



# Prevalence and Predictors of Neurobehavioural Disability amongst Traumatic Brain Injury Survivors in the Community

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# *Presentation Outline*

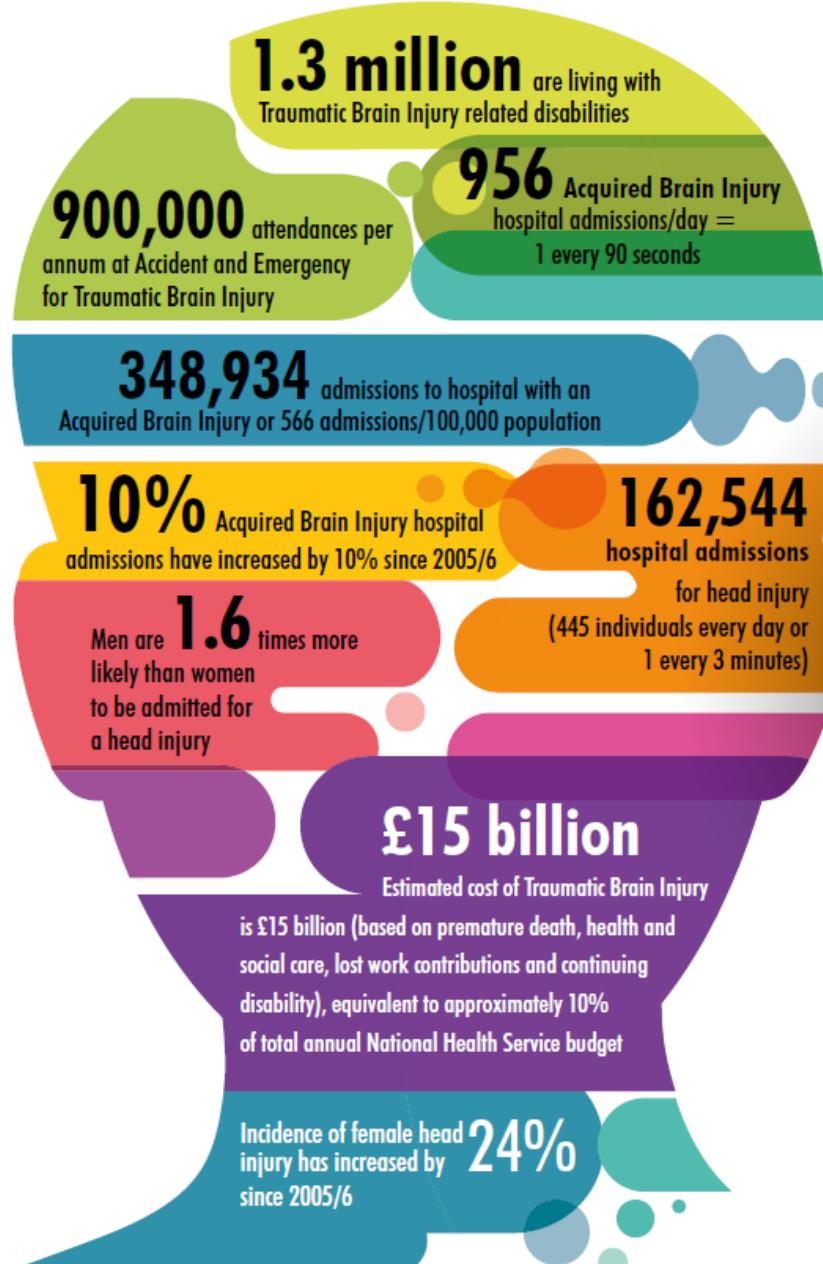
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- ABI & Neurobehavioural Disability
- SASNOS
- Prevalence of NBD in an opportunistic sample of TBI survivors in Swansea
- Comparisons with NBD measured in other contexts
- Conclusions & Recommendations



# Acquired Brain Injury Key Facts

- More survivors
- Disabilities are chronic
- Disabilities often hidden
- A ‘silent epidemic’
- Rehabilitation provision is patchy and often inadequate



# *Outcome After ABI*

- Physical
- Functional
- Cognitive
- Psychosocial
- Emotional
- Behavioural



## *Outcome After ABI*

In studies conducted over many years, challenging behaviour has been recognized as posing a greater long-term impediment to community integration after TBI than physical disabilities



# *Outcome After ABI*

## Barriers to good psychosocial outcome after ABI:

- Poor inhibitory control: aggression, disinhibition
- Diminished drive, interest & motivation
- Poor social cognition, lack empathy, egocentric
- Reduced ability to make and sustain relationships
- Lack of initiative & purposeful behaviour
- Problems planning or making decisions
- Diminished awareness & poor judgement
- Unrealistic aspirations



# *Neurobehavioural Disability (NBD)*

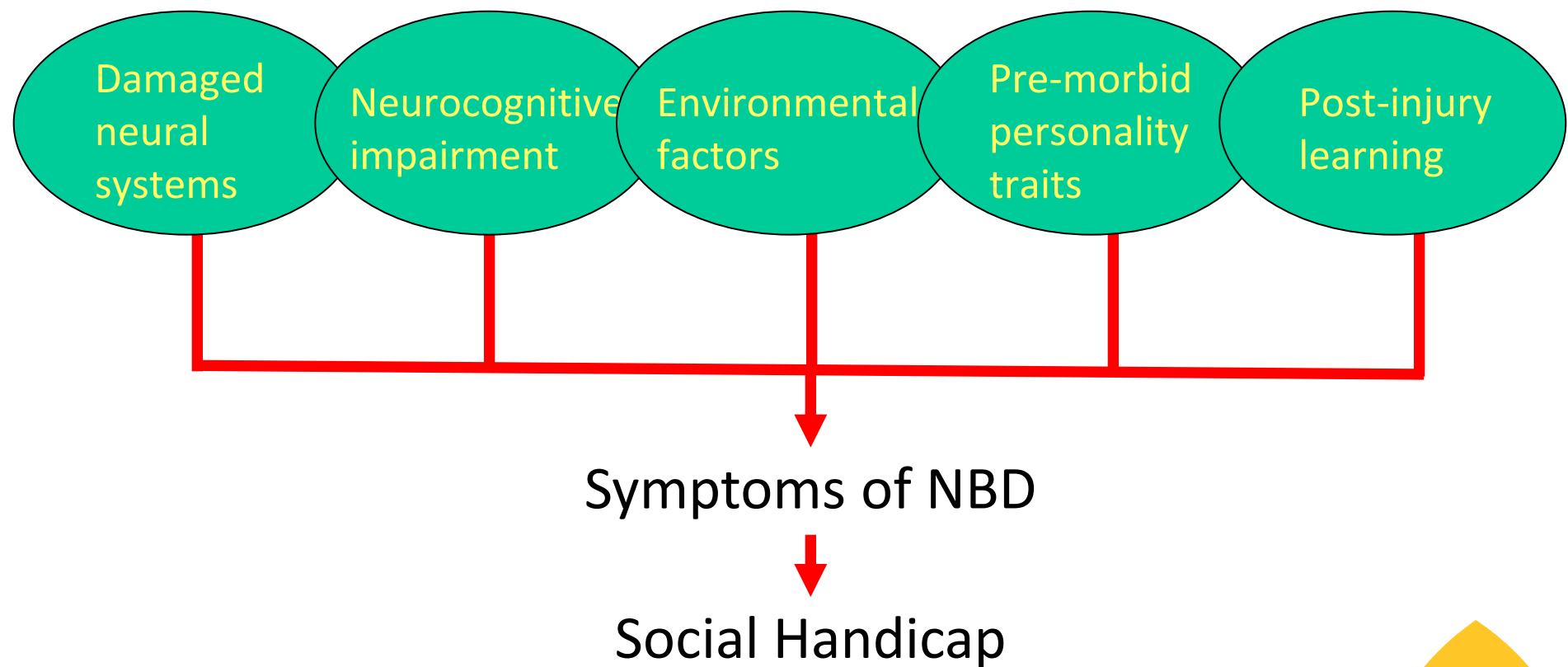
Understanding what underpins these difficulties –  
the concept of NBD

Prof Rodger Wood (2001)

Complex, subtle, pervasive  
constellation of cognitive-  
behavioural changes that  
characterise post-acute ABI



# *Neurobehavioural Disability*



# *Neurobehavioural Disability*

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- Product of interactions between damaged neural systems and neurocognitive impairment, further modified by premorbid personality traits and learning results in an array of symptoms:
  - *executive and attentional dysfunction*
  - *altered emotional expression*
  - *poor impulse control*
  - *range of personality changes*
  - *poor insight*
  - *problems of awareness and judgement*

# *Neurobehavioural Disability*

Neurobehavioural disability has a major impact on long-term psychosocial outcome

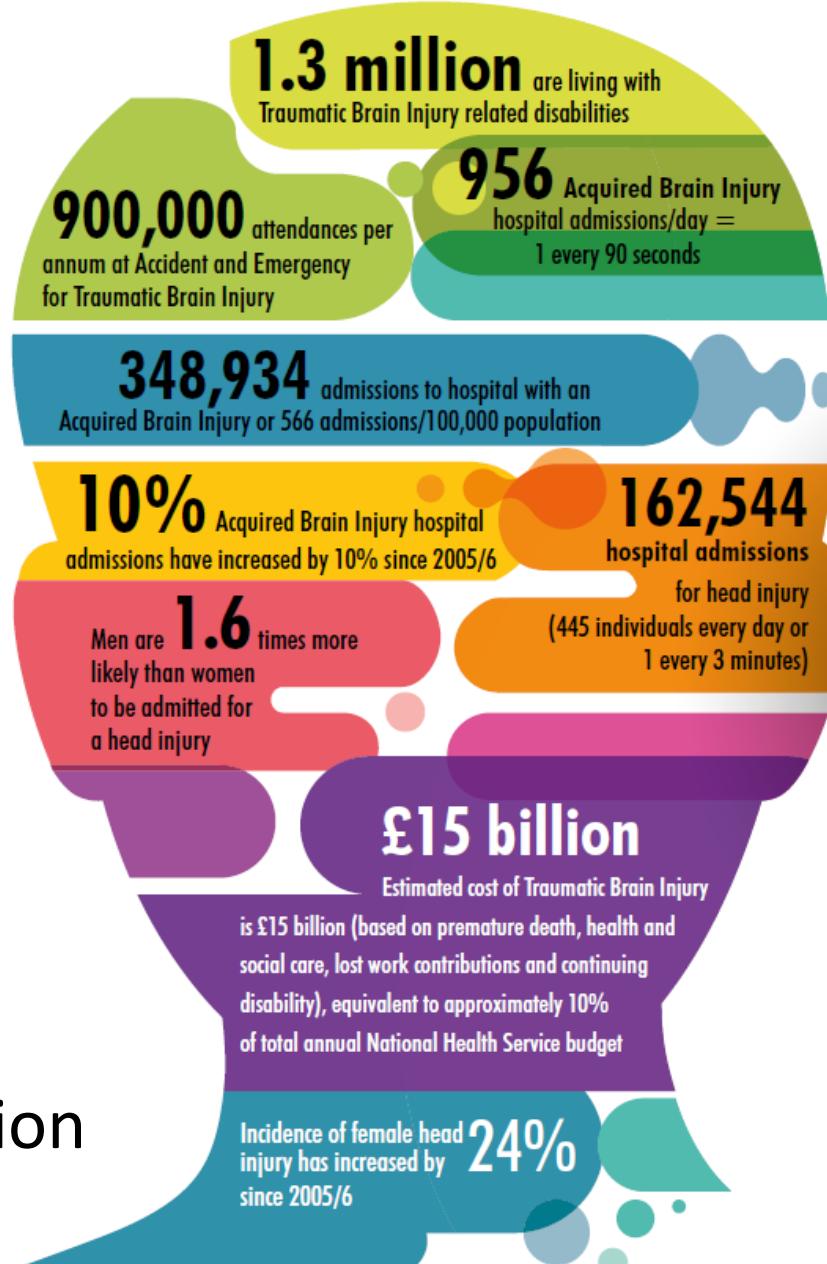
- Capacity for independent living
- Employment
- Relationships
- Contact with forensic services
- Quality of life

Presence of NBD = poorer prognosis

# Acquired Brain Injury Key Facts

1.3 million people live with the effects of a brain injury at a cost of £15bn per annum to the UK economy, equivalent to 10% of the annual NHS budget

Early identification/rehabilitation should be a priority



# NBD & Social Handicap – SASNOS

## ‘St Andrew’s-Swansea Neurobehavioural Outcome Scale’ (SASNOS)



- 2008 review of NBD measures revealed significant problems.
- SASNOS developed as a response, comprising a 49-item global assessment measure that captures five major domains and 12 subdomains of NBD.
- Designed specifically to capture NBD.
- Multipurpose measurement tool.
- Meets many of the recommendations made in the 2008 review of NBD measures.
- Potentially provides, for the first time, a measurement instrument enabling inclusive assessment/prediction of NBD.

