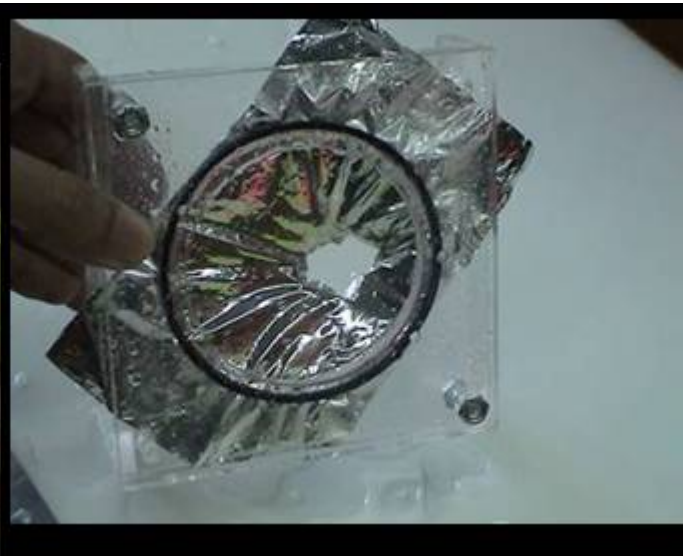


$$E\,(j) = m\,(kg)v^2\,(metres/second)\,/2$$

Water gun safety

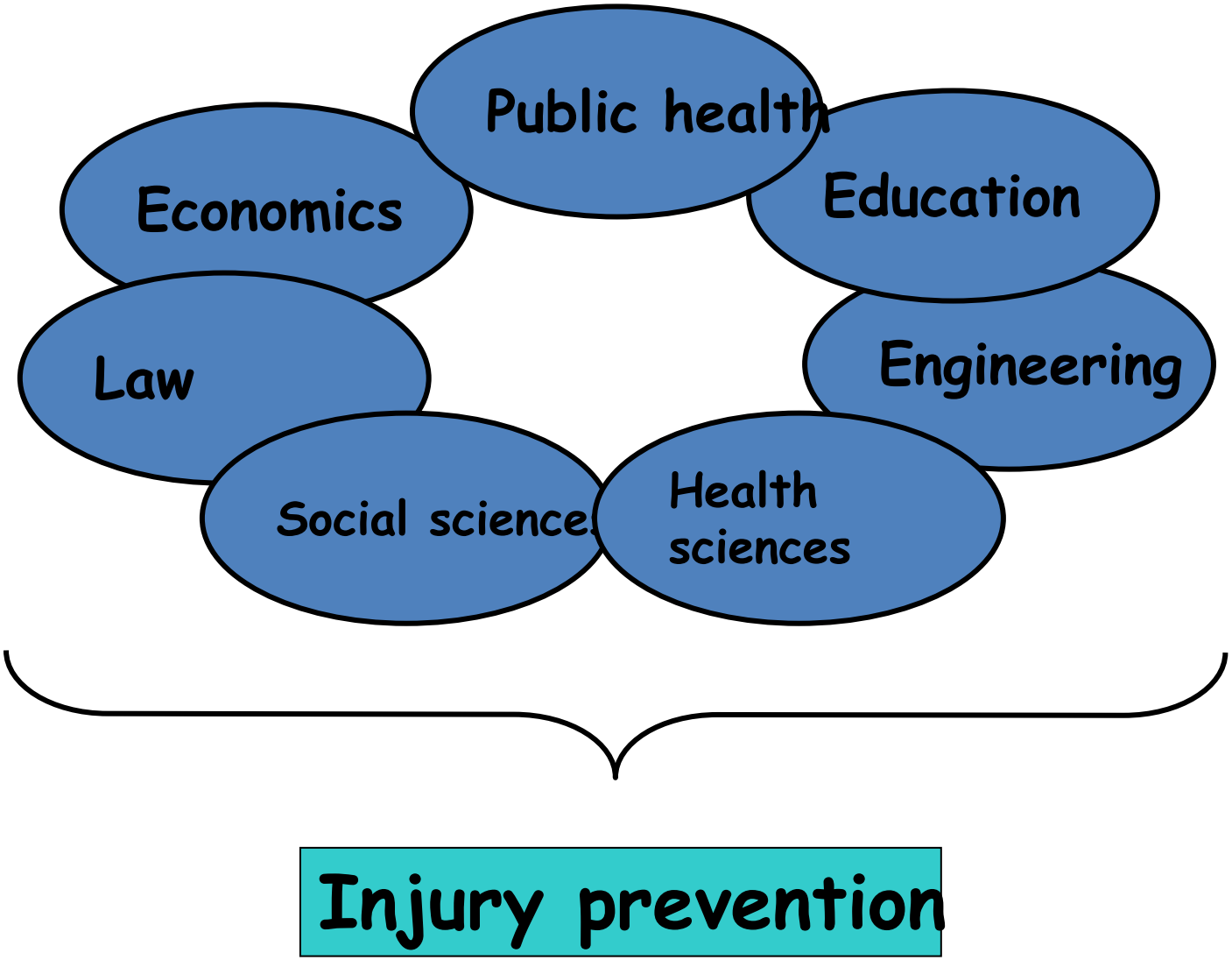






The multidisciplinary nature of injury prevention research and practice

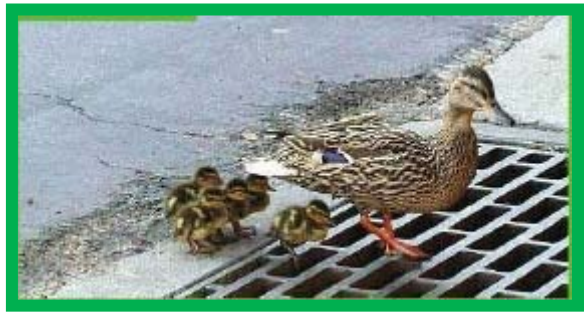
The inter-disciplinary nature of injury studies



Multidisciplinary approach

Discipline	Roles
Medicine	Data collection, trauma systems, case identification
Epidemiology	Descriptive and analytic studies, trials and evaluations
Health economics	Cost of injury, benefits/cost analysis
Social sciences	Ergonomics, behavioural studies
Political science	Policy development
Law	Legislation, compliance, legal remedies
Biomechanics	Biomechanical tolerances, mechanisms of injury
Engineering	Design and testing of countermeasures, investigation of failures

Child Right for Safe Environment



Safe City for Children??