



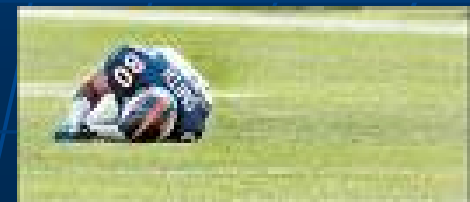
The New Hampshire High School Sports Concussion Management Project

NH Sports Concussion Advisory Council

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The problem of concussion in sports

- Far greater recognition
- Multiple-concussion increases disability, time lost, etc.
- New management strategies
 - Based on current research & consensus conferences
 - Don't work if not used properly
 - Require resources
 - ATC, NP, costs & time



Older approaches of limited value

- Grading scales were an improvement over nothing and allowed for research to begin
- Obtaining baseline data is very useful
 - Cognitive testing
 - Balance testing & other new approaches
 - More objective than symptom report

In 2008, 5 of 7 football deaths
due to head injury

- American Football Coaches
Association Annual Study of Football
Injury Research

Ohio Study

- 40.5% of concussed athletes were returned to play too soon (following old guidelines)
- 16% of fb players reported returning to play the same day they lost consciousness
- Only 42% of high schools have athletic trainer

Majority of concussions resolve

in 7-14 days with rest, with no subsequent problem

“simple concussions”

- The issue is knowing which concussion is resolved and which isn't;
- Premature return is dangerous...

How to sort it out?

National & International Concern

- CDC Head's Up program
- 3rd International Consensus Conference at Zurich 2008
 - Definition of concussion
 - Evaluation standards
 - Other methods (MRI, balance, NP, etc)
 - Management

Zurich 2008 Definition of concussion

- did not differentiate concussion from mTBI
- *a complex pathophysiological process*
- *several common features that may be utilized in defining the nature of a concussive head injury include:*

Concussion, cont.

1. Concussion may be caused either by direct blow “impulsive” force transmitted to the head (e.g., whiplash).
2. Concussion typically results in rapid onset of short lived impairment of neurologic function that resolves spontaneously.
3. Concussion may result in neuropathological changes; acute symptoms reflect a functional disturbance rather than a structural injury.
4. Concussion results in graded set of clinical symptoms that may or may not involve loss of consciousness.
5. No abnormality on standard structural neuroimaging studies is seen in concussion.

Evaluation needs to include...

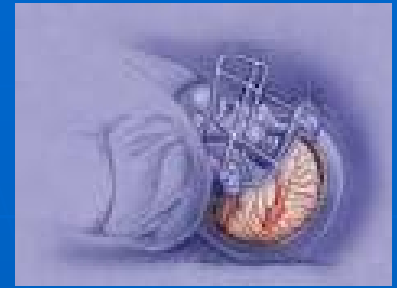
Signs & symptoms

- (a) Symptoms—somatic (e.g. headache), cognitive (e.g. feeling like in a fog) and/or emotional symptoms (e.g. lability);
 - (b) Physical signs (e.g. loss of consciousness, amnesia);
 - (c) Behavioral changes (e.g. irritability);
 - (d) Cognitive impairment (e.g. slowed reaction times);
 - (e) Sleep disturbance (e.g. drowsiness).
- If any one or more of these components is present, a concussion should be suspected and the appropriate management strategy instituted.

Baseline neuropsychological (cognitive) testing suggested, not required

- Cognitive tests & symptom presentation overlap
 - BUT test scores appear to be more sensitive to recovery
- NP tests should be administered, supervised & interpreted by appropriately trained neuropsychologists

Sideline Assessment



- Cognitive testing is essential and should be done on the sideline
 - Orientation questions are not sensitive or reliable for sideline identification
 - Brief neuropsychological tests such as SCAT-2 or Maddox questions;
 - These are not to be used for ongoing management

- Symptoms (and diagnosis) may not emerge for several hours

Management & Return to Play Protocols

- Cognitive & physical rest is recommended
 - Use of serial assessment
 - Symptoms & test scores return to baseline
- Graded exertion protocol before RTP
- Special populations:
children/adolescence

Graded exertion protocol

Graduated return to play protocol.

Rehabilitation stage	Functional exercise at each stage of rehabilitation	Objective of each stage
1. No activity	Complete physical and cognitive rest	Recovery
2. Light aerobic exercise	Walking, swimming or stationary cycling keeping intensity <70% MPHR No resistance training.	Increase HR
3. Sport-specific exercise	Skating drills in ice hockey, running drills in soccer. No head impact activities	Add movement
4. Non-contact training drills	Progression to more complex training drills, e.g. passing drills in football and ice hockey May start progressive resistance training)	Exercise, coordination, and cognitive load
5. Full contact practice	Following medical clearance participate in normal training activities	Restore confidence and assess functional skills by coaching staff
6. Return to play	Normal game play	

Special Considerations for Youth

- Completely symptom free before RTP;
- May need to limit scholastic activities
 - School attendance may need to be modified;
- Importance of neuropsychologists to interpret results;
- A more conservative return to play approach is recommended;
- It is not appropriate for a child or adolescent athlete with concussion to RTP on the same day as the injury regardless of the level of athletic performance.

Local Issues

- Too many athletes being seen with repeat concussions
- New programs not always utilized effectively
- Agreement that this is important, but what to do?
 - Limited resources, knowledge, etc.