# *NBD & Social Handicap – SASNOS*

## 'St Andrew's-Swansea Neurobehavioural Outcome Scale' (SASNOS)

**Proxy Rating**

**St Andrew's - Swansea Neurobehavioural Outcome Scale (SASNOS)**

Swansea University  
Prifysgol Abertawe | SASNOS Neurobehavioural Outcome Scale

Name: \_\_\_\_\_ Date: \_\_\_\_\_

This questionnaire looks at some of the difficulties that people with acquired brain injury may experience. Please think about your observations of the person over the last two weeks and for each statement tick the box that best describes how prevalent it has been as per the definitions below. Please complete ALL items. Tick N/A if there have been no opportunities to observe items 1, 11 or 13. See separate Guidance Notes for more information, including scoring.

**Descriptor**      **Definition**

Never	No behaviour/symptom observed within the review period
Rarely	The behaviour/symptom has been observed once or twice
Occasionally	The behaviour/symptom has been observed a few times
Sometimes	The behaviour/symptom has been observed on about 50% of occasions when applicable
Fairly Often	The behaviour/symptom has been observed on many occasions
Very Often	The behaviour/symptom has been evident nearly all the time
Always	The behaviour/symptom has been a constant feature of the person throughout the review period

**Interpersonal Relationships**

**Social Interaction**

- 1. Interacts appropriately with strangers
- 2. Recognises and responds to the feelings of others
- 3. Maintains good personal appearance
- 4. Recognises when to end conversations
- 5. Willing to accept criticism or feedback from others

**Relationships**

- 6. Forms close meaningful relationships with others
- 7. Displays warmth and compassion in relationships
- 8. Content of conversation is appropriate to social situation
- 9. Initiates and maintains social interactions independently
- 10. Maintains good eye contact during conversation

**Engagement**

- 11. Participates in family activities
- 12. Considerate and caring about the needs and circumstances of others
- 13. Is well mannered and polite with friends and family
- 14. Behaviour is cheerful and happy
- 15. Demonstrates interest in other people and activities

Never    Rarely    Occasionally    Sometimes    Fairly Often    Very Often    Always    N/A

Page 1 of 5    sasnos.swansea.ac.uk    Swansea University Hospital Department V    SASNOS Neurobehavioural Outcome Scale

### Principal Domains

Interpersonal Behaviour 15

### Sub Domains

Social interaction 5  
Relationships 5  
Engagements 5

Cognition 12

Executive function 6  
Attention & memory 6

Inhibition 6

Sexual 3  
Social 3

Aggression 12

Provocative behaviour 5  
Irritability 4  
Overt aggression 3

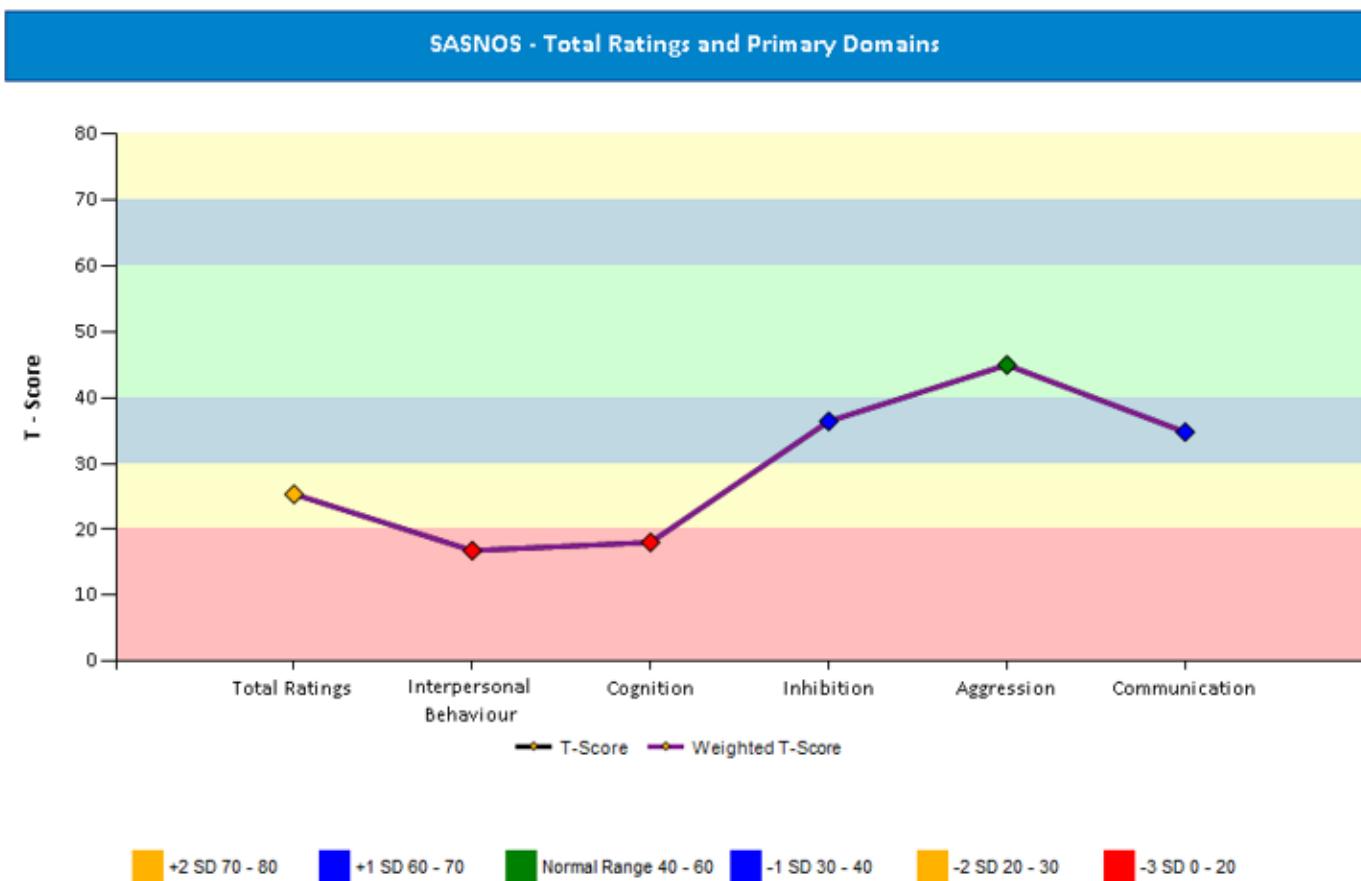
Communication 4

Speech & language 2  
Mental state 2

# Outcome Measures - SASNOS

The below scores are based on the SASNOS assessment which took place on 19/10/2017

	T - Scores	Weighted T-Scores
<b>INTERPERSONAL BEHAVIOUR</b>	<b>16.81</b>	<b>16.81</b>
Social interaction	22.64	22.64
Relationships	13.31	13.31
Engagement	25.25	25.25
<b>COGNITION</b>	<b>18.06</b>	<b>18.06</b>
Executive function	25.65	25.65
Attention & Memory	13.96	13.96
<b>INHIBITION</b>	<b>36.42</b>	<b>36.42</b>
Sexual inhibition	57.96	57.96
Social inhibition	17.07	17.07
<b>AGGRESSION</b>	<b>44.98</b>	<b>44.98</b>
Provocative behaviour	50.60	50.60
Irritability	26.06	26.06
Overt aggression	64.31	64.31
<b>COMMUNICATION</b>	<b>34.79</b>	<b>34.79</b>
Speech & language	17.75	17.75
Mental state	51.86	51.86
<b>TOTAL SUM OF RATINGS</b>	<b>25.37</b>	<b>25.37</b>



# *Milestones in SASNOS Development*

- 2008      Review of existing, global measures of NBD highlighted psychometric and other concerns; concluded ability to monitor progress in rehabilitation or determine the quality of outcome remains unreliable  
*“Therefore, ABI is one of the few clinical conditions for which reliable long-term prognoses remain elusive.”* (p84)
- 2011      Publication of SASNOS, included description of reliability & validity
- 2012      Microsite published within Swansea University website to provide a platform to disseminate SASNOS from and promote interest in NBD
- 2016      First annual conference co-hosted by Swansea University & Elysium Neurological to promote SASNOS & developments in assessment and management of NBD
- 2017      Publication of SASNOS Responsiveness indices confirm it can be reliably used to assess change in NBD symptoms over time (repeat assessment)
- 2018      Publication of supplementary scale to enable recalibration of SASNOS scores to reflect effects of context-dependent support
- 2019      Publication of multisite study (INPA) confirmed strengths of SASNOS in measurement & assessment of NBD in repeated-measures context



# **SASNOS Development**

One important application of ASNOS envisaged by the authors was providing a means of articulating the extent of NBD amongst different ABI subpopulations in different contexts and ascertaining if it “...can discriminate between different neurological populations.” (p98)

Such studies are now beginning to appear, including:

## **1. NBD in Neurobehavioural Rehabilitation Units**

Single and multisite studies (Alderman, Williams & Wood, 2011; Alderman & Knight, 2017; Alderman, Williams, Knight & Wood, 2017; Alderman, Williams & Wood, 2018; Alderman, Pink, Williams, et al., 2019)

## **2. NBD in an inpatient subacute stroke rehabilitation programme**

Inpatient subacute stroke rehabilitation programme (Stolwyk, O'Connell, Lawson, Thrift & New, 2018).  
(N = 82)

## **3. NBD amongst ABI survivors in a community setting**

1-3 yrs post injury (Soendergaard, Siert, Poulsen, Wood & Norup, 2019)  
(N = 32)

# ***SASNOS NBD in Different Groups/Contexts***

## **1. NBD in Neurobehavioural Rehabilitation Units**

- NBD endemic: 91.7 – 95.9% of participants exhibited NBD in at least one SASNOS domain, many presented with 4-5.
- Nearly all presented with coexisting difficulties with Interpersonal Relationships (95.6%) and Cognition (97.1%).
- Aggression (63.2%) and difficulties with Inhibition (79.4%) were also widespread.
- Severity ‘mild-to-moderate’.

## **2. NBD in an inpatient subacute stroke rehabilitation programme**

- NBD frequent: nearly 60% exhibited at least ‘mild’ NBD in at least one SASNOS domains.
- NBD difficulties with Interpersonal Relationships (44.4%) and Cognition (52.4%) were most frequent.
- Inhibition (1.2%), Aggression (3.6%) and Communication (2.5%) were not common.
- Severity predominantly ‘mild’.



