Snow Machine / ATV / Non-Motorized Related Injury in Alaska Children Aged 1-14 Years

- Stephen S. Tower, M.D.
- Orthopedic Surgery
- Anchorage Fracture and Orthopedic Clinic
Snowmachine related mortality and morbidity in Alaska: a comparison with non-motorized winter sport.

Tower SS, Simonsen BL, Propst MT.

1990-1994 Alaskan Snowmachine related Deaths

- Mortality rate per 100,000 population 2.2
- Highest in the Nation
- Next highest Wisconsin rate of 0.3
Monthly SM and ATV Admissions 1996-7

1996-7 Totals
SM 315
ATV 243
Combined 558
Ave. year 279
Ave. Month 23

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Snow Machine / ATV Death in Alaskans

- Proportional to population.
- Equivalent to 9/11/01 every four months
Trend in snow machine related death and hospitalization in Alaska

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1993-1994 Alaskan Snowmachine related Deaths and Hospitalizations

- 13.5 deaths, 119 hospitalizations per year
- Rate of death per mile driven 8.5X that of road traffic
- Rate of hospitalization per mile driven 11.4X that of road traffic
- Median age of victims 29 years, range (10-61 years)

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Disability Related to Snow Machine / ATV Injury in Alaskan

- Proportional to population
- Equivalent to 9/11/01 every 2 days.
Children are at risk for Snowmobile/ATV related Death or Hospitalization

- Nationally of the thousands of snowmobile related injuries, 18% occur in children, 48% in adolescents of young adults.
- The American Academy of Pediatrics position statement: “Snowmobiles are inappropriate for use by children and young adolescents and should not be used by children younger than 16 years of age.”

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Any Beach in Alaska
Snow Machine / ATV related Death and Hospitalization in Alaska

- WHY ?????????????
- 7 y.o. SM Driver
- Collision Dock
- 40 MPH
# Deaths Ages 1-14 from Unintended Injury 2004-2009

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<tr>
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<tr>
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<td>109</td>
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<tr>
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<td>rate/year</td>
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# Deaths Ages 1-14 from MVA 2004-2009

<table>
<thead>
<tr>
<th>Year</th>
<th>Car</th>
<th>Airplane</th>
<th>Boat</th>
<th>PED/BIKE</th>
<th>Motorbike</th>
<th>ATV and SM</th>
<th>PED/BikeMB/ATV/SM</th>
<th>% PED/BIKE/ATV/SM</th>
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</table>

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Summary SM/ATV Death 1996-9

- 52 deaths
- 79% adult machine operators
- 19% minors (2-3 per year)
- 2% pedestrian
- Yearly rate 17
- Adjusted yearly rate 23
- SM fatalities 1999-0 season 24
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<td>Falls</td>
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<td>Assault</td>
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<td>Snow Machine</td>
<td>Sports</td>
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<td>8</td>
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<td>30</td>
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10 Leading Causes of Non-Fatal Hospitalized Injuries, Alaska Residents 2006-2010
Source: Alaska Trauma Registry, Division Public Health, Dept. Health & Social Services. Admitted to the hospital for 24 hours or greater. Occurrences less than 5 not listed. Created April 9, 2012

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1993-1994 Alaskan Snowmachine related Hospitalizations

- 38% Lower extremity fracture
- 19% TBI
- Mean ISS 7.6
SM Injury 1996-7

- 161 hospitalizations, 949 hospital days per year
- Up 36% in three years
- 19% TBI
- 2% spinal injury
**SM Injury 1991-2000 0-18 yo**

- 311 Hospitalizations (now 10 per year ages 1-14)
- 60 TBI (19%)
- About 1500 hospital days
- 52% Alaskan Native
- 64% + operating machine at time of injury
- 55% of TBI’s known not to be using helmet
- 66% of medical care publicly funded

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Ages of SM Hospitalizations 1996-7

- >18 YO: 77% (#242)
- 0-18 YO: 23% (#73)

#315 Total Admissions
33% Increase from 1993-4

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Ages of SM Hospitalizations 1996-7

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Snowmachine/ATV related Death or Hospitalization in Children