New Hampshire's response: Sport Concussion Advisory Council

- NHSCAC began with a collaboration of individuals & organizations:
 - the Brain Injury Assoc. of NH
 - NH Department of Health & Human Service Bureau of Developmental Services
 - Dartmouth Dept. of Psychiatry – Neuropsychology & Sport Concussion Program
- Added several more...
- (Note: several schools have begun implementing management protocols).

Participating Organizations

- Brain Injury Association of NH
- Children's Hospital at Dartmouth Injury Prevention Program
- Dartmouth Neuropsychiatry Brain Imaging Group
- Dartmouth Traumatic Brain Injury Program
- New Hampshire Athletic Directors Association
- New Hampshire Musculoskeletal Institute
- New Hampshire Athletic Trainers Association
- New Hampshire Department of Health & Human Service Bureau of Developmental Serv.
- New Hampshire Department of Health & Human Services, Injury Prevention Program
- New Hampshire Emergency Nurses Association
- New Hampshire Interscholastic Athletic Association, Sports Medicine Committee
- New Hampshire Pediatric Society
- New Hampshire Department of Education
- New Hampshire School Learning Incentives
- New Hampshire School Nurses Association
- Northern New England Neurological Society
- Emergency Physicians Assoc.
- New Hampshire Association of School Psychologists

NH-SCAC Mission

- Mission: Improve concussion-related safety of young athletes in NH
- Support best practice in
 - concussion prevention,
 - education,
 - screening and
 - clinical management
- Goal: establish state-wide standards

Objectives:

- Adopt a statewide “consensus statement” that defines concussion and outlines the issues involved in managing return-to-play and return-to-school decisions for youth athletes.
- Review “best practices” in concussion prevention, education and clinical management.
- Recommend/test/implement a model concussion screening & management protocol utilizing “best practice” in neuropsychological assessment that can readily be adapted and utilized by local schools
- Test/implement a “model” education and outreach effort for parents, youth athletes, coaches and physicians.

Council Management

- BIANH: Coordinating agency
- Steve Wade, Project Director
- Art Maerlender, Chair
- Laura Decoster, Vice chair
- Committees-chairs
 - Statewide Consensus: Laura Decoster
 - Concussion management protocol: Art Maerlender
 - Return to school issues: Laura Flashman
 - Education, outreach, funding: Steve Wade

Two broad phases

Phase I

- Year 1:
- Provide education to constituent groups
 - Parents, coaches, PCP's ATC's athletes, school personnel, etc.
- Develop consensus; obtain acceptance
- Implement pilot project to demonstrate management protocol
- Advocate and support best practices

Phase II

(years 2-3)

- Continue education activities
- Seek continued funding
- Fine-tune management protocols
- Expand pilot project
 - 5+ additional high schools
 - Consider middle schools
- Develop capacity
 - ATC's
 - neuropsychologists

Development of NH Consensus Statement

- Patterned after newest international standards for concussion management
- Recommended by recent consensus statement
 - (McCrory et al. "Consensus statement on Concussion in Sport—The 3rd International Conference on Concussion in Sport held in Zurich, November 2008. Journal of Science and Medicine in Sports. 2009)
 - Follows from Vienna and Prague conferences
 - NATA statement in agreement
 - Replaces previous grading scales and protocols

NHSCAC pilot project

- Provide resources to implement management protocol;
- To support best-practices;
- Demonstrate feasibility;
- Establish best-practice standard.

Pilot Project

- Selecting 5 high schools in each of 2 years
- 3 year commitment
- Education, tests & neuropsych consulting
 - must have ATC
 - Support from NP
- Will assess feasibility & success
- Starting fall 2009

Management Protocol



- Education
- Baseline testing
- On-field identification
- Post-injury management/assessment
 - Neuro
 - Balance
 - Symptoms
 - CNP follow-up/communication
- School accommodations if necessary
- Graded exertion to sport-specific activity
- RTP



Moderate to Severe Injuries

- When there is loss of consciousness (>15 sec.), frank amnesia, or any other significant signs/symptoms on the field, athletes will be removed to emergency room for immediate medical evaluation.
 - Protocol has specific criteria

