CANCER-RELATED COGNITIVE IMPAIRMENT (CRCI) AND COGNITIVE SCIENCE NETWORK

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CANCER-RELATED COGNITIVE IMPAIRMENT

- AKA "chemobrain", "chemofog"
- Cognitive difficulties faced by cancer survivors after treatment
  - Mostly in chemo, but also other treatments
- Persists after treatment for months or years
- Impairments also seen before treatment

COGNITIVE ASSESSMENT CHALLENGES

- Subjective/objective mismatch

- Poor sensitivity

- Disagreement about which domains are impaired

- Disagreement about which tests measure which domains

POOR OBJECTIVE X SUBJECTIVE CORRELATION

Castellon et al. 2004

	CFQ
CFQ	--
Verbal Fluency	.15
Verbal Memory	-.10
Verbal Learning	.03
Visual Memory	.10
Visuospatial	**.33***
Reaction Time	.08
Psychomotor Speed	.03
Executive Attention	.12

Jansen et al. 2007

POOR SENSITIVITY

Meta-analysis

313 studies

2 tests

8 domains

Only 6 tests, in 3 domains, yielded significant effect sizes

Table 3. Effect Sizes for Neuropsychological Tests Used in Studies of Chemotherapy-Induced Impairments

Test	Number of Studies	N	Effect Size	Lower 95% Confidence Interval	Upper 95% Confidence Interval
Attention/concentration					
d2 test	3	316	−0.399192	−0.898373	+0.100013
HSCS attention subtest	2	343	−0.184726	−0.540761	+0.171310
WAIS digit span subtest[a]	2	222	−0.348107	−0.782188	+0.072237
WAIS digit span forward	4	340	−0.023283	−0.542055	+0.495490
WAIS digit span backward	3	235	−0.448912	−0.961065	+0.063241
WAIS spatial span subtest	2	188	+0.008552	−0.442101	+0.459204
Executive function					
Booklet Category Test	2	46	−0.456752	−1.084876	+0.171314
HSCS self-regulation subtest	2	343	−0.258260	−0.615507	+0.008087
Stroop test	4	357	−0.021877	−0.492703	+0.448949
TMT-Part B	9	567	−0.125702	−0.606911	+0.370226
WAIS similarities subtest	2	46	+0.188273	−0.422259	+0.798805
Speed of information processing					
Fepsy binary choice subtest	2	211	−0.105302	−0.573555	+0.362945
Fepsy visual reaction subtest	2	211	−0.501889	−0.978857	+0.160956
Fepsy visual searching subtest	2	211	−0.055699	−0.523706	+0.412307
Paced Auditory Serial Addition Test	2	81	−0.538267	−1.107843	+0.031309
TMT-Part A	8	547	−0.299549	−0.766981	+0.191314
WAIS digit symbol subtest	7	523	−0.375823	−0.816644	+0.100617
Language					
COWA	8	557	−0.332899	−0.791787	+0.125989
HSCS language subtest	2	343	**−0.434461**	**−0.816900**	**−0.096861**
Motor function					
Fepsy finger tapping test	2	211	**−0.599585**	**−1.078915**	**−0.120254**
Grooved pegboard	3	87	**−0.955051**	**−1.684365**	**−0.225752**
HRNB finger tapping	2	213	+0.194945	−0.214320	+0.541522
HSCS psychomotor subtest	2	343	−0.282503	−0.640663	+0.107783
Visuospatial skill					
HSCS spatial subtest	2	343	−0.114439	−0.470401	+0.177954
RCFT copy	4	292	**−0.512445**	**−1.017514**	**−0.007376**
WAIS block design subtest	4	169	**−0.554656**	**−1.106400**	**−0.002912**
Verbal memory					
CVLT	4	216	−0.409361	−0.883348	+0.065488
HSCS memory subtest	2	343	**−0.453015**	**−0.813005**	**−0.093025**
RAVLT	4	328	−0.269487	−0.750206	+0.211232
WMS logical memory subtest	3	216	−0.409361	−0.883348	+0.344564
Visual memory					
RCFT delayed recall	7	514	−0.373973	−0.886677	+0.138735
WMS visual reproduction subtest	4	339	−0.194879	−0.625094	+0.235345

