

Social cognition in people with HIV: a neglected cognitive domain?

Karl Goodkin^a and David Dorfman^b

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The recently published article by Vance and Lee [1] is highly relevant to the agenda of how best to advance our knowledge of social cognition today related to people with HIV (PWH). With long-term viral suppression due to combination antiretroviral therapy, PWH currently can now look forward to a lifespan approaching that of the general population. The next step in optimizing treatment outcomes is to maximize functional status in activities of daily living and quality of life. Vance and Lee [1] define the domain of social cognition, integrate the social cognitive domain with underlying research in social neuroscience, and relate it to specific brain regions as well as to the Theory of Mind, prosody, facial emotion recognition, and cognitive and emotional empathy. The differentiation of the domain of social cognition from other more traditional areas of cognitive performance is also addressed. Moreover, the domain of social cognition is related to its impact upon functional status in activities of daily living. Further, they integrate research expanding into the social conceptual domains of stereotypes, implicit social bias, and stigma. Finally, they address the largely unexplored area of the implications of research in the domain of social cognition for cognitive and functional status impairment amongst PWH and the development of interventions necessary to address these deleterious outcomes. The authors should be commended for assembling the results of research across such a great breadth of work and applying it to the needs of PWH.

Given the clear significance for the field, we will endeavor to amplify aspects of their article [1] to further delineate its

potential impact on future research. A basic issue is the definition of the domain of social cognition itself. Social cognition has been referred to as a domain that broadly includes cognitive processes used to decode and encode the social world. Vance and Lee refer to a definition of social cognition as the ability to perceive social stimuli, interpret their meaning, respond appropriately, and navigate dynamic social environments including professional and personal relationships in order to secure interpersonal and external resources for effective social functioning [1]. Perhaps, an alternative definition of social cognition would be the processes used to perceive other people and the self as social objects, the cognitive filter through which others are perceived, and the fund of social knowledge enabling people to manage life tasks and stressors [2]. While an initial focus regarding social cognition research involved schizophrenia, social cognition has since evolved into a much broader perspective. A variety of models have been developed to operationalize this domain, yet there has been a relative dearth of well validated measures with which to assess them [3].

With respect to specifying social cognition, this domain might be most properly regarded as “thinking about interacting with others” rather than “the ability to interact with others” *per se*. The primary neurocognitive ability domains typically investigated in the literature with respect to PWH are attention/concentration, processing speed, verbal learning and memory, abstraction/executive function, working memory, motor function, and language. While there are significantly overlapping areas

^aAdvancing Clinical Therapeutics Globally for HIV/AIDS and Other Infections (ACTG) [formerly the AIDS Clinical Trials Group], Los Angeles, California, and ^bIcahn School of Medicine at Mount Sinai, New York, New York, USA.

Correspondence to Karl Goodkin, MD, PhD, AIDS Clinical Trials Group at UCLA, Department of Medicine (ID), 11075 Santa Monica Blvd, Suite 100, Los Angeles, CA 90025, USA.

Tel: +1 310 994 1892; e-mail: kgoodkin@att.net

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of “social cognition” across these “primary neurocognitive ability” domains, they are best represented as two separate domains rather than as a single domain overall [4]. Thus, it is appropriate to consider social cognition as a separate neurocognitive domain within what would be more broadly considered neurocognition rather than limiting the domain to characteristics of the “primary neurocognitive domains.”

The authors describe facial emotion recognition/perception, prosody, the Theory of Mind, and empathy as aspects of the social cognitive domain. The delineation of subdomains of social cognition is critical, given the insufficient attention that has been paid to date to the areas of performance that together comprise the domain as a whole. To further amplify this point, the designated social cognitive subdomain of “Theory of Mind” is relevant. Theory of Mind is described as the ability to infer and understand the mental states (e.g., beliefs or intentions) of oneself and others. In this regard, a noteworthy study by Bradford *et al.* [5] examined the extent to which “self” versus “other” belief attributions are made within the Theory of Mind mechanism. Specifically, using a computerized false-belief task, participants showed longer reaction times when attributing beliefs to other people versus oneself. Further, reaction times were longer when the perspective shift was from self-to-other rather than from other-to-self, suggesting that adopting another person’s perspective requires more cognitive effort than recalling or reflecting upon one’s own self-oriented belief states.