Baseline Screening

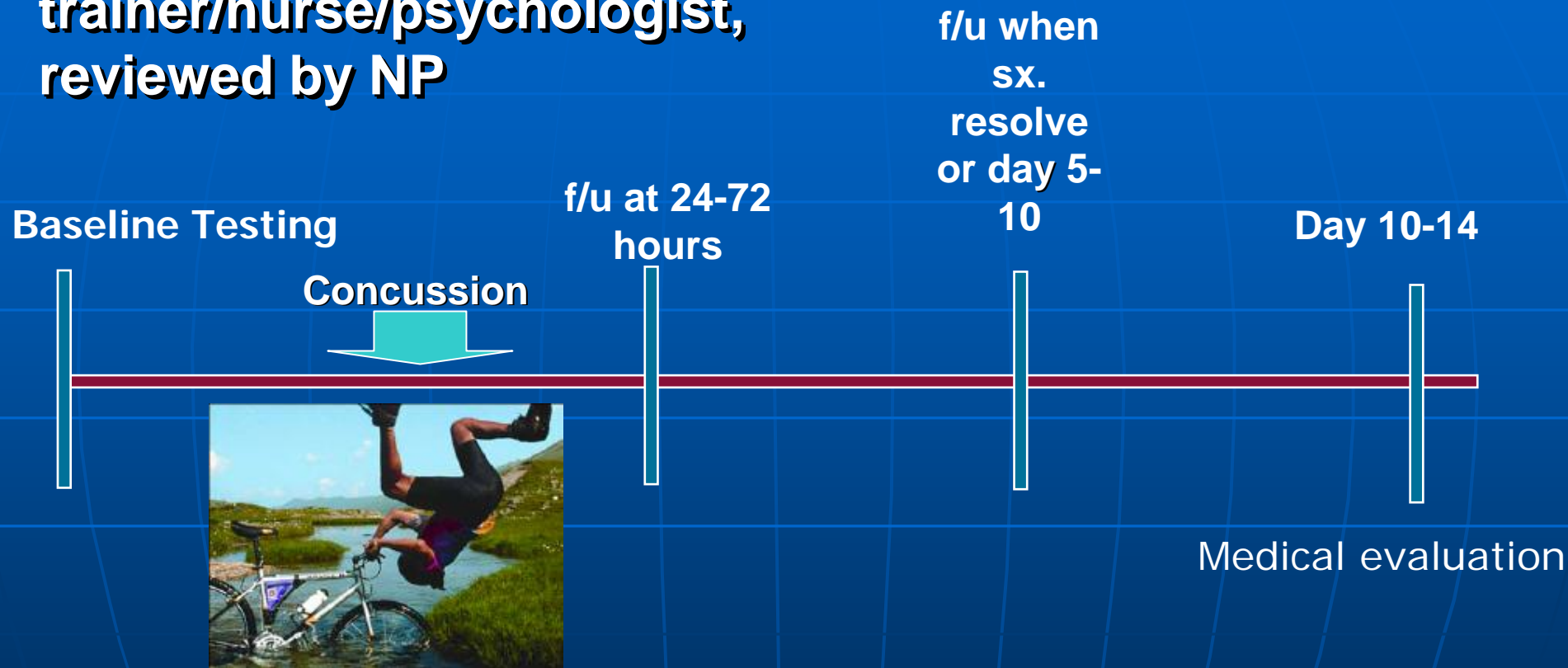
- Allows for a comparison of cognitive status relative to self;
 - Normative standards available
- Using computerized neuropsychological test: ImPACT - online
 - Needs organization
 - Balance testing where available
 - Baselines reviewed by neuropsychologist
 - Athletes repeat if necessary

Computerized NP Testing

- Advantages
 - Sensitive and reliable
 - Objective
 - Well-established
 - Automatic data collection
- Disadvantages
 - Cost
 - Time consuming
 - Interpretability

Clinical Protocol

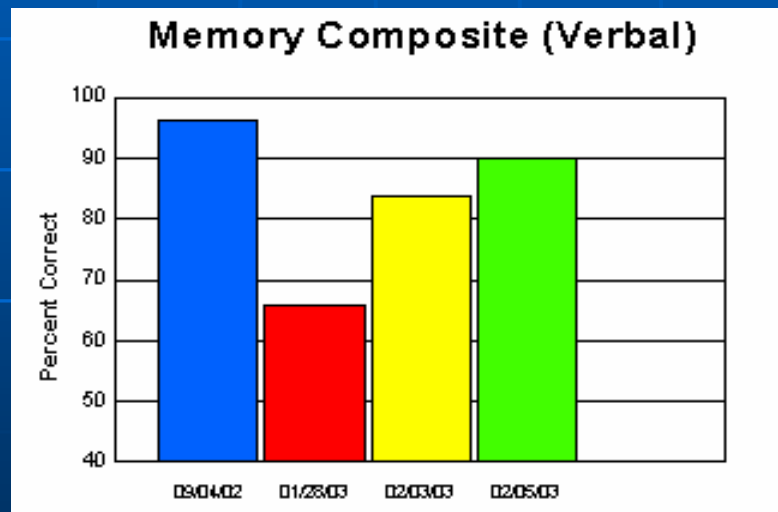
Cognitive testing admin by
trainer/nurse/psychologist,
reviewed by NP



(Normative data available for decision making
when baseline data not available)

Follow-up testing

- Post concussion testing happens within 72 hrs of injury
- Then again when symptoms resolve
- Compare athlete to own baseline scores:



- Scores are statistically compared & controlled for retesting

Notification

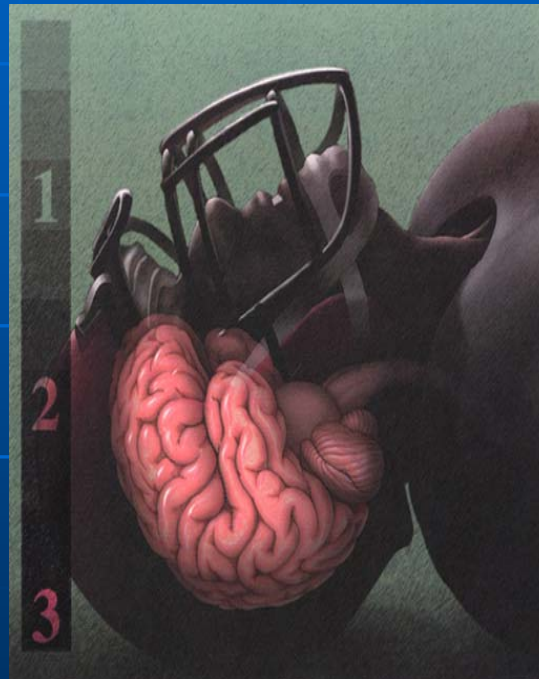
- When concussion is diagnosed, ATC notifies
 - Parent
 - PCP
 - Team MD
- ATC monitors management
 - Unless symptoms and signs warrant medical attention
 - NP reviews cognitive testing (online)
 - Includes PCP, team MD in email communication with ATC
 - Refer to specialist if symptoms > 10-14 days

When symptoms & scores have returned to baseline

- ATC directs an exertion protocol
 - Light aerobic exercise
 - Sport specific exercise
 - Non-contact training drills
 - Full contact practice
 - RTP

The importance of cognitive testing (baseline & follow-up):
some data....