Horowitz et al. (2019)

DISAGREEMENT ABOUT WHICH DOMAINS ARE IMPAIRED

Anderson-Hanley, Sherman, Riggs, Agocha, & Compas, 2003

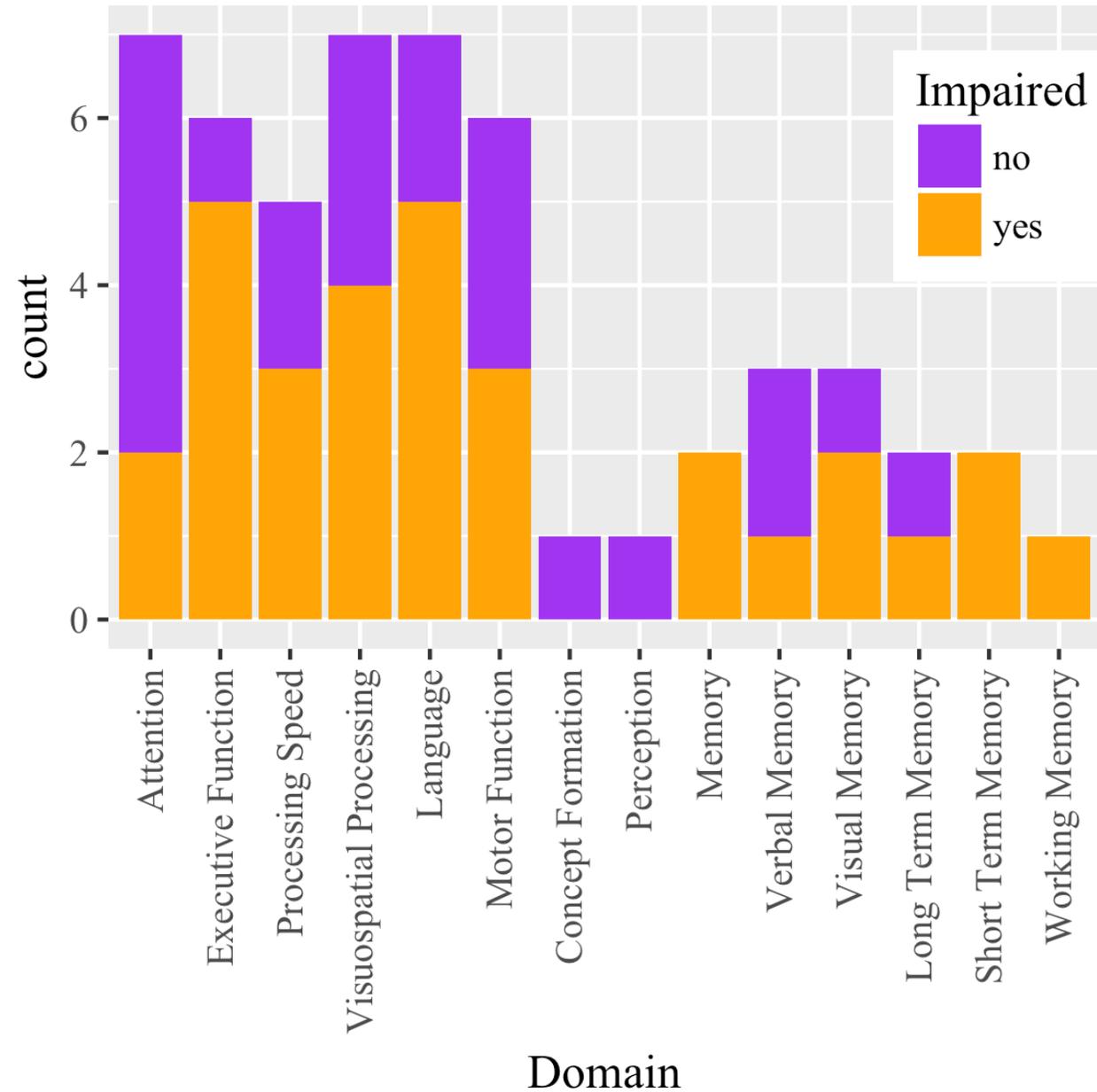Falleti, Sanfilippo, Maruff, Weih, & Phillips, 2005