- Snowmachine/ ATV trauma is the second leading cause of death and hospitalization in Alaskan children ages 10-14.
ATV Hospitalizations 1996-7 All Ages

- 122 admissions / Year
- 937 hospital days / year
- 29% TBI
- 2% spine fracture
ATV Hospitalizations 1991-2000 0-18 yo

- 432 Hospitalizations
- About 2580 Hospital days
- 116 TBI’s (27%)
- 58% Native Alaskans
- 64%+ operating machine at time of injury
- 68% of TBI’s noted not to be using helmet
- 66% medical care publicly funded

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Ages of ATV Hospitalizations 1996-7

243 Admissions

#138
>18 YO
57%

#105
0-18 YO
43%

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Ages of ATV Kids Hospitalized 1996-7

- 12-18 YO: 58% (60 cases)
- 7-12 YO: 32% (34 cases)
- 0-6 YO: 10% (11 cases)

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Alaska Trauma Registry
2004-2010 Data

– Margaret B. Young, MPH

MCH Epidemiology Unit
Alaska Division of Public Health, Section of Women's, Children's, and Family Health

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Hospital Admissions ages 1-14 2004-2010

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Hospital Admissions ages 1-14 2004-2010

Yearly Admissions

Yearly Cranial Spinal Admissions

Combined non-motorized without Bikes

Combined Motorized

Bike

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C-spine 3 time loser
1996-7 Snowmachine related Hospitalizations:
Category of Hospitalized #322

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Mechanism of SM injury resulting in Hospitalization 1996-7 #322

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Mechanism of Injury ATV 1996-7

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Role of injured adults / minors 1996-7 Snow Machines

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SM Pedestrian (both pediatric)

- Bilateral tibial fractures
- Hepatic laceration
- Rib fractures
- Pulmonary contusion
- Clavicle fracture
SM Pedestrian (both pediatric)

- Bilateral tibial fractures
- Hepatic laceration
- Rib fractures
- Pulmonary contusion
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- Pulmonary contusion
- Clavicle fracture
17 y.o. “jumping my machine to impress my girlfriend”
17 y.o. “jumping my machine to impress my girlfriend”
SM Adult Track Injury

- Avascular Foot
- Segmental bone loss
- Soft Tissue Deficit

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SM Adult Track Injury

- Illizarov Device
- Docked bone transport
- Early bone regenerate

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**Illizarov Limb Salvage**

- Initial unilateral fixator
- Multiple debridements
- Soft tissue management with STSG
- Bone transport to manage segmental bone defects

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Went of a drop off on my snowmachine
10 hour operation 12 units blood
0-18 yo SM/ATV 1991-2000

- 75 kids hospitalized yearly (now 40 1-14 ages)
- About 400 hospital days a year
- About half at Native
- About a quarter are brain injured
- Majority of brain injured know not to be using helmet
- Two thirds of funding for medical care is publicly funded

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So What?

- Unintentional injury is the leading cause of potential year of life loss in Alaska (37.9%).
- Single most common cause of unintentional injury is motor vehicle injury (21.3%).
Dangerous compared to what?

• Snowmachine 24 months 322 hospitalizations, 1897 hospital days.
• Skiing, skating, sledding, hockey combined 130 hospitalizations, 380 hospital days, same review period.
So What?

• If a disease were killing our children at the rate unintentional injuries are, the public would be outraged and demand that the killer be stopped.

• C. Everett Koop, M.D.
Cost of ATV/SM injuries Alaska

- Death is cheap!
- Cost of initial hospitalization per year 5.9 million dollars (hospital cost only, 1897 hosp. Days, $3,140 dollar per day)
- This is a fraction of the societal cost
- 42% of the hospitalized are not insured and the cost is borne by public sources.