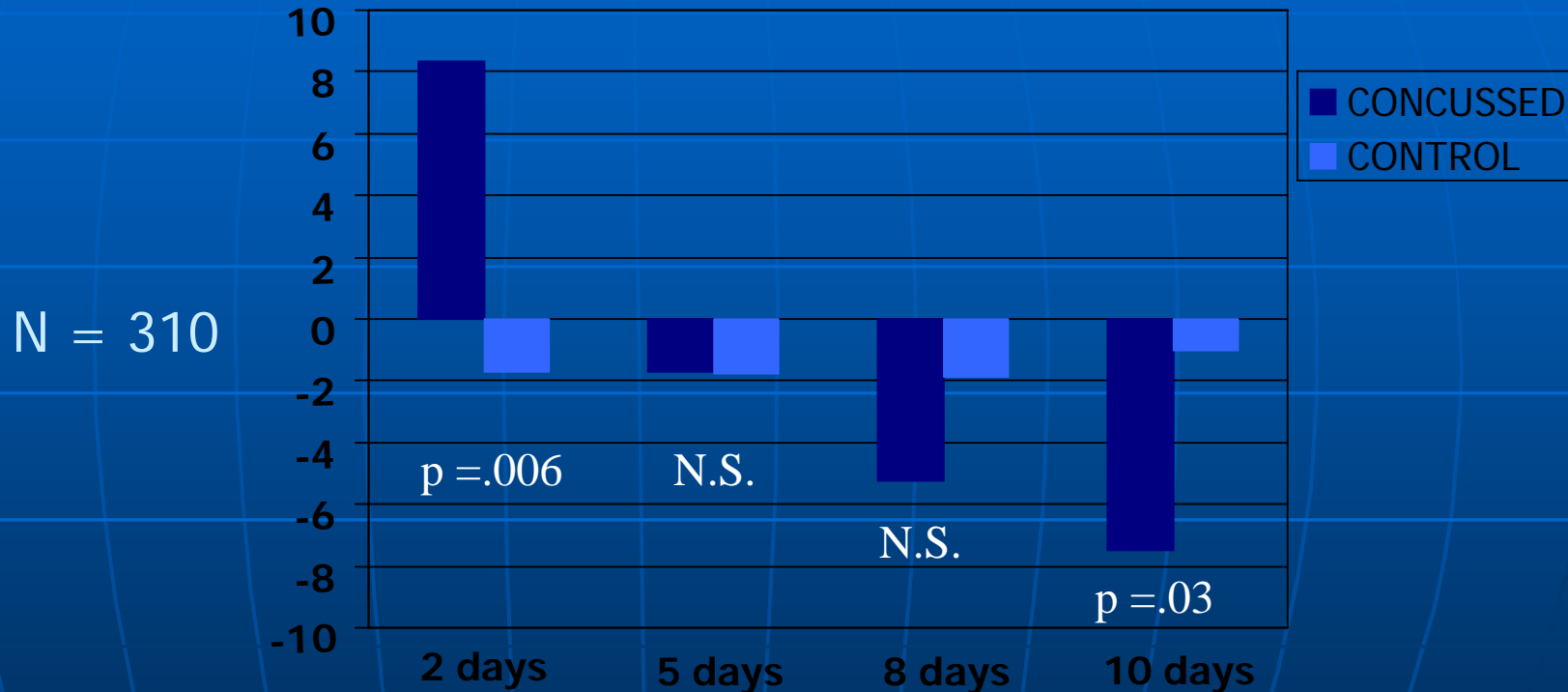
Do Athletes Underreport Symptoms?



Lovell MR, Collins MW, Maroon et al. Medicine and Science in Sports Exercise, 34:5;2002

SYMPTOM REPORTING

concussed athletes show more sx. at 2 days, but less than baseline at 10 days (less than controls)