# **SASNOS NBD in Different Groups/Contexts**

## **3. NBD amongst ABI Danish survivors in a community setting**

- NBD infrequent: nearly 70% had no domain scores below cut-off.
- Most numerous NBD difficulties with Cognition (32.3%) and Interpersonal Relationships (12.9%).
- Only one case (3.2%) rated below cut-off regarding Aggression, none (0%) for either Inhibition or Communication.
- Severity predominantly ‘mild’.
- Suggested insight/awareness difficulties as multiple statistical differences between mean ratings on proxy vs. self SASNOS assessments
- However, (*we found*) effect size (ES) did not suggest differences were generally meaningful and all group means fell within the normal range (clinical significance?).



# ***SASNOS NBD in Different Groups/Contexts***

## Lack of NBD within the Danish Community ABI study surprising

- Authors of the Danish Community ABI study concluded their study revealed far fewer NBD symptoms amongst survivors than expected.
- Results especially surprising as all incurred ‘severe’ ABI.
- Suggested number of reasons for this, including that survivors with the most severe NBD may have been excluded from the study.
- Although high incidence of NBD amongst stroke survivors, Stolwyk and colleagues were also surprised difficulties regarding lack of inhibition and increased aggression were relatively uncommon.
- Offered similar reasons to Soendergaard and colleagues including exclusion of those with most severe NBD.
- Also unexpected as studies of focal NBD symptoms suggest some are widespread, e.g. Sabaz et al., (2014) found 54.4% of 507 people with severe TBI participating in community rehabilitation programmes met the criteria for challenging behaviour, which included 31.9% having engaged in aggression.

# NBD Observed in TBI Community Sample: study goals

1. Further investigate the utility of SASNOS by investigating NBD exhibited by TBI survivors in the community
2. Compare and contrast with NBD found in other contexts/samples, and especially ascertain if it is as uncommon as suggested by Soendergaard and colleagues (2019)
3. Investigate potential issues regarding poor awareness and lack of insight by comparing self and proxy SASNOS assessments
4. Ascertain prediction models of NBD from the range of independent variables available



# NBD Observed in TBI Community Sample: study goals

## A note on scoring SASNOS

- Raw scores are totalled for the overall score and each of the 5 Domains and 12 Subdomains
- These are converted to T-scores based on a neurologically healthy Population
- Higher scores reflect increasing absence of NBD symptoms
- Scores < 40 interpreted as reflecting significant NBD (Alderman et al., 2011)

## Stolwyk, O'Connell, Lawson, Thrift & New (2018)

Severity categorized according to T-scores so SASNOS rescored to constitute an ordered categorical variable

- ‘no impairment’ ( $\geq 40$  recoded 0)
- ‘mild’ (30–39.99 recoded 1)
- ‘moderate’ (20–29.99 recoded 2)
- ‘severe’ ( $\leq 19.99$  recoded 3)



# NBD Observed in TBI Community Sample: the sample

- Data was culled for the purpose of clinical audit from the records of TBI survivors assessed by RLW referred for medicolegal assessment or to a head injury clinic.
- Case information was included if a SASNOS (proxy, self or both) had been completed.
- Information from records was compiled into an anonymous database for analyses.
- 97 cases met study inclusion criteria.
- 87 proxy SASNOS assessments completed (H1,2,4).
- 79 cases had both self and proxy assessments completed (H3).



# NBD Observed in TBI Community Sample: sample characteristics

		%	Mean	(SD)
Age (years)			36.9	14.1
Time since injury (years)			2.8	3.1
Severity (PTA):	mild moderate severe	14.6 18.3 67.1		
TBI cause:	RTA fall assault/blow to head cerebral hypoxia explosion	62.9 18.6 16.5 1.0 1.0		
In relationship	pre-injury post-injury	67.0 59.8		
In employment	pre-injury post-injury	78.0 31.4		



# NBD Observed in TBI Community Sample: the sample characteristics

	%	Mean	(SD)
Psychiatric history pre-injury	26.8		
Medical history pre-injury	17.5		
Neurological history pre-injury	7.2		
Learning disability pre-injury	17.5		
DEX-O (% above cut-off)	57.3	40.9	15.5
BDI-II (% above cut off)	86.8	26.5	11.0
BAI (% above cut-off)	18.3	18.3	11.1

# NBD Observed in TBI Community Sample: study aim 1

## Goal 1

Further investigate the utility of SASNOS by investigating NBD exhibited by TBI survivors in the community.

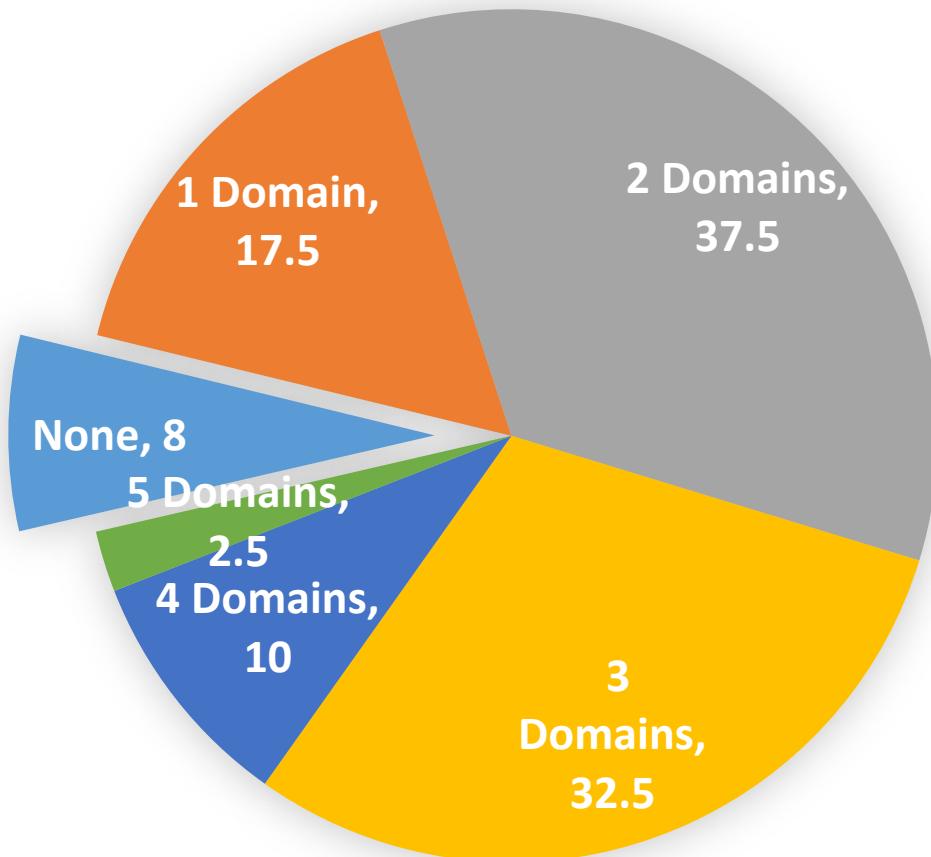
## Method

Examination of the 87 proxy assessments – summary statistics, distribution of severity categories, % cases falling below cut-off (< 40).



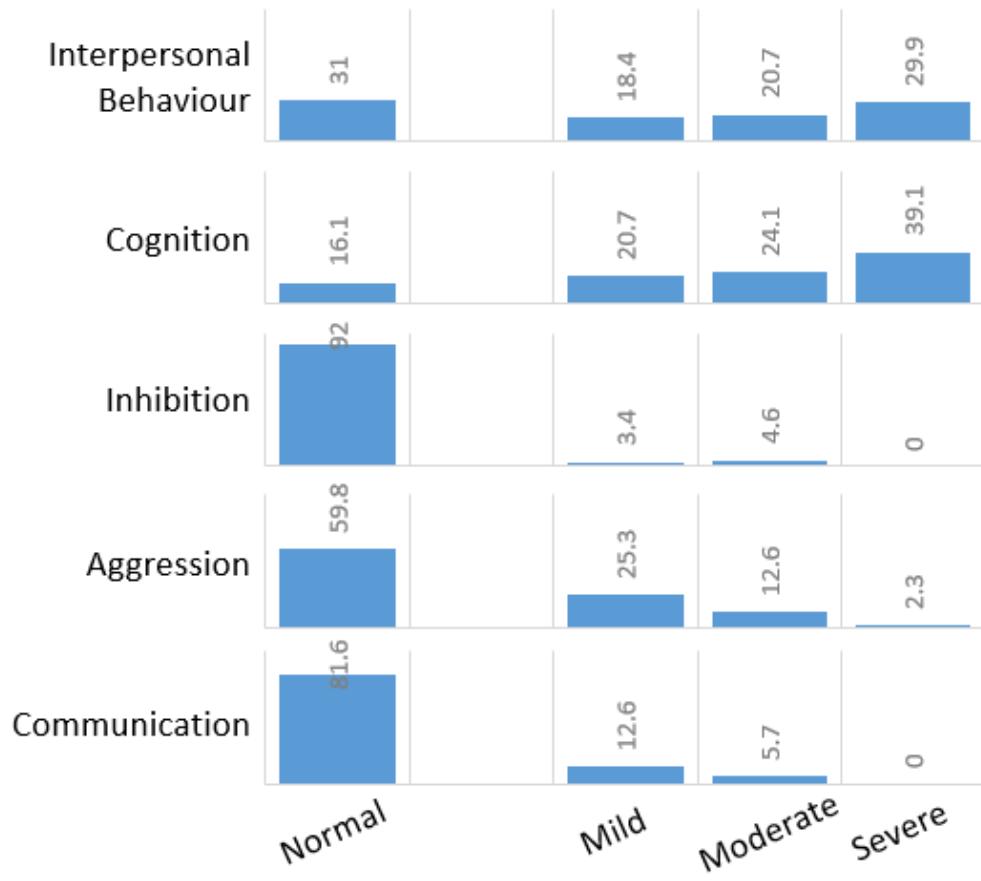
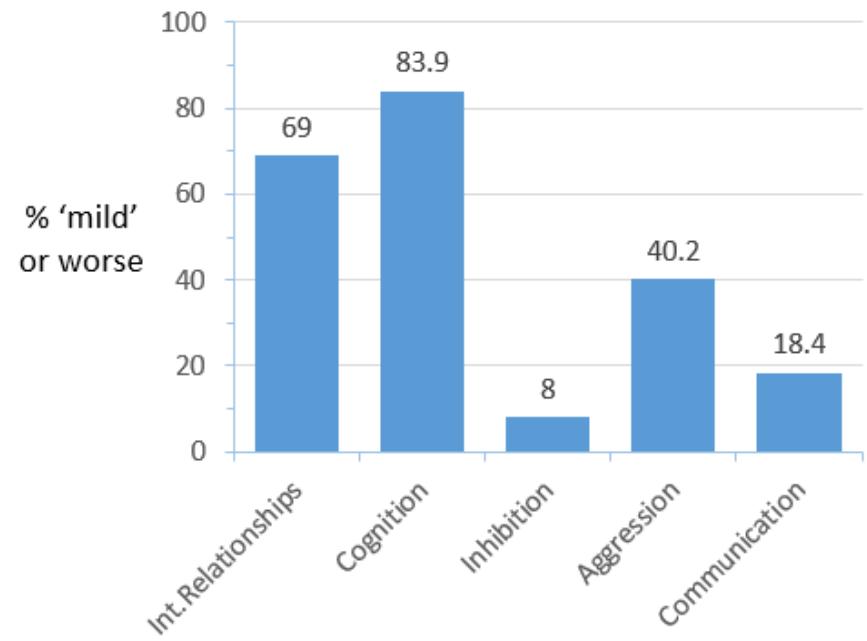
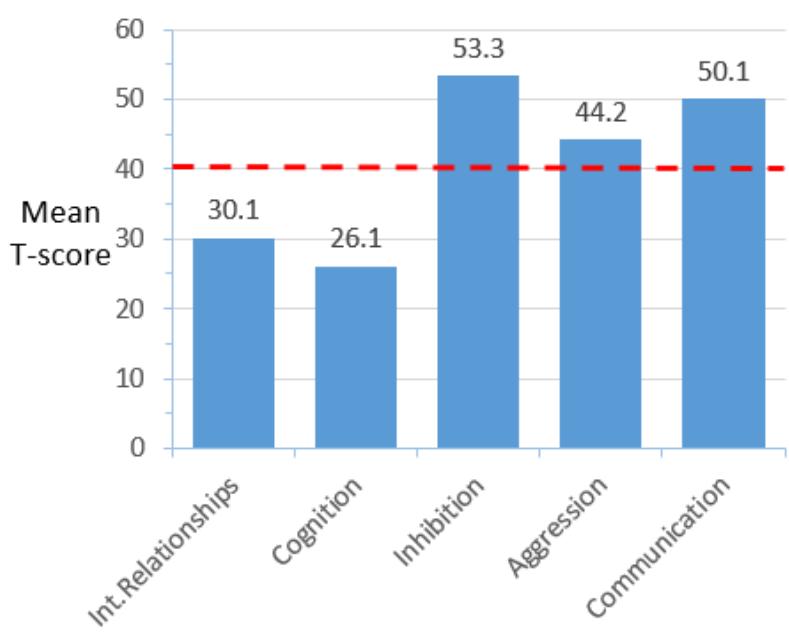
# NBD Observed in TBI Community Sample: number and percentage major SASNOS domains