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Machine Factors

- Exposed mechanism
- Freeway speeds obtainable
- No operator restraint or protection
Traffic Factors:

- No traffic code
- No traffic enforcement
- Mad max scenario
- Admixed pedestrians on same trails
Terrain Factors

- Limited visibility
- Irregular surface, variable control and braking
- Remote locations of accidents
- Hostile environment
Operator Factors

- No operator training or licensure
- Full power machines operated by minors
- Intoxication
- No deterrent to unsafe machine operation
- Protective equipment variably used
Pedestrians are endangered by SM and ATV use

- A snowmachine traveling 60 MPH travels 130 feet in the reaction time of the driver. Visibility and trail width limit make these speeds much more hazardous to pedestrian traffic than in a freeway setting. Non-motorized traffic is banned from freeways.
- Off road exclusive pedestrian space is not defined.
- 5% dead and hospitalized are pedestrians

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16 y.o. pedestrian struck by SM

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SM with 14 y.o. operator strikes Pedestrian
Conclusions SM/ATV Pediatric Death and Hospitalizations

- SM/ATV should not be operated by children
- Children at risk for hospitalization and death as operators, passengers, and pedestrians.

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Conclusions SM/ATV Pediatric Death and Hospitalizations

- Helmet use should be universal
- SM/ATV traffic code and enforcement needed
- Operator age limits, education and licensure needed
- Off road motorized and non-motorized space needs definition
- ? Insurance of SM/ATV operators similar to road traffic
- Such an approach slashed SM/ATV injury rates in N.H.

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Public Education to the risk of SM/ATV operation

- 14 y.o. unsupervised boy dies after being crushed by his high power 600 lb. machine doing unsupervised aerial maneuvers.
- Mother’s comment “it was a freak accident”
AAP Position Statement on ATVs

- AAP strengthens its recommendations for passage of legislation in all states prohibiting the use of 2- and 4-wheeled off road vehicles by children younger than 16 years as well as a ban on the sale of new and used 3-wheeled ATVs, with a recall of all used 3-wheeled ATVs.

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8 y.o. full power machine no Helmet

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Helmets are at least a start
Helmet use reduces disability
Reducing TBI related to SM/ATV/BIKE in Minors

- Operator age limits and training may not be politically achievable in Alaska.
- Mandatory use of helmets in operators and passengers 16 years of age and less should be achievable.
TBI Morbidity by Age and Activity
In annual Hospital Days 1996-7
TBI Morbidity by Activity Minors 1996-7

- ATV: 47%
- Bike: 19%
- Snowgo: 34%

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Annual Hospitalizations Bike, Bike/MVA Minors 1996-7

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TBI Admissions Bike, Bike/MVA, Minors 1996-7

- Bike: 54%
- Bike/MVA: 46%

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TBI Morbidity Bike, Bike/MVA, Minors 1996-7

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Brain Injury in Alaskans

• An Overview of Cost and Consequences
National Scope of TBI

- 1 million treated and released from ER every year.
- 80,000 experience long term disabilities.
- 50,000 die as a result of TBI.
- Risk is highest among adolescents, young adults, and people over 75.
- Incidence: 96 per 100,000
National Costs of TBI

- NIH estimates cost of hospitalization at 25 billion annually.
- Brain Injury Association estimates hospitalization costs at 31.7 billion.
State Scope of TBI

- 1996-1998 1932 hospitalizations or deaths from TBI among Alaska Residents.
- Average Incidence: 105.2 per 100,000
- Approximately 10% higher than national average.
## Traumatic Brain Injuries in Alaska, 1996-98.

<table>
<thead>
<tr>
<th>Region</th>
<th>Number</th>
<th>Region</th>
<th>Rate/100,000</th>
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<td>Aleutians</td>
<td>60.8</td>
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<tr>
<td>Barrow/North Slope</td>
<td>36</td>
<td>Fairbanks North Star</td>
<td>67.4</td>
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<td>Dillingham/Bristol Bay</td>
<td>41</td>
<td>Juneau/Southeast</td>
<td>82.1</td>
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<td>Valdez-Cordova/Copper River</td>
<td>49</td>
<td>Anchorage</td>
<td>88.8</td>
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<td>Kodiak Island</td>
<td>50</td>
<td>Kenai Peninsula</td>
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<td>Kotzebue/Northwest Arctic</td>
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<td>Kodiak Island</td>
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<td>Nome/Norton Sound</td>
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<td>Matanuska-Susitna</td>
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<td>Bethel/Yukon-Kuskokwim</td>
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<td>Kotzebue/Northwest Arctic</td>
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<td>681</td>
<td>Interior</td>
<td>277.1</td>
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<td><strong>Total</strong></td>
<td><strong>1932</strong></td>
<td><strong>Average</strong></td>
<td><strong>105.2</strong></td>
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Figure 1. Rate of Traumatic Brain Injuries* in Alaska by Age and Gender, 1996-1998