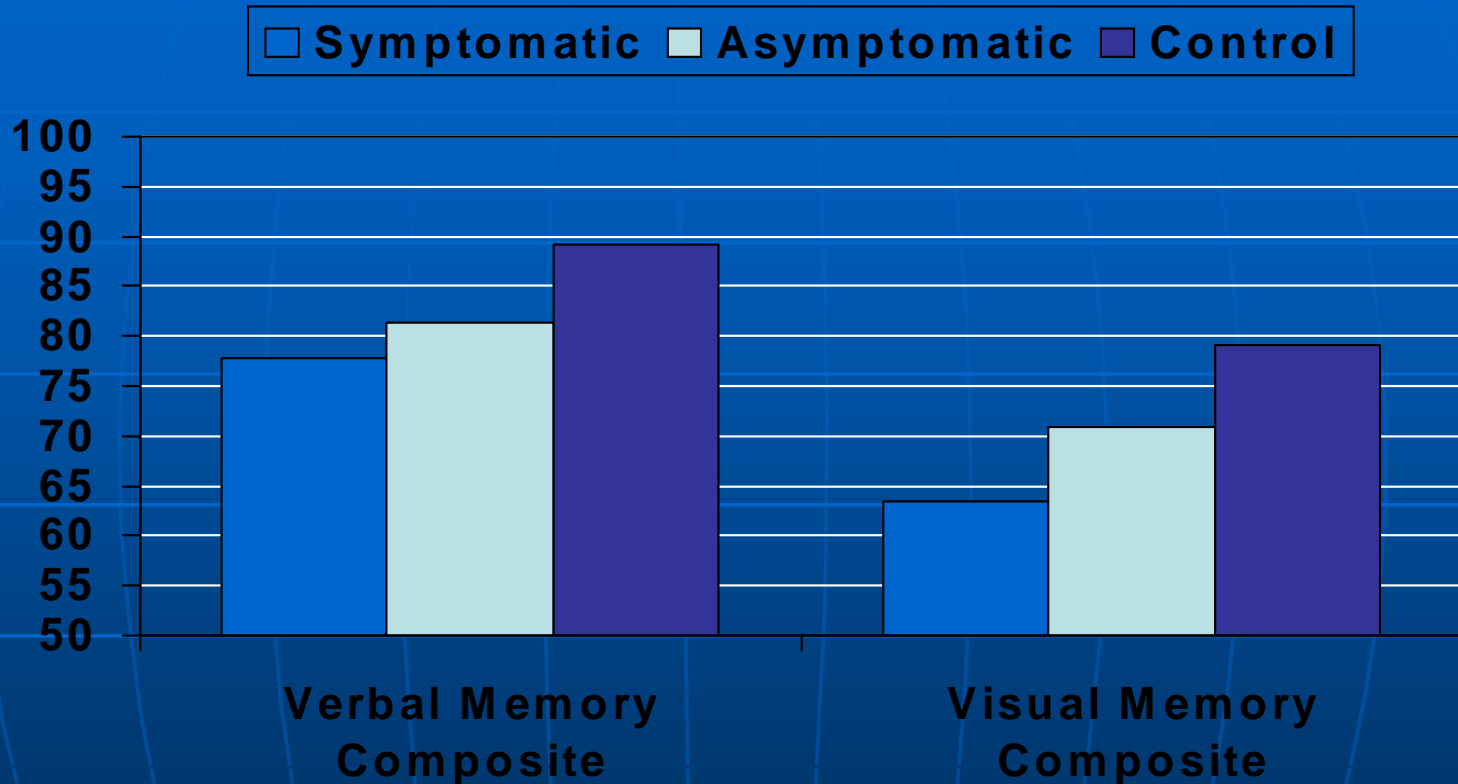


*Score reflects differences between post-injury and baseline scores

Can NP testing help?

- NP testing provides an objective and independent index of cognitive recovery
 - Symptoms & cognition are likely NOT related
- Tests are not perfect

Asymptomatic athletes have significantly lower scores than controls at day 4 – no difference at baseline

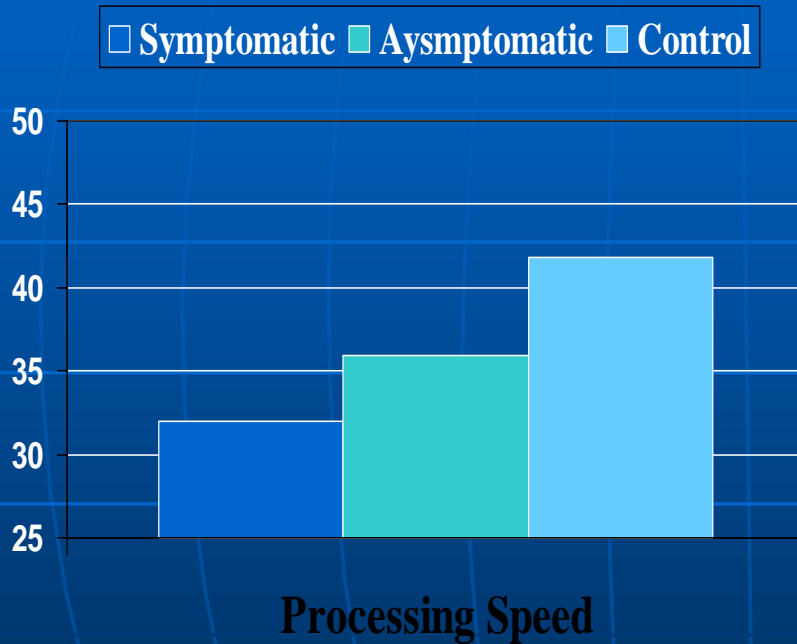


N=115

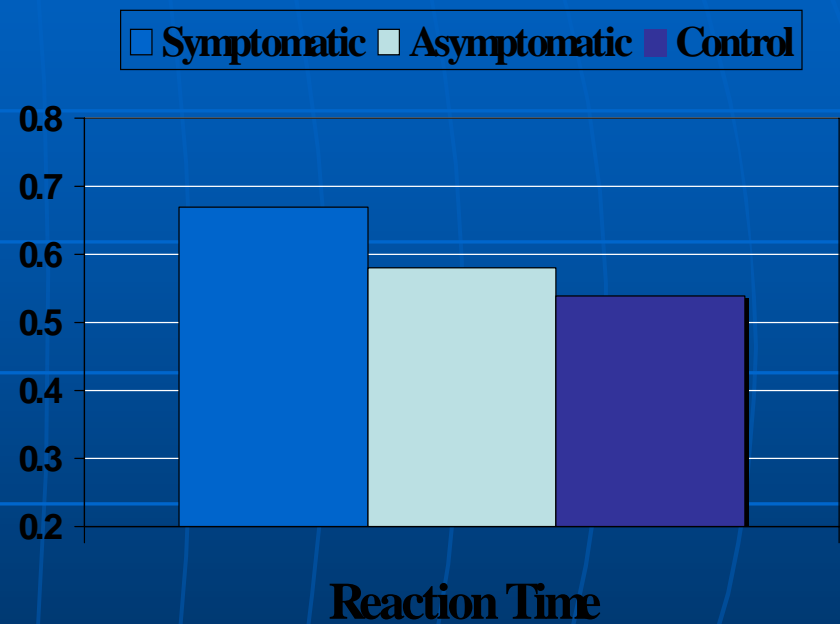
MANOVA $p < .000000$

Testing reveals cognitive deficits in asymptomatic athletes within 4 days post-injury

UNIQUE CONTRIBUTION OF NP TESTING, cont.