92% exhibited at least mild symptoms of NBD as assessed by significant others

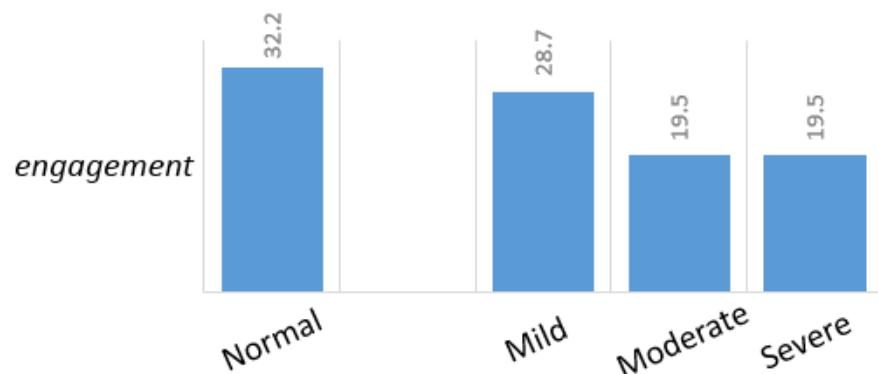
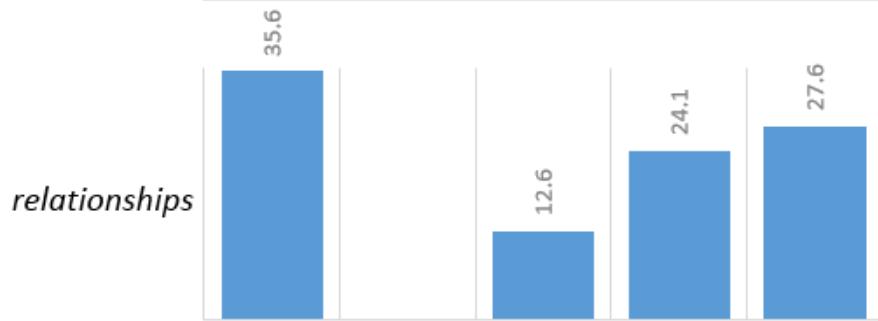
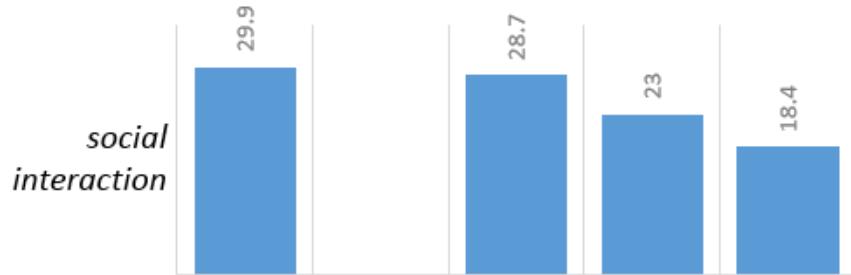
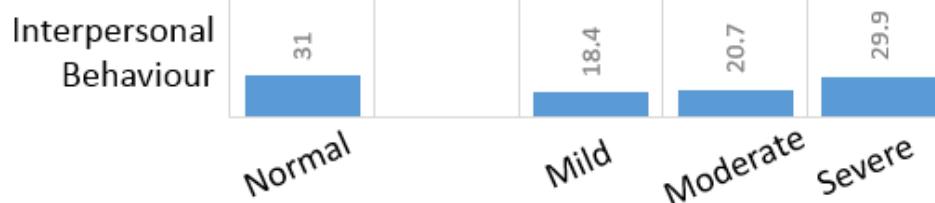


- 13 different domain combinations reflects heterogeneity of NBD symptoms
- Most prolific were:
  1. Interpersonal Relationships + Cognition (27%)
  2. Interpersonal Relationships + Cognition + Aggression (22.5%)

# NBD Observed in TBI Community Sample

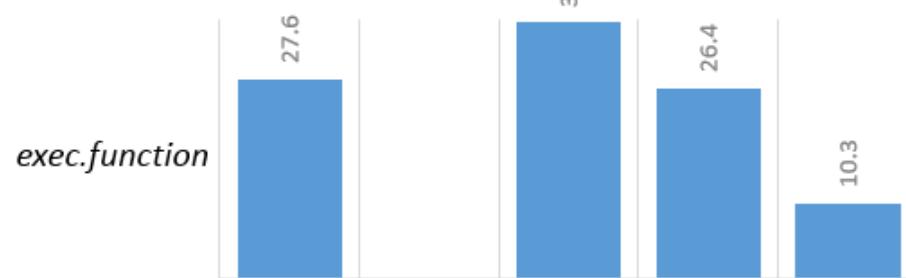
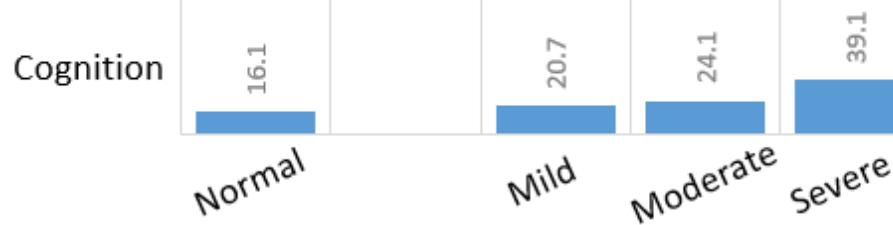


# NBD Observed in TBI Community Sample: Interpersonal Relationships

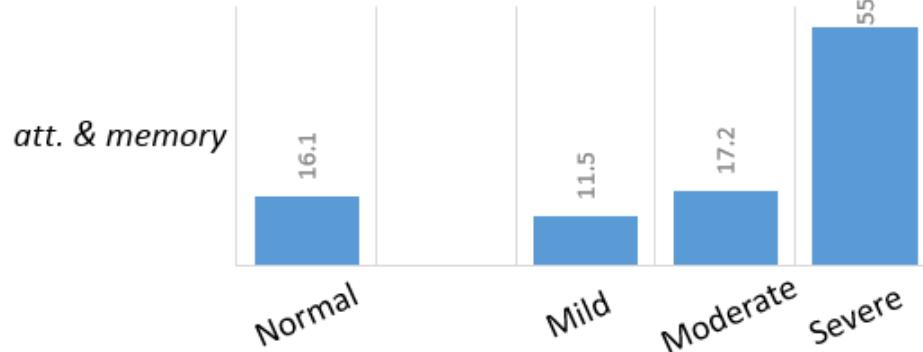


- % survivors rated as having at least 'mild' difficulties with the three Interpersonal Relationships subdomains were broadly similar (64.4 – 70.1%)
- However, whilst there was a tendency for 'mild' ratings for *social interaction* and *engagement*, those for *relationships* were skewed towards the 'severely impaired' category.

# NBD Observed in TBI Community Sample: Cognition



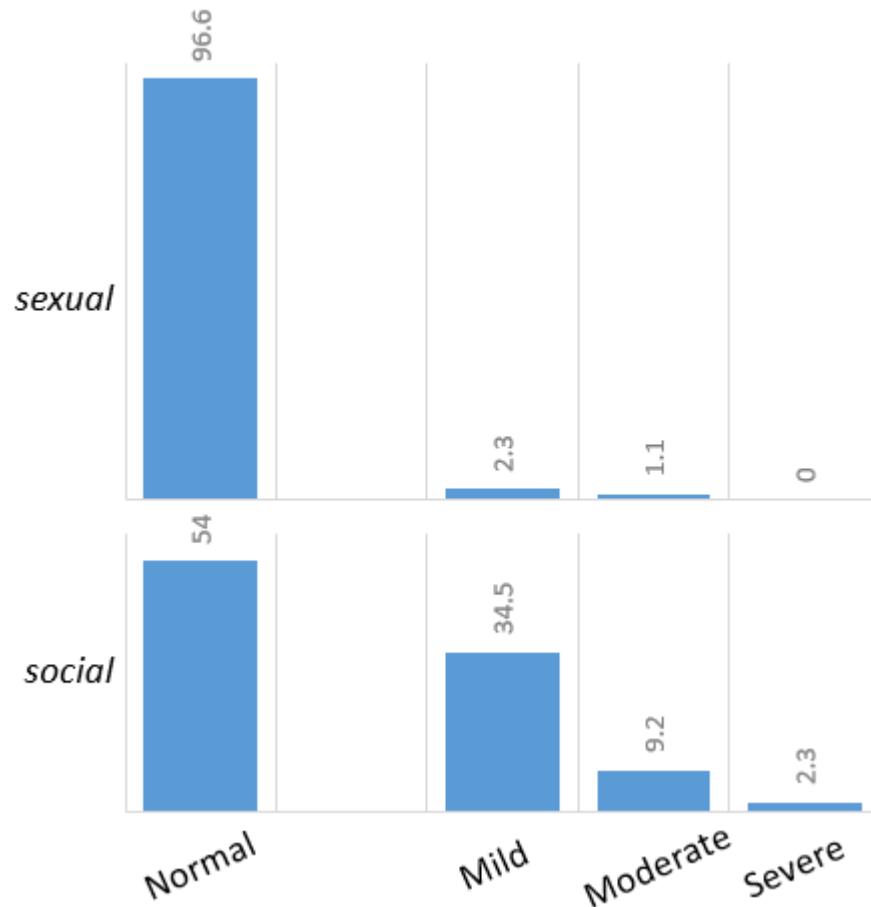
- Both subdomains characteristic of the sample but *executive function* NBD symptoms mainly 'mild-to-moderate' whereas *attention & memory* chiefly 'severe'



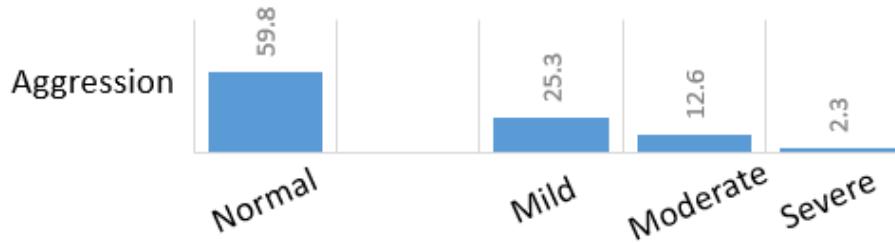
# NBD Observed in TBI Community Sample: Inhibition