* Includes hospital admissions and out-of-hospital

N=1932
Figure 2. Rate of Traumatic Brain Injuries* in Alaska by Race/Ethnicity, 1996-1998

* Includes hospital admissions and out-of-hospital deaths.
Definition of Costs

- Direct Costs
- Indirect Costs
Direct Costs

• Hospital Charges and Professional Fees for Acute Care.
• Pre-hospital (EMS, Emergency Room, Medivac)
• Rehospitalization
• Rehabilitation
• Outpatient Medical Care
• Attendant Care
• Special Education
## Correlation Between Direct Costs and Injury Severity (GCS)

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<tr>
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<th>Severe</th>
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<td>$12,022</td>
<td>$53,332</td>
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</table>

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Direct Costs Represent Only 12% of Overall Lifetime Costs.
Indirect Costs

- Reduced Economic Output
- Caregiver Burden
- Mortality Costs
Productivity Losses

• Only 8% of TBI survivors are able to return to the job they previously held within 6 months of sustaining a TBI.
Caregiver Burden

- 80% of adults with TBI cannot be left unattended.
- 33% of caregivers stop working because of caregiving responsibilities.
- 75% of people with TBI are male.
- 75% of caregivers are women.
# Injury Severity, Cost, and Incidence (1997-8)

<table>
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<tr>
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<td>Cost per Patient</td>
<td>859</td>
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<td>8,655</td>
<td>14,248</td>
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<td>179,454</td>
<td>294,270</td>
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Helmet Effectiveness

- Helmets reduce the risk of TBI by 88%.
Admissions 2006-10 Ages 1-14 Helmet Use %

- Snow Machine
- ATV

Legend:
- Not Noted
- Helmeted
- Not Helmeted

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Admissions 2006-10 Ages 1-14 Helmet Use

- Not noted
- Helmet
- Not Helmeted

Snow Machine  ATV

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Reduction in Costs

• Total anticipated savings in hospital costs alone if all children age 0-16 were to have worn helmets in 1997-8: $729,575
# Who Pays?

<table>
<thead>
<tr>
<th>PAYER</th>
<th>% Patients</th>
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<tr>
<td>Private</td>
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<td>Patient Self Pay</td>
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<tr>
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<tr>
<td>Other</td>
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</tbody>
</table>
Helmets

• Cost Effective?
Norwegian Case Study

• For children age 4-16, incidence of TBI from bicycle related injuries requiring hospitalization is approximately 100 per 100,000
• 1 year cumulative risk = .001
• 5 year cumulative risk = .005
Absolute Reduction in Risk

- \(0.005 \times 0.88 = 0.0044\)

- 0.0044 is the reduction in risk of TBI for one child over a five year span due to helmet use. (ARR)

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Number Needed to Treat

• The reciprocal of the AAR yields the Number Needed to Treat (NNT)

• \( \frac{1}{ARR} = \text{NNT} \)

• NNT: Number of children who need to wear helmets for 5 years to prevent one injury.

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NNT

- \( \frac{1}{.0044} = 272 \)
Cost of Prevention

• \( (NNT)(\text{individual cost of prevention}) = \text{Total cost of preventing one injury} \)

• \( (272 \text{ children}) (\$20) = \$5440 \) to prevent one injury.
Prevent or Pay

- Cost of Prevention = $5440
- Average Hospital Charge = $6,311
What’s the Point?

- TBI is very expensive to Alaskans.
- TBI erodes the health, wealth, and happiness of families and communities.
- TBI is 88% preventable by using a helmet.
Let’s Have Helmet Legislation for Children

• It’s a no brainer.
Helmets

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Questions, References

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