Hodgson, Hutchinson, Wilson, & Nettelbeck, 2013

Jansen, Miaskowski, Dodd, Dowling, & Kramer, 2005

Jim et al., 2012

Ono et al., 2015

Stewart, Bielajew, Collins, Parkinson, & Tomiak, 2006

DISAGREEMENT AS TO WHICH TESTS MEASURE WHICH DOMAINS

Horowitz et al., 2019

Proportion of tests

CLASSIC NEUROPSYCHOLOGY PARADIGM IS NOT A GOOD FIT FOR CRCI

- Designed for focal lesions, not diffuse damage

- Tests that draw on multiple faculties

- Drawbacks of traditional test setting

  - Time consuming

  - Inflexible paper-and-pencil format

  - Labor-intensive

  - In person

COGNITIVE-SCIENCE-INFORMED NEUROPSYCHOLOGY?

- Improved sensitivity

- Theoretically-motivated tests designed to measure specific cognitive functions

- Neuroscience measures (e.g., EEG)

- Flexible computerized testing

NCI INITIATIVES IN CRCI

- FOA
- SBIR
- Bridging project
- CRCI network

Department of Health and Human Services

Part 1. Overview Information

Participating Organization(s)	National Institutes of Health (NIH)
Components of Participating Organizations	NATIONAL CANCER INSTITUTE (NCI)
Funding Opportunity Title	Leveraging Cognitive Neuroscience to Improve Assessment of Cancer Treatment-Related Cognitive Impairment (R01 Clinical Trial Optional)
Activity Code	R01 Research Project Grant

LEVERAGING COGNITIVE NEUROSCIENCE TO IMPROVE ASSESSMENT OF CANCER TREATMENT-RELATED COGNITIVE IMPAIRMENT

- RO1s and R21s

- Expires June 09, 2022

- Currently funding 4 projects

  - Ahles: Assessment of sensory gating, attention, and executive control in breast cancer

  - Chao: Neurocognitive Changes from Long-Term Androgen Deprivation Therapy in Prostate Cancer Patients

  - Janelsins: Translational Neuroscience Approaches to Cancer-Related Cognitive Impairment: Measurement, Mechanisms, and Function

  - Sussman: Characterization of brain dysfunction during development in survivors of childhood acute lymphoblastic leukemia

SBIR TOPIC 343: AN ELECTRONIC PLATFORM FOR COGNITIVE ASSESSMENT IN CANCER PATIENTS

- Holt: MindCap: Monitoring for Cognitive Impairment and Dysfunction in Cancer Patients

- Winder: Cognitive Assessment and Monitoring Platform For Integrative Research (CAMPFIRE II)

- Allen: Neuropsychological assessment system for cancer patients

BRIDGING PROJECT

- Use factor analysis to relate neuropsychological tests and cognitive psychology paradigms

- Attention domain

- General population: N = 646

- Cancer survivors: N = 314

CRCI-COGNITIVE SCIENCE NETWORK

- Goal: facilitate collaboration between CRCI community and cognitive scientists

- Identify barriers and issues

- 17 (non-NCI) members:

  - Clinical oncologists

  - Neuropsychologists

  - neuroscientists

CRCI-COGNITIVE SCIENCE NETWORK

- Expand the universe of clinicians interested in CRCI research
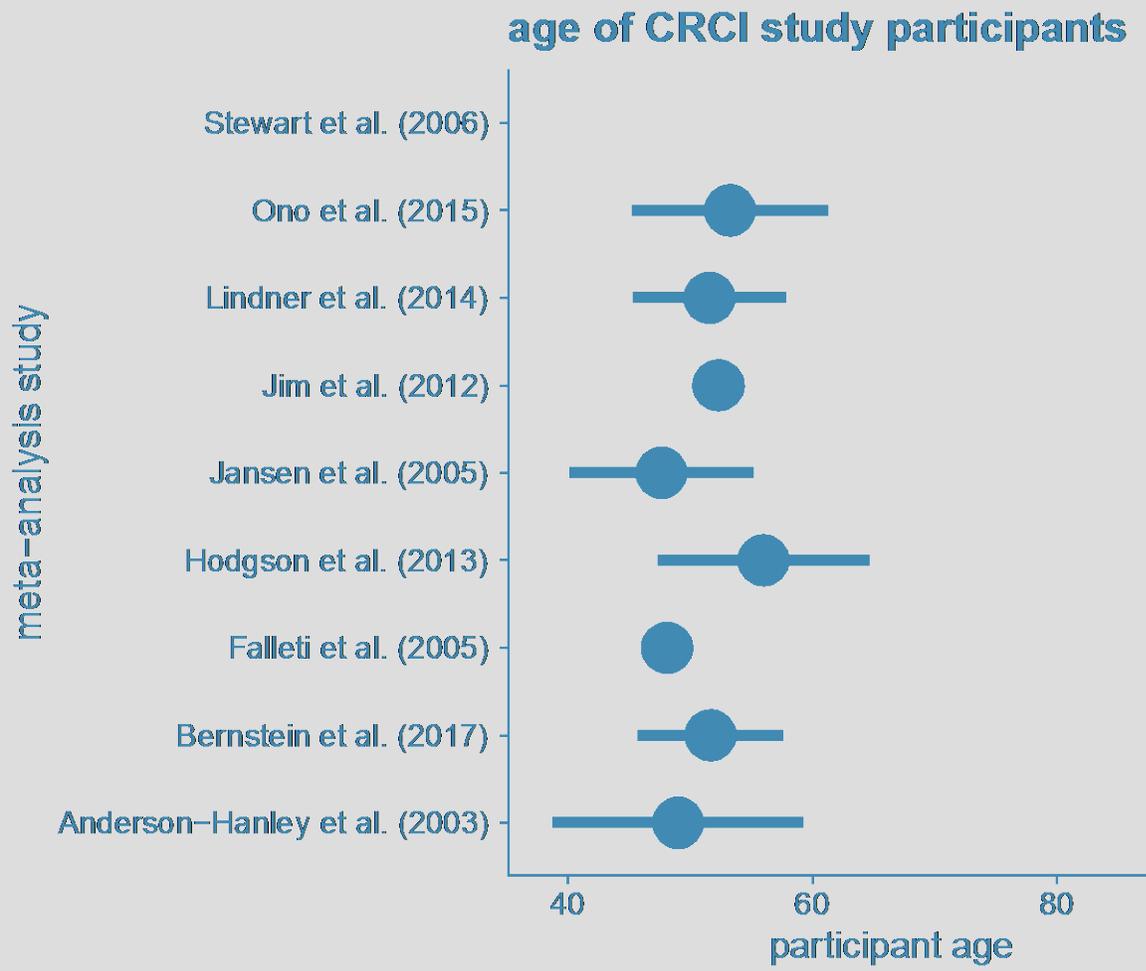
- Increase diversity of populations and cancer sites
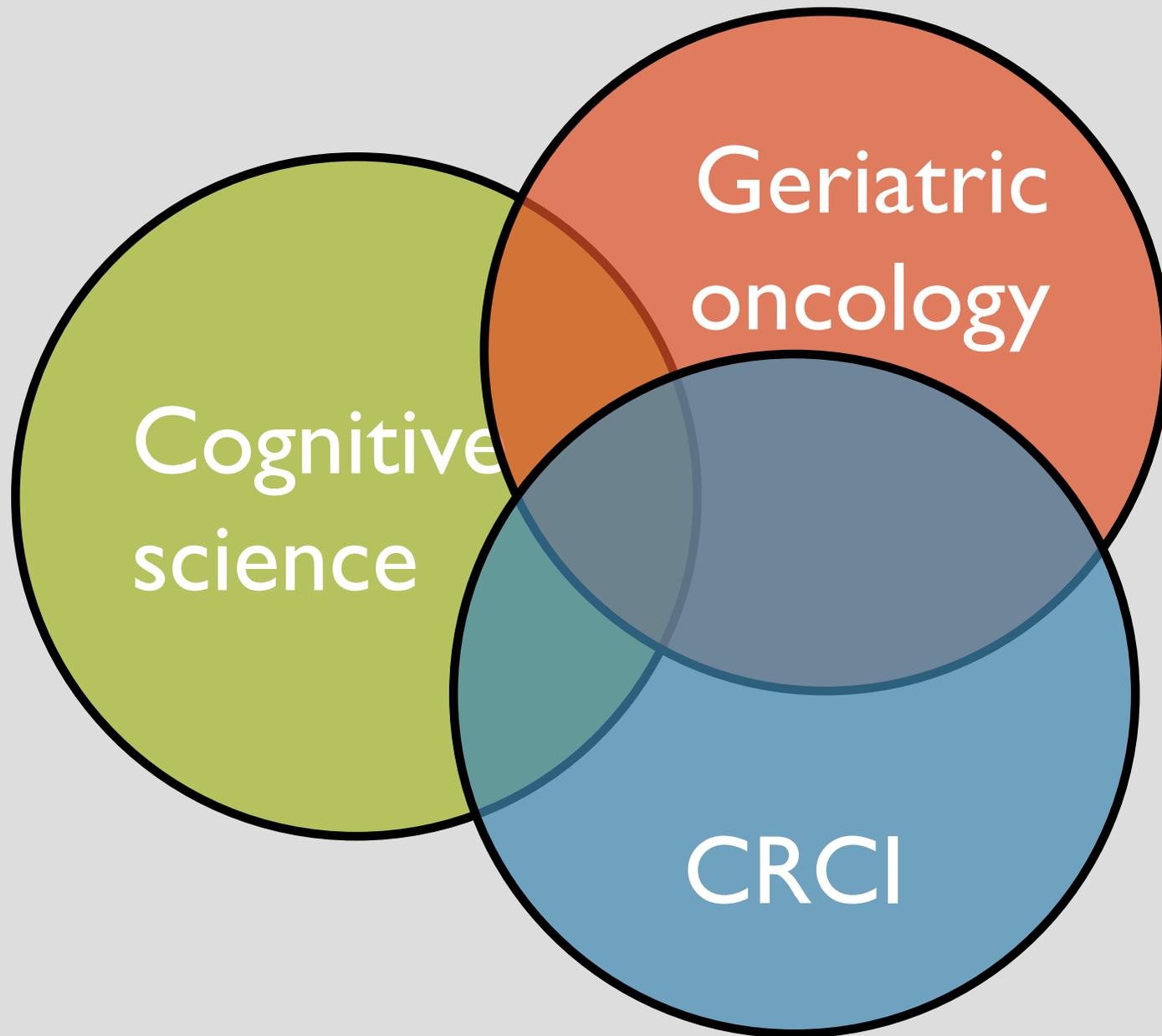
CRCI PARTICIPANTS ARE OVERWHELMINGLY MIDDLE-AGED

Data from 9 meta-analyses

A GERIATRIC CRCI RESEARCH AGENDA

- Importance of cognition for older patients' ability to participate in treatment and follow-up care decision making

- Cognitive function as an alarm system?

  - Can cognitive changes serve as a toxicity indicator during treatment?

  - Can cognitive science methods be used to predict risk of CRCI?

A GERIATRIC CRCI RESEARCH AGENDA

- Disaggregating the "R" in CRCI
  - Cancer
  - Psychosocial effects of being a cancer patient
  - Treatment
  - Aging
  - Multi-morbidity

THANK YOU!

- Questions? Interested in joining the network? Email me todd.horowitz@nih.gov

- Thanks to Paige Green for useful input on the talk