N=115



MANOVA $p < .000000$

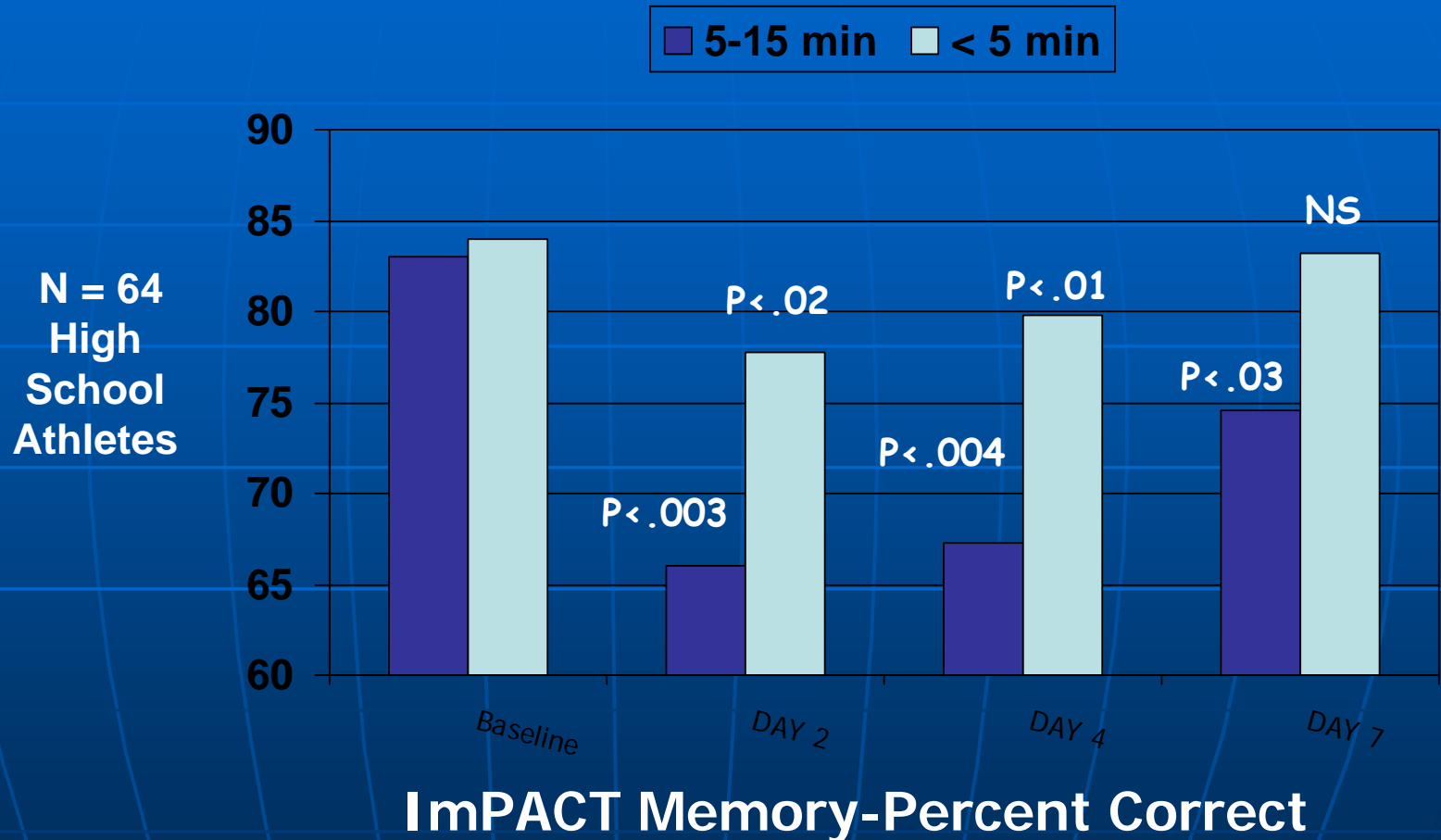
H.S. Bell Ringer Study

- **64 high school athletes with “mild” concussion**
- **Two groups compared on ImPACT performance**
 - - Athletes with <5 min of signs/symptoms
 - - Athletes with 5-15 min of signs/symptoms
 - » *No athlete in sample sustained LOC*
- **No athlete returned to contest**
- **Cognitive evaluation obtained at baseline, day 2, day 4, and day 7 post-injury**

