

Risk Taking, Injury, & Substance Abuse:

Data Regarding Safety and Management of the Child & Adolescent with ADHD

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Overview

- What about ADHD predisposes child to injury or safety concerns
- Injury in the ADHD population
 - Are there injury prone children?
 - How do ADHD children process hazards and risks?
 - Burns
 - Pedestrian, Traffic and other Accidental Injury in the ADHD population
 - Injury prevention

Overview, cont.

■ ADHD and Driving

- Does ADHD pose a risk to the young driver?
- Research on stimulant medication and driving.

■ Abuse of Psychostimulant Medication

- Does stimulant medication tx set the stage for later substance abuse?
- What is the abuse potential of stimulant medication?

“Executive Functions”

- self-regulation
- maintaining set / persistence
- vigilant attention
- cognitive flexibility
- selective inhibitory responding
- selecting goals
- planning and organizing behavior to fulfill goals
- decision making
- working memory

Development of EFs: **3 Levels of Skill Maturation**

■ **Age 6 years**

- simple planning
- organized visual searching

■ **Age 10 years**

- set maintenance
- hypothesis testing
- impulse control

■ **Adolescence**

- complex planning
- motor sequencing
- verbal fluency

■ **Maturation of EF skills...mid 20's.**

Process Approach to Studying Injury in Childhood Farmer (1995)

- Injury in children “reflect(s) a complex series of interactions between the child and the environment
- What factors may be involved in why the ADHD child is injured?

Possible Injury Factors

- overactive
- inattentive
- easily excitable
- impulsive
- low frustration tolerance
- oppositional, defiant, or aggressive behav.
- information processing deficits
- perceptual search strategies inefficient
- difficulty modulating arousal level to meet situational demands
- difficulty generating solutions to complex problems
- respond to most immediate and salient environmental contingencies instead of cognitive appraisal
- poor rule governed behavior

Studying Injury: methodological limitations:

- Type of injury surveyed varied
- How we measure the injury variable
- Do studies consider all variables so interactions can be determined-
(environment, psychosocial, behavioral)
- May not control for exposure
(environmental)
- Prospective vs retrospective studies

“Accidental” Injury in the ADHD Population

- Are There Injury Prone Children?
- Process Approach to ADHD kids and injury

Wazana (1997): Analysis of General Child Injury Studies

- Canadian study included 11 studies which utilized control group design
- 1985-1995
- general child injury studies examined child proneness factor (not solely ADHD population)
- Concluded that there were *risk factors for injury: both child factors as well as environmental factors.*

Are there injury prone children?, cont. (Wazana)

- Consistent Risk Factor: Aggression
(increased risk= 1.6 to 2.4 X more likely)
- Inconsistent Risk Factors
 - Extroversion, exploring, daring
 - Decreased ability to cope with hazards
(impulsive, careless, unreliable, disobedient, competitive)
 - Hyperactivity was not a consistent factor
 - Possible temperament after age 3

Process approach to ADHD and injury Farmer et. al. (1985)

- How well do ADHD kids “recognize hazards, evaluate risk, and define preventive strategies”?
- 30 boys ages 7-11 years with moderate to severe ADHD
- Active minded control group
- Two part video tape series

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- Part 1 10 min. tape of a kid walking home. Embedded in the tape were 5 risky situations
 - click mouse if the child in the movie should stop and change what they are doing, and hold down the button until everything is OK again.
 - Part 2: Questions and ratings about child's perception and own experience

Farmer (1985) conclusion

- “cognitions of boys with ADHD may play a more central role in determining relative risk of injury than hazard identification does. [They had] lower expectations for negative consequences...decreased rule-governed behavior...Thus, when confronted with a hazardous situation, children with ADHD may be less likely to accurately estimate their own personal risk and less likely to implement an effective prevention strategy.” (p. 330)

- Both groups equally identified/responded to hazards
- ADHD group showed
 - less concern about hazards
 - reported a somewhat higher likelihood of engaging in risky behavior
 - reported less distress about getting hurt
 - anticipated less severe medical consequences
 - generated fewer means to prevent injury
- Non-ADHD group reported
 - more alternate “safe behaviors”
 - more rules of what to do or not do
 - more frequently reported changes which could be done in the environment to increase safety

Burns and the ADHD population (Mangus et al. 2004)

- 7 year review (1995-2001) of burn registry of a regional pediatric burn center
- children 5-18 years

Mangus et al (2004) cont.