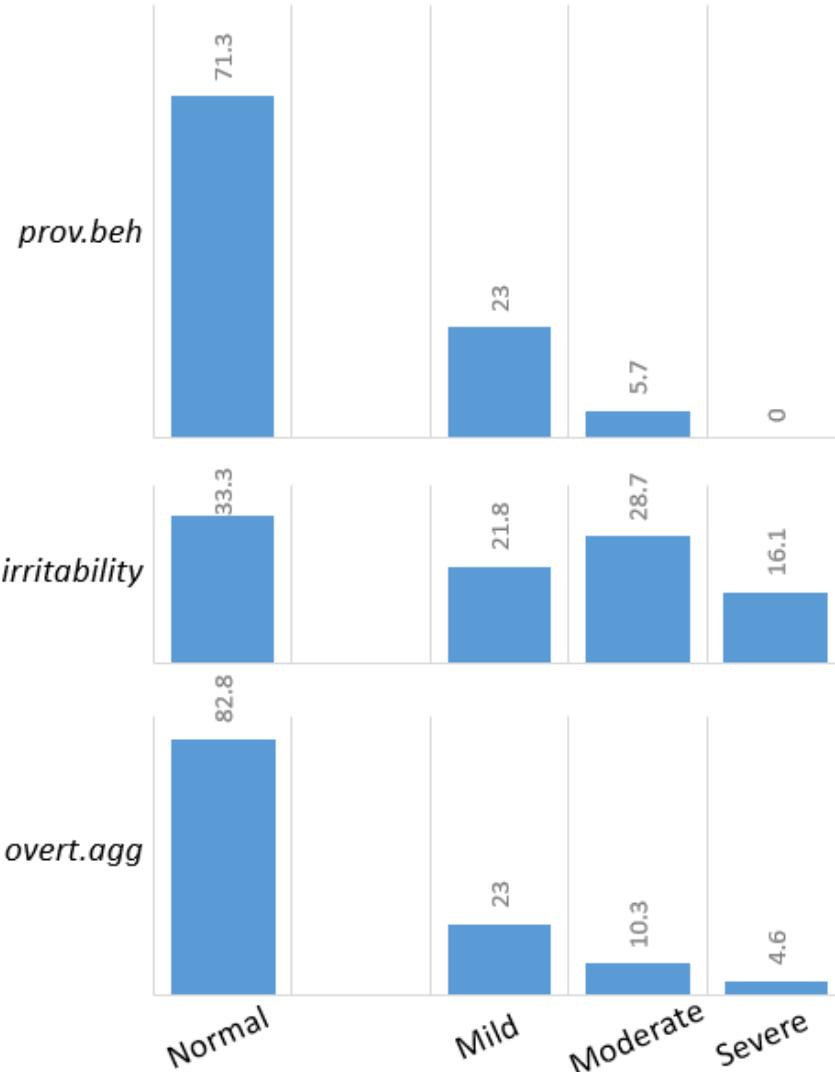
- Domain scores for Inhibition suggest difficulties were few (92% falling in the 'normal' range)
- However, great disparity between the two subdomains:
  1. Very few survivors assessed as having sexual inhibition problems (3.4%)
  2. in contrast nearly half had difficulties with *social inhibition* (46%), albeit predominantly to a 'mild' extent (75%)



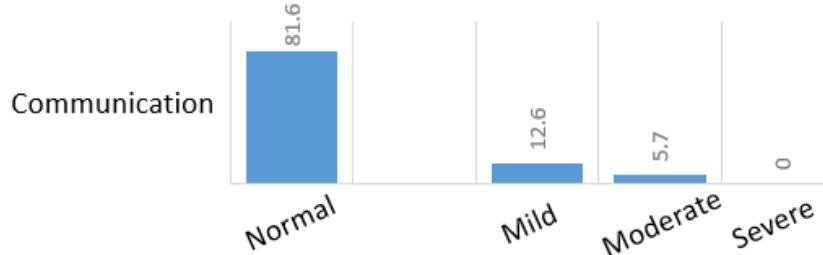
# NBD Observed in TBI Community Sample: Aggression



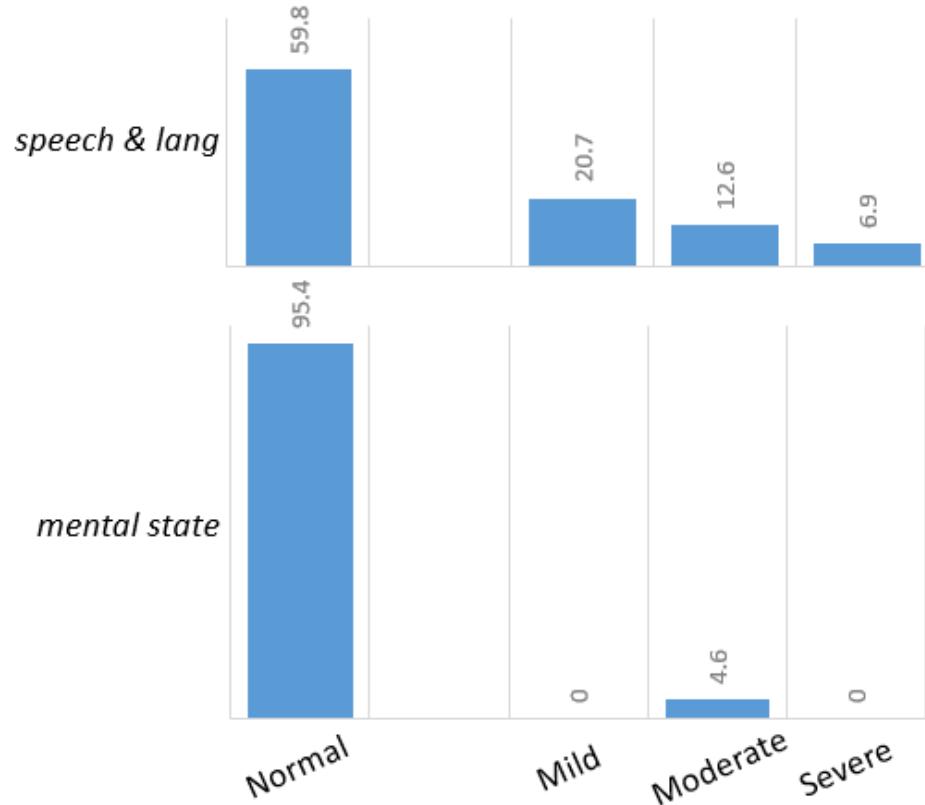
- The domain score suggests less than half exhibited problems with Aggression (40.2%)
- However, subdomain scores reveals *irritability* was highly characteristic (66.7% of total sample), the majority of which was rated ‘mild – moderate’ severity (75.7%)



# NBD Observed in TBI Community Sample: Communication



- Evidence of further dissociation within NBD domains
- Communication score not consistent with difficulties of this type across the sample (81.6%)
- But nearly half (40.2%) rated as having predominantly 'mild' symptoms with regard to *speech & language*
- In contrast, only 4.6% achieved ratings regarding *mental state* that fell below the range for neurologically healthy controls



# NBD Observed in TBI Community Sample: study aim 1

## Goal 1

Further investigate the utility of SASNOS by investigating NBD exhibited by TBI survivors in the community.

## Findings

- NBD widespread and of variable severity – only 8% no significant symptoms.
- Problems with Interpersonal Relationships and Cognition were endemic, nearly half had issues with Aggression too.
- Subdomain scores especially instructive: tendency towards severe difficulties with *relationships, attention & memory* and *irritability*; most also had difficulties with *social inhibition* and *speech & language*, although these were predominantly ‘mild’.

# NBD Observed in TBI Community Sample: study aim 2

## Goal 2

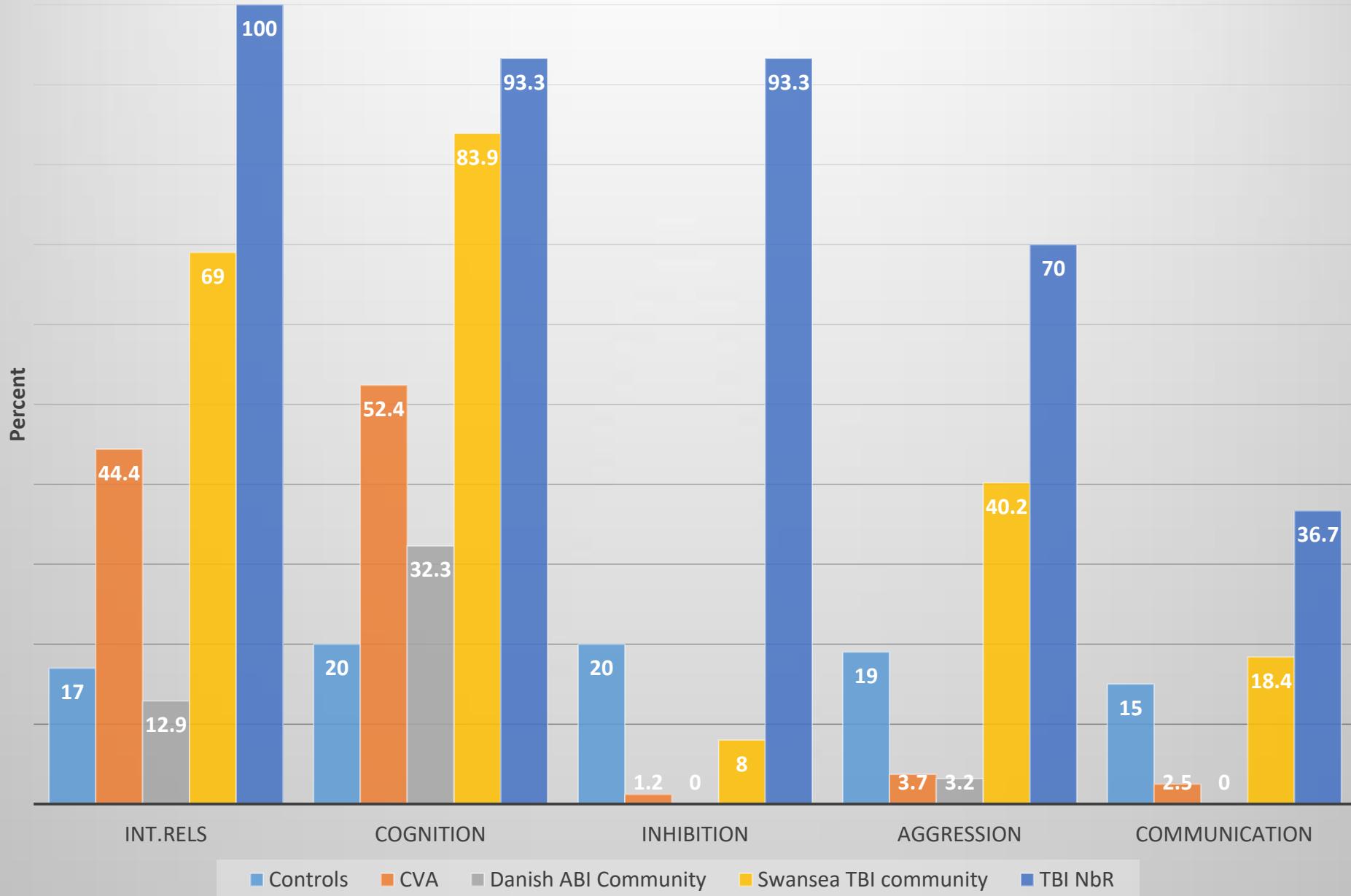
Compare NBD found in other contexts/samples, and especially ascertain if it is as uncommon in the Danish ABI community sample