NP MEMORY COMPOSITE SCORES

Brief versus Prolonged On-field Mental Status Changes

Brief group had better scores, but still sig. lower than their own baselines

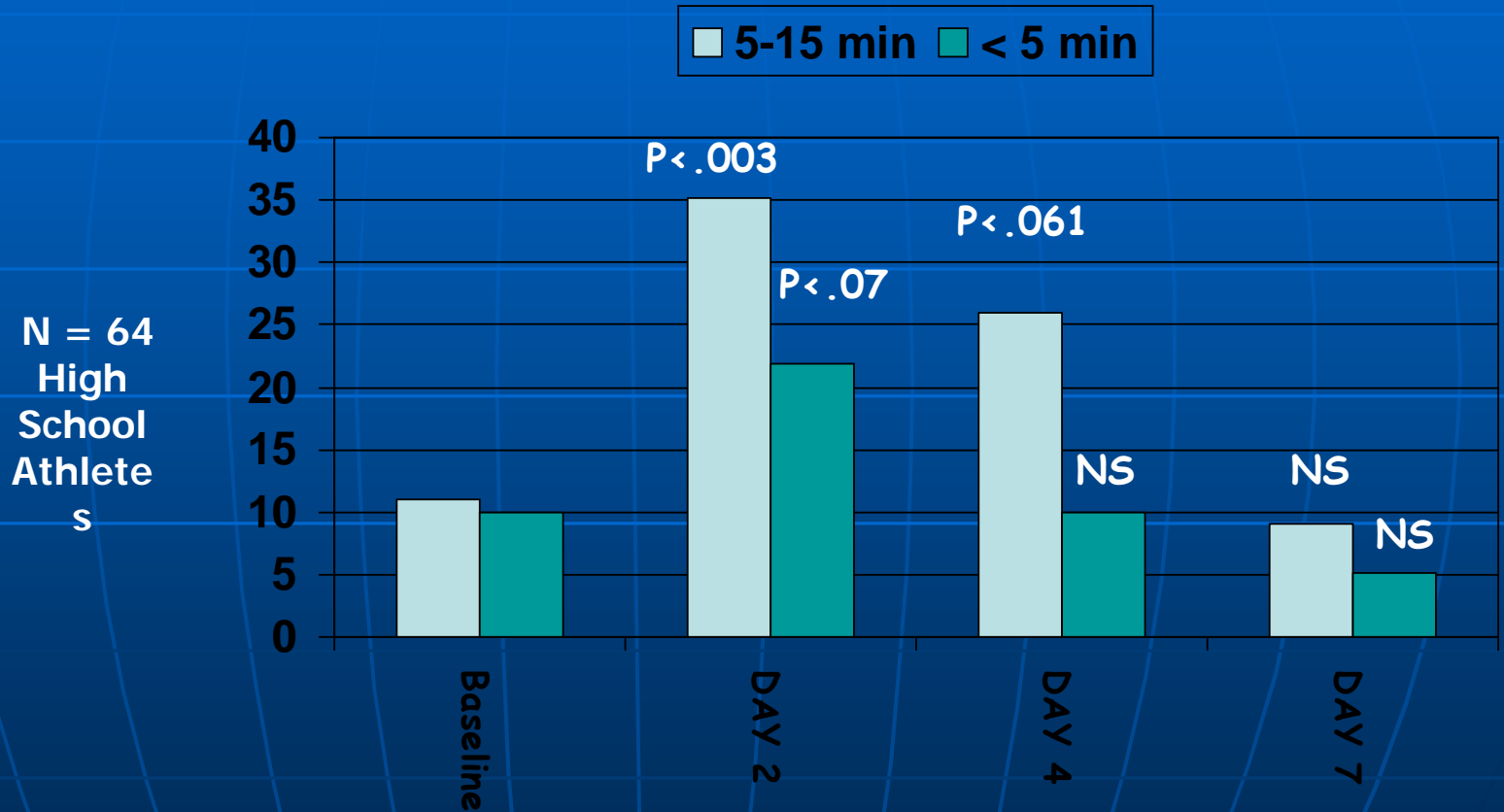


Lovell, Collins, Iverson, Field, Podell, Cantu, Fu; J Neurosurgery; 98:296-301,2003

Lovell, Collins, Iverson, Johnston, Bradley; Amer J Sports Med; March 2004

SYMPTOM-SCALE SCORES

Brief versus Prolonged On-field Mental Status Changes



“BELL-RINGER” SUMMARY

First study to challenge assumption that Grade 1 or mild concussion in high school athletes is associated with rapid and complete recovery

- While prolonged mental status alteration leads to worse outcomes, brief changes still cause significant cognitive declines
- Findings contrary to most grading systems (AAN)
- Recovery from concussion may not be linear process
- Symptoms resolve earlier than neurocognitive deficits

Lovell, Collins, Iverson, Field, Podell, Cantu, Fu; J Neurosurgery; 98:296-301,2003

Lovell, Collins, Iverson, Johnston, Bradley; Amer J Sports Med; 32:47-54;2004

Take-home message

- Self-reported symptoms are important
 - Often indicate lower NP scores
- Are not reliable or sensitive indicators of recovery
 - Athletes may under-report;
 - Symptoms resolve before cognition;
 - Athletes returned based on symptoms appear to be at risk (Ohio study).

Can it be done?