- overall rate of ADHD in burn population exceeds general population (13% vs. 5%)
- most children had concurrent ODD or conduct disorder
- males exceeded females
- ADHD more likely than non-ADHD to have thermal or caustic burns (kitchen/ bath) than flame related injury (e.g. matches, fires)
- ADHD kids less likely to be discharged home (instead to foster care)

Mangus et al (2004), cont.

- authors wondered if parents knew to protect ADHD kids from matches and flames but were less vigilant re: stovetops, hot water and grease
- felt burns related to impulsivity and vigilance deficits

Pediatric Burns: Badger et al. 2008

- Records review of 1025 thermal burn pts.
 - Of those who qualified:
 - 44 were then identified as ADHD (4.3 of sample)
 - 59 non-ADHD
- 36% of ADHD kids (vs. 10% of control group) had documented histories of playing with fire or were doing so at the time of their injury
- 73% of ADHD kids on meds at time of injury
- ADHD group had
 - more comorbid mental health difficulties
 - greater occurrence of school behavior problems
 - greater history of fire experimentation

Injury in the ADHD Population (DiScala et. al. 1998)

- Review of National Pediatric Trauma Registry
- Subjects:
 - ADHD noted in history (n=240)
 - Injury controls with no preexisting medical condition
 - Ages 5-14

Injury in the ADHD Population (DiScala et. al. 1998)

- ADHD group was 1% of total injury group
- ADHD group had
 - more self-inflicted injuries (10X)
 - 60% due to means of transportation
 - More frequently injured on the road
 - 50% more frequent bicycle/pedestrian injuries
- Injury controls
 - more assaultive injuries
 - More frequent injuries at school

Injury in the ADHD Population (DiScala et. al. 1998)

- ADHD group :
 - more multiple body region injuries and more head injuries
 - injured more severely using measures such as GCS
 - length of hospital stay a little longer but not sig.
 - 50% higher ICU admission
 - no difference in surgical intervention
 - more likely to develop functional limitations and had a much higher rate of # of limitations
 - 2X more likely to be discharged to rehab or extended care facility

Pedestrian Injury in Children (Wazana, 1997)

- Review of 6 studies
- Not correlated with pedestrian injury:
 - aggression
 - internalizing and externalizing disorders
 - Objective experimental hyperactivity measures / questionnaires
- Correlated with injury:
 - lack of caution and preventive behavior
 - precocious physical development.
 - general measures of behavior problems
 - most sig. risk factor was traffic volume

Traffic Injuries: Pedestrian & Cyclist (Pless et al. 1995)

- Compared two groups of ER referrals 5-15 years of age:
 - 286 Pedestrian (n=172) & Bicyclist (n=114) injuries
 - 562 injuries sustained due to a factor where there child's behavior was not a factor (MVA, sport, fall)

Traffic Injuries: Pedestrian & Cyclist (Pless et al. 1995)

- Ped/Bike group was:
 - Significantly less attentive and more impulsive on neuropsych. measures
 - Higher Parent and Teacher Hyperactivity Index
 - Teacher's rated as more inattentive

Do all researchers agree?