## Method

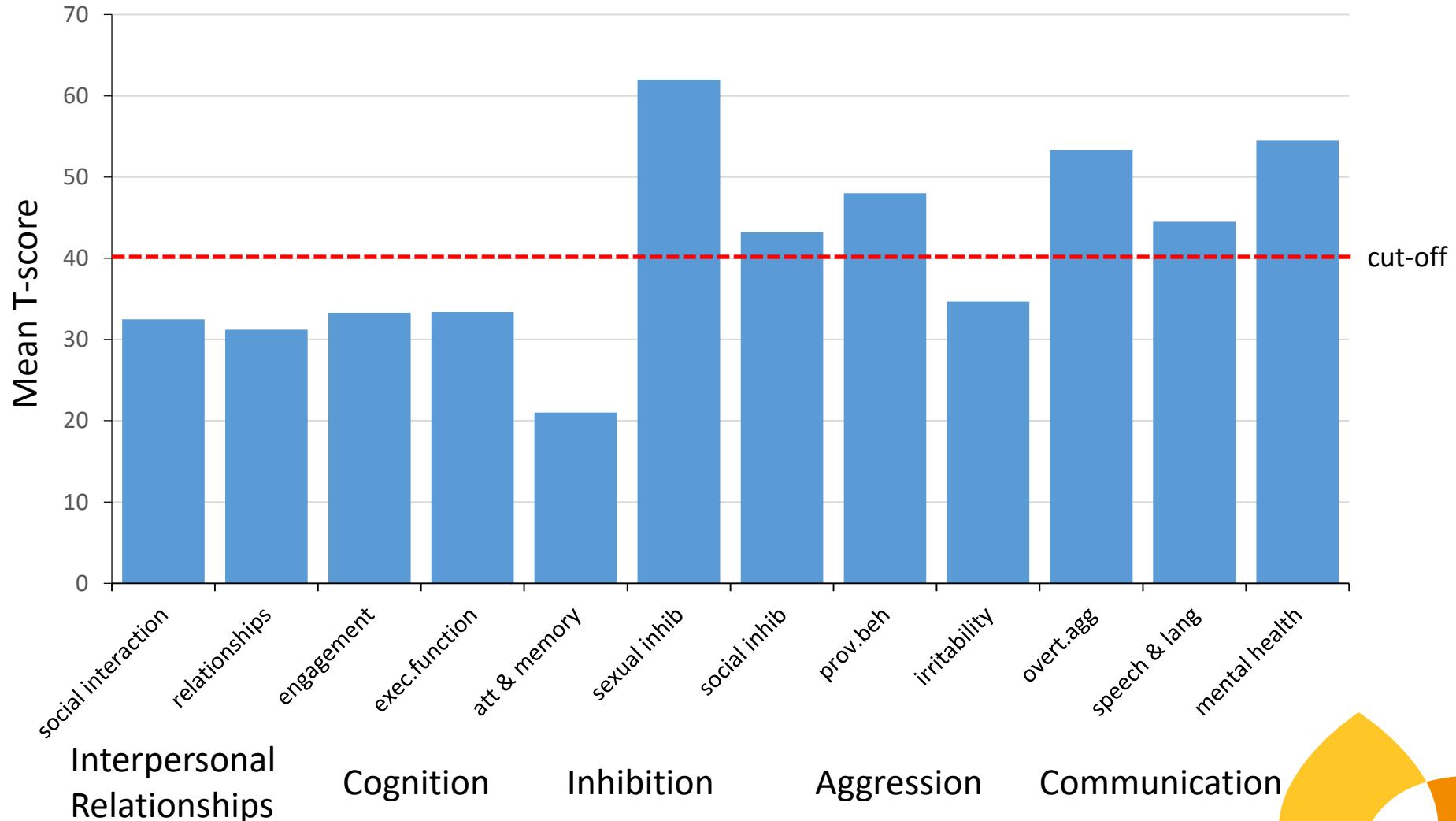
Investigated magnitude of subdomain mean differences (ES) between the Swansea sample with the NbR, CVA rehabilitation and Danish community samples



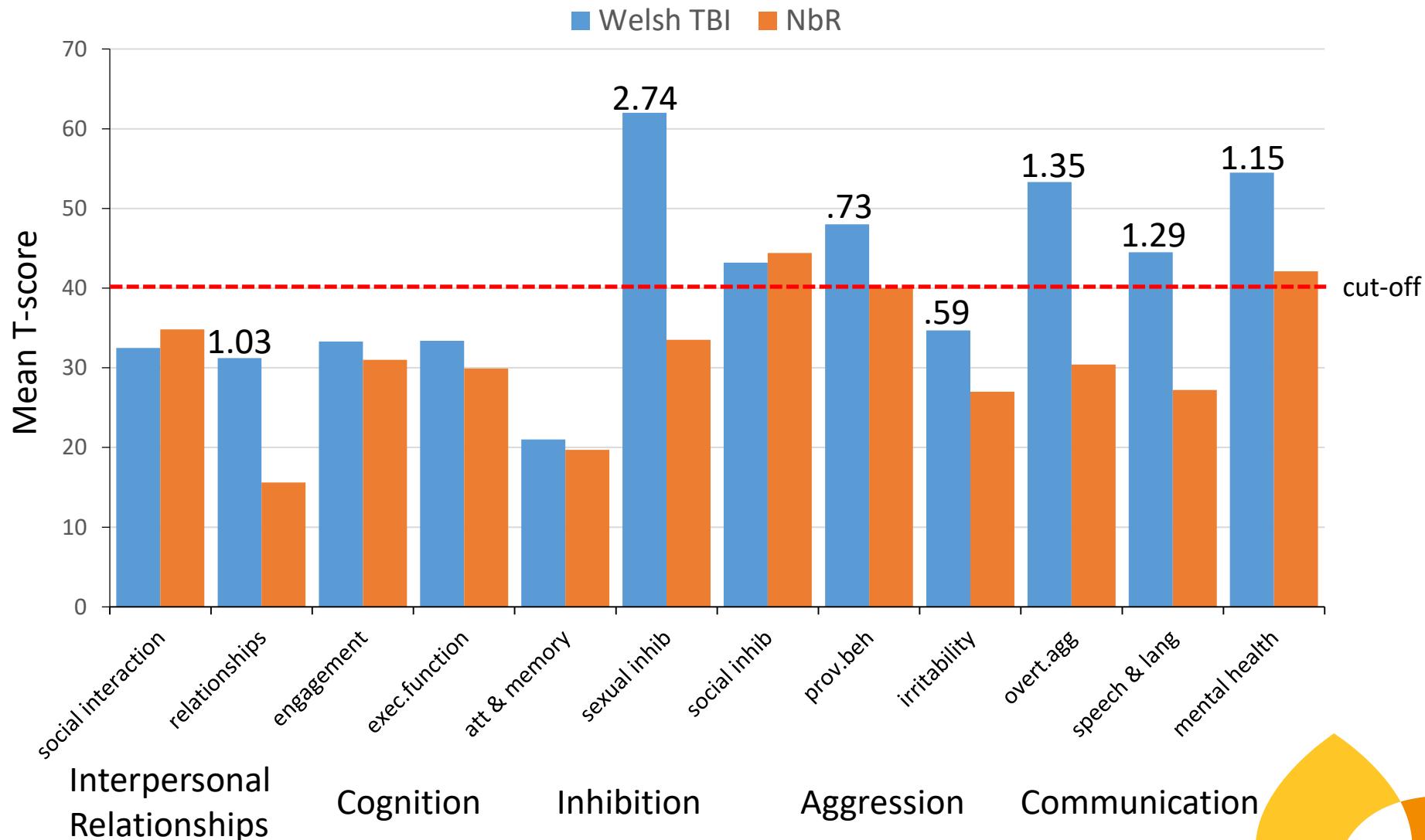
# SASNOS Percentage Rated as Exhibiting Mild – Severe NBD Symptoms



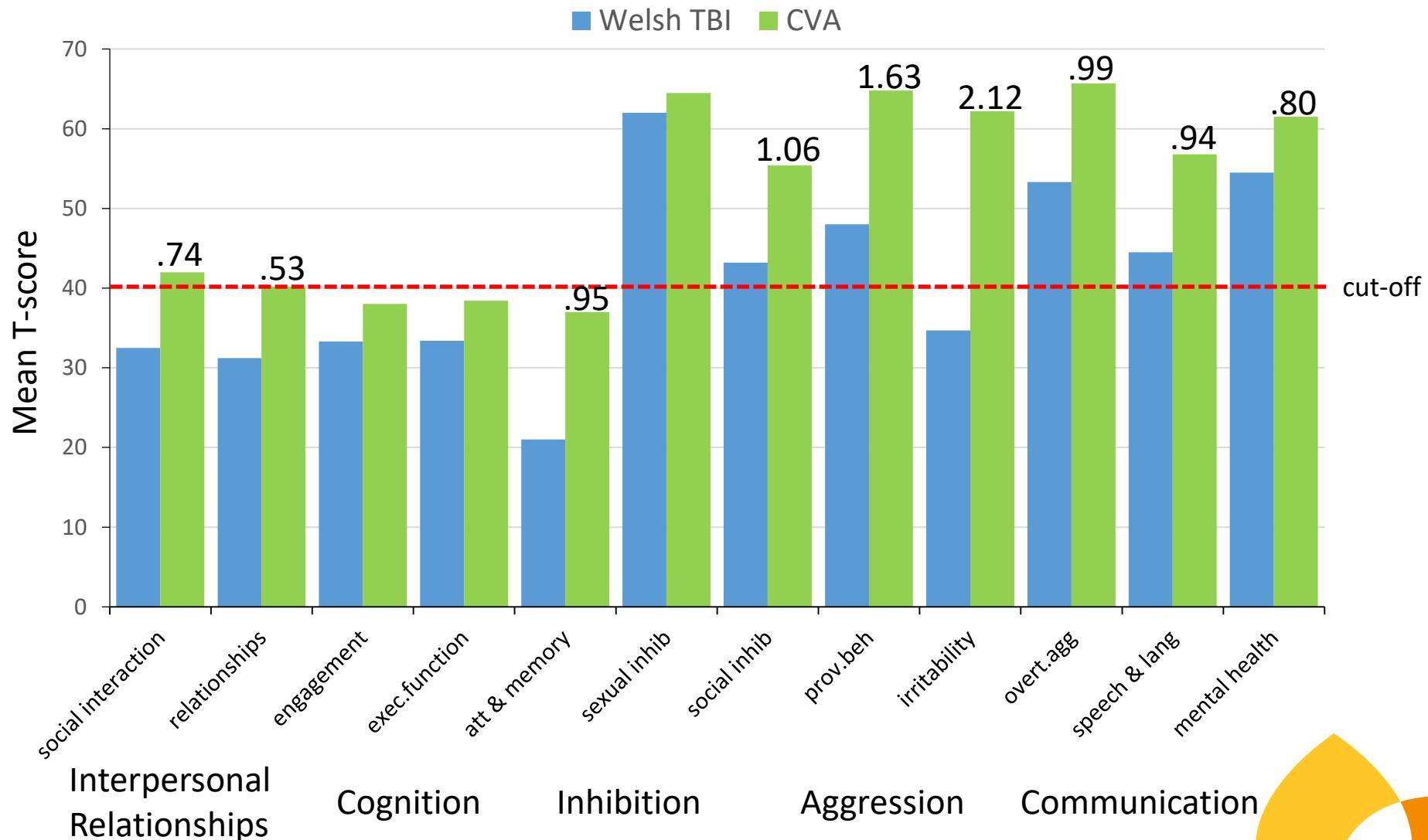
# Swansea Community TBI Cohort: SASNOS subdomains