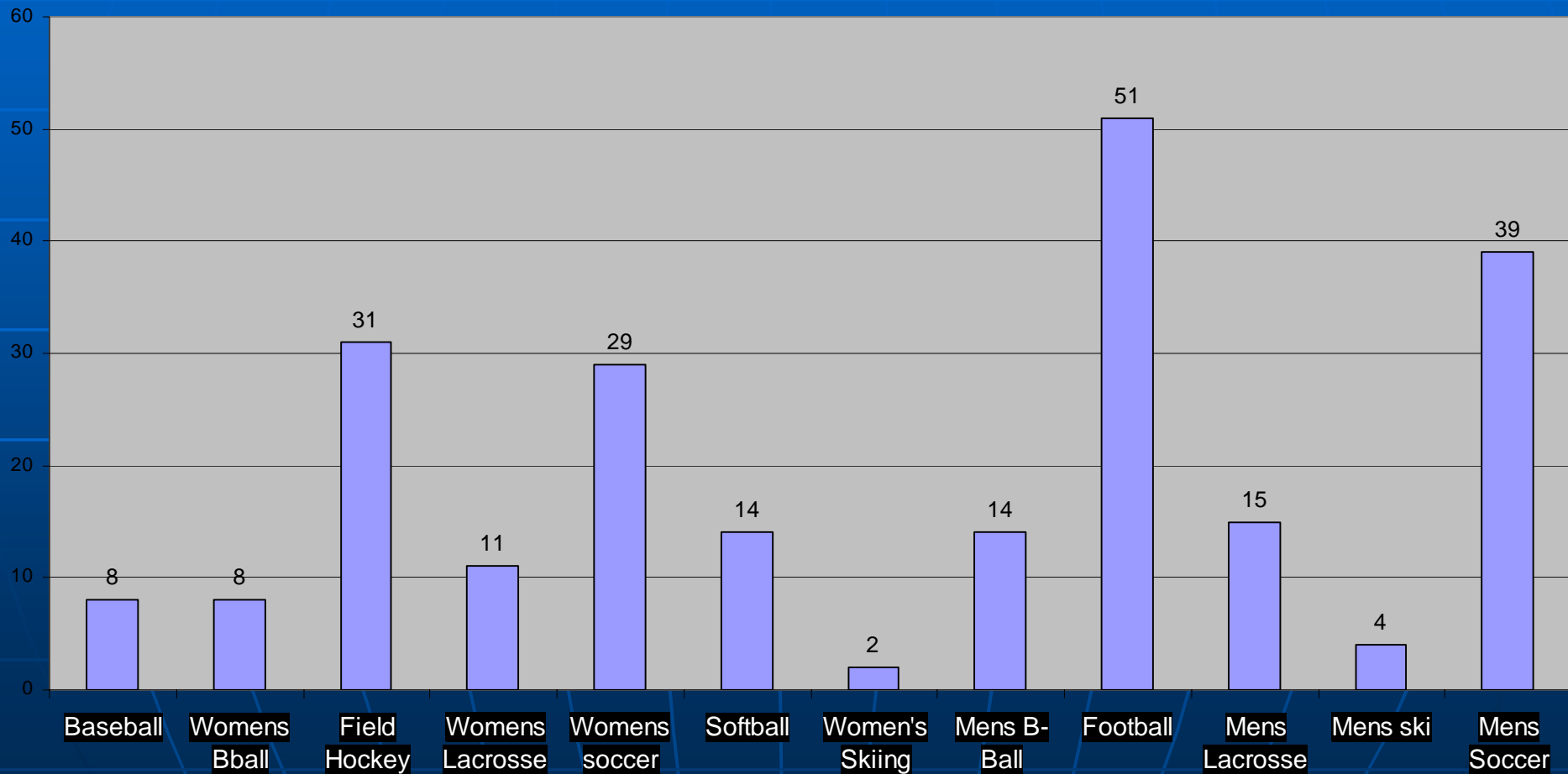
- Results from 1 year at one medium sized high-school

Sample High School

- ~600 students at school
- Full-time ATC
- ~225 athletes screened (baseline)
 - Basketball, field hockey, lacrosse, football, rugby, soccer, some baseball, some skiing
- All baselines screened for abnormally low scores, high symptom counts, previous concussions
 - 10 repeat baselines (4%)

Number of H.S. baselines by sport

baselines



Concussion Statistics

- 13 concussions SY 2008-2009
 - 6% of total (baselines)
 - 4 required more than 1 follow-up (31%)
 - 1 retired due to high number of previous concussions
 - 3 football
 - 2 field hockey
 - 4 basketball (2 m, 2 f)
 - 4 soccer (1 m, 3 f)
 - 6 males, 7 females

Review of Baselines Clinical Case

- Jr. male soccer player (FR)
- Low baseline scores and need to retest
- Parents notified
- Reported long-standing complaints of difficulty in school
 - Reading
- Review of available testing was not informative (achievement tests)
- Re-tested (see table)

Case of FR

Original baseline
scores

2nd baseline (2-
month interval)

- | | |
|-------------------------|-------------|
| • <u>VrbMem</u> 68 (7%) | 71 (10%) |
| • <u>VisMem</u> 46 (1%) | 45 (1%) |
| • <u>PS</u> 38.65 (47%) | 40.38 (56%) |
| • <u>RT</u> .68 (16%) | .63 (28%) |
| • <u>Impulse</u> 7 | 5 |

Concern: scores and parent report suggest underlying problem

Case Outcome

- FR referred for full NP battery
- Results consistent
 - Very low memory scores
- Referred to neurology
- Diagnosed with a seizure disorder

Challenges

- Parent education
- MD education
- Baseline testing is challenging
 - Completed as first step to getting equipment
 - Effort and distractions
 - Be vigilant on testing
- Parent cooperation with protocol
 - Doctor “shopping” when concussion identified
 - Going around trainer

NHSCAC

- Will continue to advocate for proper medical coverage in all schools;
- universal screening and appropriate management;
- Provide support & education to the state;
- Report to BIANH next year –



Stay tuned



slides available at
www.bianh.org/conncussion



Thank you