- ***Conduct problems*** and not *hyperactivity* were related to injury. (Davidson, 1987)
 - “Skillful parenting” as mediator (Davidson et al. 1992)
- Correlation childhood ***oppositonality*** with injury and not *hyperactivity*. (Jaquess & Finney, 1994)
- ADHD a risk factor only if comorbid with ***Oppositional Defiant D/O*** (Ford et al., 1999)
- Comorbid ***motor coordination*** issues in adolescents (Brehaut et al., 2003)

Non-U.S. Populations

- Brook & Boaz (2006) Israel
 - 108 10th – 12th graders mixed ADHD/LD, 87 controls
 - Retrospective history
 - 2X risk for accidents in ADHD/LD
 - Increased risk in all accident categories
 - Mean age of accident 11.1 ± 3.4 yrs.
- Sabuncouglu (2007) Turkey
 - Dental Trauma prevalence 10-25% in childhood
 - Significantly higher rate in ADHD children

Special populations: Epilepsy

- cognitively normal children with epilepsy and matched controls
- age 5-16 , n=25
- Seizure diagnosis did not predict injury
- However, ADHD groups - both normals and seizure- did have a higher risk of injury
- Recommendation: other than water and height cautions, safety restrictions should resemble those of the non-epileptic population

Injury across the lifespan

- **Preschoolers**: Byrne et al. (2003)
 - association between IBC risk status and both the ADHD group status and a variety of measures of attention and hyperactivity and impulsivity
 - ADHD group rated by parents as showing more risky behavior - 58.3% vs. 0 %

Preschoolers, cont.

- No correlation between study variables and presentation at a hospital for treatment of a significant injury
- Don't know if there would have been a correlation with milder injuries which did not require medical attention
- Could be that an important variable is oppositional / conduct disorder behavior (group excluded from study)

Lessons & Recommendations from the Literature: Prevention

- target risk factors which are both important and modifiable
- countries which have deliberately modified environments resulting in lowest pedestrian rates and largest decrease in pedestrian accident mortality
- importance of community involvement to engineer and legislate interventions such as play areas, safe walkways, traffic calming measures

Lessons & Recommendations from the Literature: Prevention

- parents be advised of children's extra need for supervision
- reduce exposure (safe route to and from school, safe play area separate from driveway and street)
- counsel caregivers re: vigilance of behavior in traffic
- use of helmets

Lessons & Recommendations from the Literature: Prevention

- safety skills training with behavioral role playing
- increasing the salience of negative consequences for risky behavior
- screen for preexisting conditions in injury cases
- add information to driver's ed (children are incapable of obeying the rules at all times)

ADHD Teens and Driving

- Psychiatric literature historically noted 1-6 fold increase in MVA in psych pop.
- Highest incidence noted in conduct , substance abuse, and antisocial disorder populations
- Early ADHD studies: Hechtman (1981)

ADHD and Driving: Barkley et al. (1993)

- Design:
 - 3-5 yr follow-up of pts in large study
 - Mean age 19.1 ± 1.7
 - ADHD $n=44$, controls $n=37$
 - Self and parent report measures

Barkley et al. (1993)

ADHD Driving Study Results

ADHD group was...

- equal to control group in number of subjects with at least one crash but:
- 4 X more total number MVA's
- 7 X more likely to have repeat crashes
- higher freq of being at fault in the crash
- non-sig. trend toward more crash injuries
- 3 X more likely to have driven without a license (and 9 times more often)

Barkley et al. (1993)

ADHD Driving Study Results

- 23% had history of revoked or suspended driver's licenses (vs. 0% in control group)
- 2 X more likely to have received traffic citations
- 2 X more likely to have speeding tickets
- 4 X more likely to be cited for failure to stop
- 3 X more likely to have repeated traffic citations

Barkley et al. (1993)

ADHD Driving Study Results

- Rated significantly lower on standardized parent driving scale
 - 40% of ADHD parents rated child as impaired
- Amount of time spent driving with parent was unrelated to the parent's assessment
- Trend toward increased DUI's
- ODD and CD accounted for a good amount of variance in driving skill ratings

Barkley et al. (1993)

Recommendations

- Increased driver training
- Increased monitoring of driving
- Decrease availability of car for "joyriding"
- "More serious cases" be considered for treatment with stimulant meds for driving

Barkley et al. (1996)

- Formally evaluated driving knowledge and actual driving performance
- ADHD young adults (mean age 22.5 ± 4.0) and 23 controls off meds with assessment of :
 - self report and DMV record
 - parent report
 - software based driving console
 - video tape of "high pressure real world driving situations"