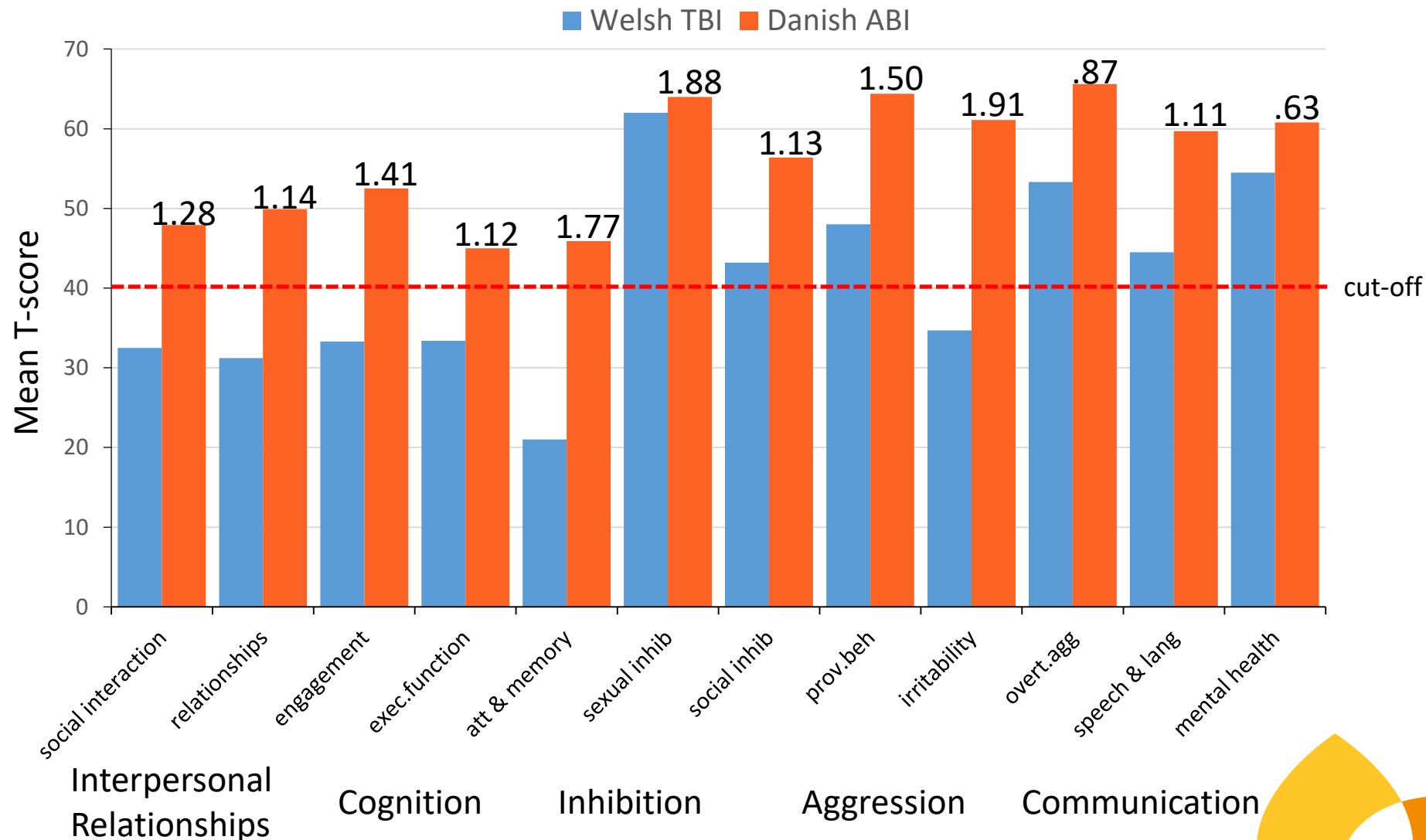
# Swansea Community TBI vs. NbR Cohorts: comparison of SASNOS subdomains (ES 'medium' or greater)



# Swansea Community TBI vs. CVA Rehabilitation Cohorts: comparison of SASNOS subdomains (ES 'medium' or greater)



# Swansea TBI vs. Danish ABI Community Cohorts: comparison of SASNOS subdomains (ES 'medium' or greater)



# NBD Observed in TBI Community Sample: study aim 2

## Goal 2

Compare NBD found in other contexts/samples, and especially ascertain if it is as uncommon in the Danish ABI community sample

## Findings

- Aspects of NBD similar between Swansea community TBI sample and that observed in NbR.
- Likewise, NBD more evident in Swansea sample than observed in CVA rehabilitation.
- Major differences in assessments of NBD between the 2 community samples; ES magnitude ‘medium’ on all 12 subdomains, but Swansea sample notably worse (< 40) for *social interaction, relationships, engagement & irritability*.

# NBD Observed in TBI Community Sample: study aim 3

## Goal 3

Investigate potential issues regarding poor awareness and lack of insight by comparing self and proxy SASNOS assessments.

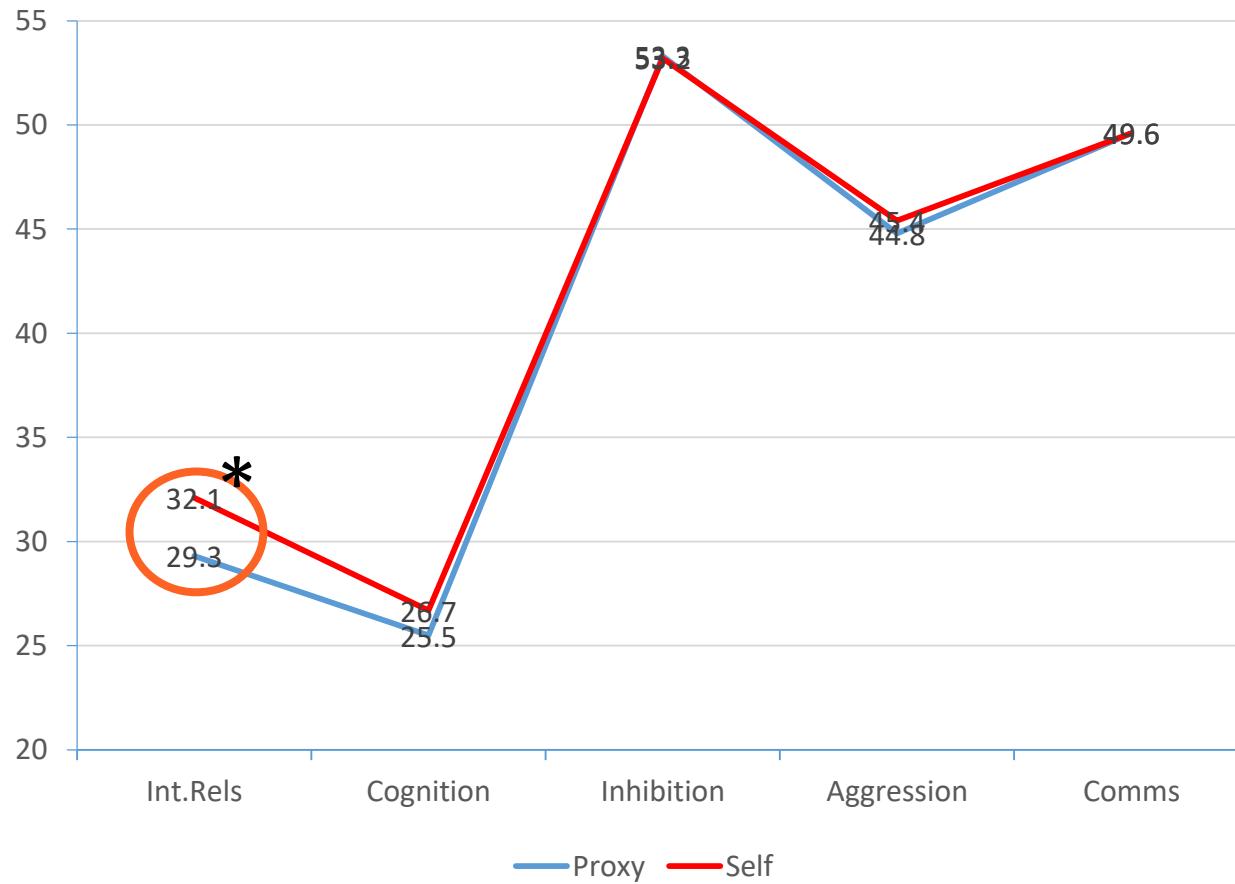
## Findings

Compare mean differences using t-tests and ES; also consider data as absolute agreement between pairs of raters (equivalent to inter-rater reliability) determined using weighted kappa as a means of inferring the degree of awareness/insight.



# NBD Observed in TBI Community Sample: study aim 3

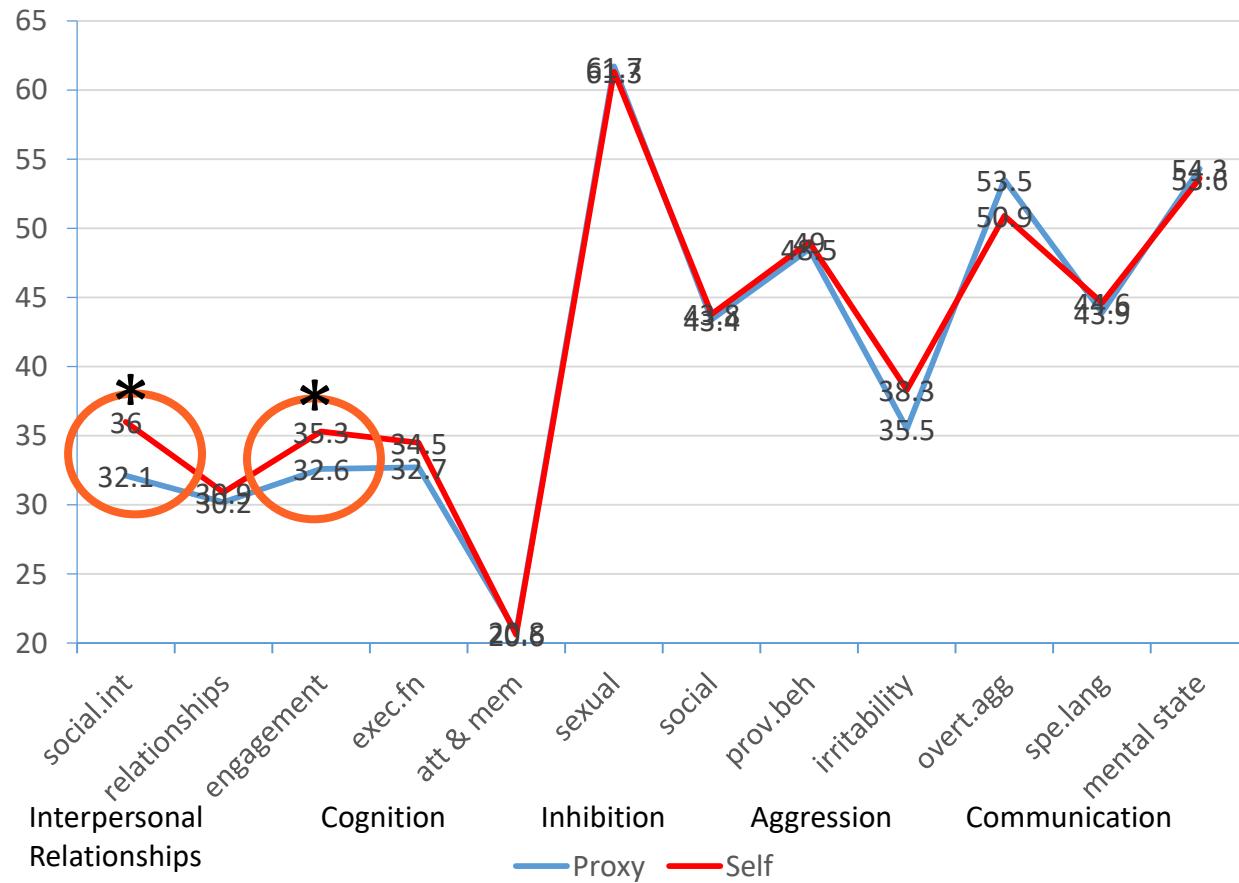
Comparison of mean ratings between proxy and self-ratings:  
SASNOS domains



- a) \*Paired t-test,  $p < .50$   
b) ES range 0 – .18 ('trivial')

# NBD Observed in TBI Community Sample: study aim 3

Comparison of mean ratings between proxy and self-ratings:  
SASNOS subdomains



- a) Paired t-test,  $p < .50$
- b) ES range .01 – .29 ('trivial – small')

# NBD Observed in TBI Community Sample: study aim 3

Weighted Kappa  
coefficients reflecting  
the extent of  
absolute agreement  
between self and  
proxy SASNOS ratings  
(\*Altman, 1991)

Domains & Subdomains	Weighted Kappa	Strength of Agreement*
<b>Interpersonal Relationships</b>	.50	moderate
Social Interaction	.29	fair
Relationships	.44	moderate
Engagement	.39	fair
<b>Cognition</b>	.40	fair
Executive Function	.35	fair
Attention & Memory	.28	fair
<b>Inhibition</b>	-.06	poor
Sexual	.24	fair
Social	-.03	poor
<b>Aggression</b>	.46	moderate
Provocative Behaviour	.65	good
Irritability	.45	moderate
Overt Aggression	.00	poor
<b>Communication</b>	.12	poor
Speech & Language	.34	fair
Mental State	.29	fair

As variability greatly reduced by considering agreement in terms of the four categories of severity, threshold to reflect acceptable agreement of .75 employed

# NBD Observed in TBI Community Sample: study aim 3

## Goal 3

Investigate potential issues regarding poor awareness and lack of insight by comparing self and proxy SASNOS assessments.