Barkley et al. (1996) Driving knowledge and performance:

- Similar self-report of driving risks as 1993
 - 4 X more crash injuries in ADHD group
- ADHD group knew what to do: No group differences in:
 - driving knowledge
 - operations procedures
 - actions to take in a high risk situation
- ADHD group performed worse in applications of knowledge:
 - more crashes and scrapes on easier trials
 - poorer steering control in simulated driving

RECOMMENDATIONS (Barkley, 1996)

- focus on altering “the motivation and self-discipline of individuals to engage in those behaviors which are beneficial for them”
 - motivate self regulation
 - doubt driver refresher courses successful
 - increase “likelihood of detections and punishment for poor driving performance”
- **“Given that stimulant drugs enhance the motor control and self-regulation of those with ADHD, such medications might also serve to reduce the driving risks associated with ADHD”**

Closer Look at EF & ADHD

Driving Outcomes (Barkley2002)

- 17-28 year old ADHD (n=105) and Controls (n=64)
- Similar measures as before with
 - NP testing of executive functions
 - Cognitive behavioral driving inventory

EF & ADHD Driving Outcomes Results: (Barkley2002)

- Again replicated adverse outcomes
- ADHD group
 - Worse attention on CPT
 - Difficulties with rule-governed behavior and poorer visual scanning
 - equivalent knowledge in perceptual skills, traffic risk situations, driving procedures, no more scrapes and crashes in simulated driving
 - worse general driving knowledge (rules of the road, laws)
- Found that lab measures did not predict well actual driving (variance under 5%)

EF & ADHD Driving Outcomes

Conclusions: (Barkley2002)

- “If the prediction of driving risks in an ADHD population is the goal, then the severity of ADHD symptoms alone may be the most powerful evidence available. The addition of a comprehensive driving assessment comprised of the measures used here would add very little predictive power”. (Barkley, 2002, pp. 670)
- the intervention which holds the best promise is stimulant medication

Potential Mediator Variables

(Thompson et al. 2007)

- Alcohol and impaired driving
- Conduct problems/ disorder
- Lack of resolution of ADHD symptoms by adulthood
- Emotional undercontrol (irritability)

Potential Mediator Variables

(Thompson et al. 2007)

- Update to Barkley
- Larger sample, not self referred pts
- More tickets, accidents, and driving without a license in ADHD group.
- But effect size more modest
- Mediator variables positive for
 - Sxs of hyperactivity and impulsivity by parent and subject explained some variance.
 - Conduct

Driving anger in ADHD college students

Richards, Deffenbacher and Rosen (2002)

- 59 ADHD college students divided into high and low ADHD Sx's
- High ADHD group
 - more driving anger
 - expressed anger in more hostile/aggressive ways
 - More aggressive/risky behaviors on the road
 - more freq. display of anger in a socially unacceptable way

Driving anger in ADHD college students

Richards, Deffenbacher and Rosen (2002)

- Related findings to Barkley's theory of ADHD:
 - "the primary difficulty for ADHD individuals addresses response inhibition, which secondarily leads to difficulties in other areas such as affect regulation" (p. 35)
 - Suggests: teach driver anger management with cognitive coping skills and relaxation training

Is Conduct Disorder/ ODD the key variable?

■ Nada-Raja et al. (1997)

- Males: Driving offenses assoc with conduct disorder, ODD
- Females: Driving offences assoc. with ADHD

■ Woodward et al. (2000)

- After covaried for confounding factors, reduced driving risks or outcomes
- ADHD remained a good predictor of:
 - MVA causing injury
 - driving without a driver's license
 - general traffic violations

Stimulant Medication and Driving

- Weiss et al. (1979)
 - More MVA's in untreated ADHD adults
- Cox et al. (2000)
 - 7 ADHD, 6 non-ADHD adults
 - Trials on sensitive driving stimulator
 - Placebo
 - Methylphenidate 10mg.
 - Clear improvement on MPH –ADHD approached normals

Stimulant Medication and Driving

- RECOMMENDATIONS -Cox et al (2000): although short acting methylphenidate was used in the study, the authors indicated that its short half life was a limitation, and suggested that longer acting stimulants “might be the medication of choice for active drivers” (p. 234).

Barkley RA and Cox, D. (2007). A review of driving risks and impairments associated with attention-deficit/ hyperactivity disorder and the effects of stimulant medication on driving performance.

Journal of Safety Research, 38, 113-128.

- Multiple studies with virtual reality simulator or on-road test show improved performance with MPH with respect to errors in attention – less for impulsive driving errors.
- No other treatments to date consistently demonstrate improvement in MVA operation.

Substance Abuse issues: An introduction

- Those related to psychostimulant medications
 - Medication diversion
 - Prescription misuse
- Those related to overall substance abuse

Abuse of Psychostimulants

- Incidence of substance abuse in the ADHD population
 - 15-25% substance abusers dx ADHD
 - Of ADHD pts, 52% lifetime rate SA
 - Equivalent SA in ADHD/ non-ADHD teens
 - ADHD adults begin SA earlier, proceed faster
 - Highest risk: Conduct D/O, ODD

Abuse Potential of Psycho- stimulants: Myth or Reality

- Volkow et al., 2003
 - Similar psychoactive properties to cocaine
 - Abuse potential decreased by
 - oral MPH slow uptake
 - Slow rate of clearance
- Kollings, 2003
 - “extended-release forms of methylphenidate have even lower potential for abuse than traditional formulations” (p. 16)

Incidence of Abuse/ Misuse Psychostimulants

- Maryland Poison Center study
(Klein-Schwartz and McGrath 2003)
- MPH use in undergraduates
(Teter et al. 2003)
- Wisconsin survey of ADHD children and
educators (Musser et al., 1998)
- Kollins et al 2001:
 - "MPH misuse is not as alarming when base
rates for prescriptions are considered" (p 627)

Does stimulant medication reduce risk for later SA?

- Wilens et al. 2003 Meta-analytic review of literature on ADHD/SA:
 - Long term studies, prospective or retrospective
 - Treated and non-treated ADHD pts. Compared on substance abuse outcome
 - 6 studies – minimum follow-up of 4 yrs
 - 674 medicated, 360 unmedicated pts.

Wilens et al. 2003 Meta-analytic review of ADHD/SA:

RESULTS:

- “Compelling evidence” that treatment with stimulants has a protective effect for both drug and alcohol abuse
- effect noted in every study where treated and non-treated ADHD groups were balanced for severity of symptoms.

Studies subsequent to Wilens (2003)

- Barkley et al. (2003)
- 13 year prospective study of 147 ADHD children surveyed at 15 and 21 years of age
- Stimulant medication treatment was not associated with adolescent or adult *experimentation*, use, or abuse of drugs

Why the protective effect of stimulant medication?

- Reduction in demoralization, low self-esteem, academic failures assoc. w/ tx
- might indirectly reduce rate conduct dx
- Families who seek stimulant medication may be different - perhaps more intact, higher SES, more involved or invested in their children
- Close monitoring of children on stimulants
- No need to self-medicate

Where do we go from here?

- Support community injury preventions
- Firearms in home
- Support treatment which addresses conduct disorders and ODD
- Advocate for bike helmets on all wheeled vehicles.
- Car restraints and booster seats
- Foster appropriate parental supervision
 - Evaluate child's developmental age:
 - Supervision needed for child
 - Staying home alone

■ Driving issues

- When to seek license
- Seat belts
- Training and post license supervision
- Instruct parents regarding risks
- Medication treatment
- AD/HD & Driving: A Guide for Parents of Teens with AD/HD by J. Marlene Snyder, Ph.D. (2001)
- Driver-Zed Video game (AAA)

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- Who's in charge of the medication?
 - Careful consideration of when stimulant medication usage is needed: when, long acting
 - Medication considerations:
 - Patches, prodrugs, and non-stimulants
 - Discuss with parents research on protective effects and differential medication goals
 - Instruct children and teens:
 - About medication sharing
 - About potential misuse effects

Thank you!

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