## Findings

- TBI survivors did perceive themselves as having NBD difficulties.
- As predicted, tendency to not rate these as severely as proxy.
- However, mean differences were small; most were neither statistically significant (t-test) or large enough to be meaningful (ES).
- Answering question by determining absolute agreement between raters failed to meet the minimum threshold, suggesting there may in fact be disparity.



# NBD Observed in TBI Community Sample: study aim 4

## Goal 4

Ascertain prediction models of NBD from the range of independent variables available

## Method

Initially identify potential predictors from the range available using univariate analysis for each SASNOS domain/subdomain; then used ordinal logistic regression to determine prediction models from these of severity NBD:

- enables building prediction models using both continuous and ordinal variables
- used for model building when the dependent variable is an ordered categorical variable (0 – 3)



# NBD Observed in TBI Community Sample: potential predictors of SASNOS NBD measures

## Continuous Variables

- age at assessment
- age at injury
- time since injury (years)
- time in formal education (years)
- WTAR predicted full-scale IQ
- DEX-O
- BDI-II
- BAI

## Binary (Categorical) Variables (0, 1)

- gender
- severity of TBI (mild/moderate vs. severe PTA)
- relationship status pre & post-injury
- paid employment pre & post-injury
- employment status pre & post-injury
- psychiatric history pre-injury
- relevant medical history pre-injury
- neurological history pre-injury
- DEX-O, BDI-II, BAI scores (above/below cut-off)

## Predicted (Dependent) Variables

SASNOS domain & subdomain scores assigned to one of four ordered categories of severity ('none', 'mild', 'moderate', 'severe') coded 0 – 3\*

\* Scores above 39.9 were considered to fall within the normal range; and otherwise categorised as 'mild' (30 – 39.9), 'moderate' (20 – 29.9) and 'severe' ( $\leq 19.9$ ) following Stolwyk et al. (2018)

# NBD Observed in TBI Community Sample: study aim 4

SASNOS Domain	Variables in initial model	Variables in final model	Chi-square	p	Pseudo R <sup>2</sup>
Interpersonal Relationships	Sex, TSI, BDI, DEX	Sex, BDI, DEX	42.64	<.001	.465
Cognition	Sex, LDH, NH, BDI, DEX	Sex, DEX	51.04	<.001	.507
Inhibition	TSI, LDH, NH, BAI, DEX	DEX	29.96	<.001	.561
Aggression	LDH, YEd, DEX	DEX	33.25	<.001	.396
Communication	TSI, BDI, DEX	-	3.83	.072	.258

SASNOS Subdomain	Variables in initial model	Variables in final model	Chi-square	p	Pseudo R <sup>2</sup>
overt aggression	MH, YEd, DEX	MH, DEX	18.19	<.001	.304
speech & language	Age, BDI, DEX	Age, DEX	9.53	.009	.128
mental state	TSI, DEX	TSI, DEX	6.70	.030	.258

TSI – Time Since Injury; BDI – Beck Depression Inventory; BDA – Beck Anxiety Inventory; LDH – Learning Disability History pre-TBI; NH – Neurological History pre-TBI; MH – Medical History pre-TBI; YEd – Years Education

# NBD Observed in TBI Community Sample: study aim 4

## Goal 4

Ascertain prediction models of NBD from the range of independent variables available

## Findings

- Range of univariate predictors of NBD found from those available
- Extent of executive impairment, depressed mood and being male were best predictors
- Best single predictor was the extent of executive impairment; predictive ability increased when combined with gender and depressed mood for most prevalent NBD domains

# NBD Observed in TBI Community Sample: Conclusions, NBD in the community (H1, H2)

1. In isolation, study of the Swansea sample suggests NBD is highly characteristic of TBI survivors in the community
2. Compared to other samples, intuitively sits about where expected regarding prevalence/severity between rates found in NbR and stroke rehabilitation
3. Main area of contention is lack of consistency with findings from the Danish ABI community sample where NBD was uncommon



# NBD Observed in TBI Community Sample: Conclusions, NBD in the community (H1, H2)

## Consider:

1. Sample representativeness (those with most severe difficulties excluded)
2. Time since injury (Danish sample assessed earlier)
3. Focal organic component (note NBD most prolific amongst stroke survivors with anterior lesions, Swansea sample all TBI)
4. National differences



# NBD Observed in TBI Community Sample: Conclusions, NBD in the community (H1, H2)



Tuesday, Nov 5th 2019 3PM 11°C ☁

## Why are people from Denmark so happy? It's all in their DNA

- University of Warwick researchers investigated why Danes are so happy
- The country regularly tops polls of the world's happiest people
- They found there was a correlation between Danish genes and happiness
- And they also discovered people with Danish ancestry were more likely to have a positive outlook on life
- Last year's World Happiness Report ranked Denmark as the happiest nation on Earth



### THE WORLD'S HAPPIEST PEOPLE

Last year's World Happiness Report from the United Nations ranked Denmark the happiest nation on Earth, with an average life satisfaction score of 7.69 out of 10.

It was followed by four other northern European countries, Norway, the Netherlands, Switzerland and Sweden.

The UK was ranked 22nd on the list of 156 countries, with a score of 6.88.

## NBD Observed in TBI Community Sample: Conclusions, NBD in the community (H1, H2)

Also Consider:

1. Although there are differences, there are also similarities – consistent finding across all four studies was highest NBD prevalence in Interpersonal Relationships and Cognition domains
2. High prevalence of focal NBD symptoms reported in other ABI community samples...



# NBD Observed in TBI Community Sample: Conclusions, NBD in the community (H1, H2)

- Challenging behaviour, Kelly et al. (2008) found 85% engaged in aggressive behaviour (including 41% physical aggression) and this increased over time
- Challenging behaviour, Sabez et al. (2014) found overall rate of 54% in TBI survivors, especially inappropriate social behaviour and aggression
- Cognitive impairment, Rabinowitz & Levin (2014), long term difficulties with memory, attention, executive functioning and processing speed in 15% of mild TBI survivors and 65% moderate-to-severe TBI survivors
- Difficulties with executive functioning common regardless of severity, underlies many symptoms of NBD including social cognition
- Low levels of emotional empathy reported by 60.7% TBI vs. 31% controls (Wood & Williams, 2008)
- Alexithymia found in 57-72% TBI vs. 7-12% general population



# NBD Observed in TBI Community Sample: Conclusions, NBD in the community (H1, H2)

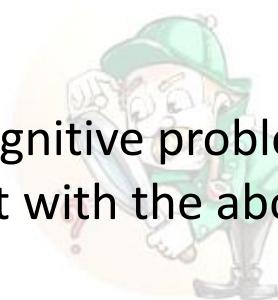
Behaviourally, some TBI survivors present as:

*“Lacking social tact, discretion, selfish, engaging in socially immature behaviour, are egocentric, self-centred, unresponsive to the needs of others, lacking emotional affection and relational commitment with loved ones”*

Loss of emotional responsibility, lack of mutual support and companionship, and reduction in overt acts of affection results in relationship breakdowns and diminution of social networks

This may account for consistent SASNOS findings with problems with Cognition driving many NBD symptoms in the other domains, especially Interpersonal Relationships

Key finding here was trend in predominantly severe cognitive problems paralleled by those in relationships, which is consistent with the above



# NBD Observed in TBI Community Sample: Conclusions, insight & awareness

- Difficulties with insight/awareness not evident when tested using tests of statistical significance or ES
- However, considering concordance between proxy and self ratings as equivalent to inter-rater agreement, there was some evidence of lack of absolute agreement which may reflect some difficulties
- Not as great as samples where greater range outcomes, e.g. Cooper-Evans et al. (2008) showed mixed concordance between ratings in NbR setting where awareness appeared to be related to severity of outcomes as a whole (DEX difference between means ES = 1.49)



# NBD Observed in TBI Community Sample: Conclusions, predictors of NBD

We found executive impairment, depressed mood and being male formed the best predictive models of NBD

Consistent with other studies:

Stolwyk et al. (2018):

- positive correlation between anxiety/depression and NBD
- negative correlation between cognitive function and NBD

Soendergaard et al. (2019):

- negative correlation between TSI and SASNOS Cognition domain



# NBD Observed in TBI Community Sample: Conclusions, predictors of NBD

Sabaz et al. (2014) regarding challenging behaviour post-ABI:

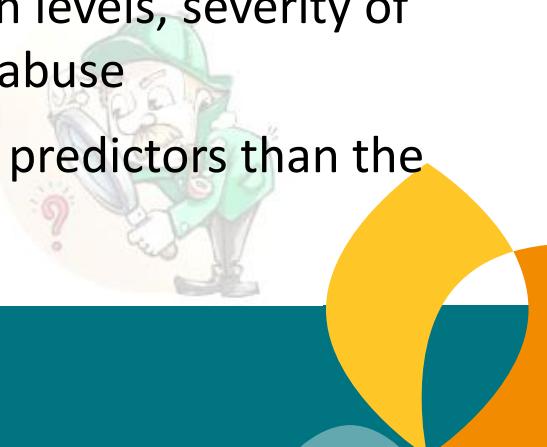
- Consistent with our study, found CB associated with depression and being male

Also highlighted associations between CB and:

- Damage to anterior brain structures
- Premorbid aggressive behaviour, mental health problems and drug/alcohol abuse
- Time since injury
- Decreased functional abilities, psychosocial participation
- Increased care needs

Best predictive model consisted of: current participation levels, severity of comorbid mental health problems & pre-injury alcohol abuse

Highlights need to capture a broader range of potential predictors than the opportunistic ones considered here in any future study



# NBD Observed in TBI Community Sample: Summary

- Study highlighted potentially high prevalence of NBD in community TBI
- Fulfilled the authors prediction the instrument could “*...discriminate between different neurological populations*”
- Further evidence of applications required, especially to resolve issues of sample representativeness highlighted here
- A prospective, longitudinal study of NBD is indicated – psychometric properties of SASNOS confirm its reliability in repeated measurement context
- Consider broader range of potential predictors drawing from the existing literature – LD may be especially interesting, whilst did not feature in the final models it did have associations with NBD; Chester et al. (2017) found high prevalence of self-reported TBI in a forensic LD population (67%)
- Longitudinal study would provide valid and reliable information about the natural progression of NBD and the effectiveness of rehabilitation interventions to reverse it



# Thanks for listening!



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