Another subdomain within the social cognitive domain is empathy, encompassing both its cognitive and emotional aspects. Vance and Lee [1] distinguish cognitive empathy (based upon the understanding of the emotional states of others) from emotional empathy (based upon feeling the emotional states of others). They had also referred to “automatic” and “explicit” empathy, linking the former to emotional empathy and the latter to cognitive empathy. Other aspects of empathy that have been examined are “reflective” empathy as an aspect of emotional empathy and “implicit” empathy (as opposed to implicit social cognition more generally) as an aspect of cognitive empathy. “Reflective” emotional empathy involves mentalizing, such as visual perspective taking and imagining another person’s guess about what a third person believes [6]. “Implicit” cognitive empathy refers to a rapid process not requiring effort or conscious thought, versus the slower, effortful, conscious “explicit” cognitive empathic process. While empathy enables the sharing of others’ emotions and may result in empathic distress or in compassion, the Theory of Mind provides the cognitive understanding of others’ thoughts or intentions [7]. The Theory of Mind and empathy are both multidimensional constructs. When a cognitive empathic response is generated, the cognitive Theory of Mind network and the affective Theory of Mind

network are typically both involved. However, the emotional empathic response is driven mainly by simulation and involves brain regions that mediate emotional experiences [8]. These issues highlight the need for further research to differentiate subdomains within the social cognitive domain as well as to define social cognition overall versus what might be referred to as the “primary neurocognitive domains.”

Vance and Lee [1] note that impaired social cognition is related to decreased social functioning among PWH. In addition, they cite evidence that lower-than-normal recognition of anger in facial expressions is linked to higher distress related to the need to maintain social connectedness [9] and that facial emotion recognition accuracy is associated with social ability [10]. Decreased social ability may also be related to increased social withdrawal, which has been associated with deficits in the “primary neurocognitive domains” among PWH, and to decreased social engagement. In turn, these effects would be expected to result in increased social isolation and loneliness, particularly among older PWH [11].

Decreased social cognition can be worsened by the impact of stigma, as noted by the authors [1]. In this regard, it may be of additional value to profile intersecting stigmas across multiple areas: HIV infection itself, race, ethnicity, socioeconomic status, sexual minority status, psychoactive substance use, and aging. However, the impact of social cognition extends beyond stigma to social support. Social support is generally assessed through its availability – by the size of one’s social support network. Beyond social support availability, however, social support can also be characterized by the level of satisfaction with the social support obtained and by the sufficiency of the social support to the needs required. Moreover, social cognition extends beyond all of these parameters of social support to a broader interaction with the psychosocial context of PWH, particularly the life stressor and coping strategy domains. The three domains of social support, life stressors, and coping strategies, taken together, have been characterized as the Stressor-Support-Coping (SSC) model of psychosocial context [12,13].

Of further note in this respect, social cognition is related to specific aspects of life stressors. Life stressors (especially when unpredictable, uncontrollable, and/or chronic) are associated with greater distressed mood states (e.g., loneliness, depressed mood, and anxious mood), which can decrease social cognition, resulting in lowered social functioning. Similarly, the domain of coping strategies (especially denial, mental or behavioral avoidance/disengagement, and psychoactive substance use strategies) can increase distressed mood states and decrease social cognition and social functioning. The relationship of life stressors and coping strategies to social cognition might be expected to be greatest for life stressors (e.g., divorce and

bereavement) and coping strategies (e.g., seeking instrumental and emotional social support) that most involve social interactions. The relationships of social support, life stressors, and coping strategies have been studied among PWH, women with cervical intraepithelial neoplasia/CIN and invasive squamous cell carcinoma of the cervix, and persons with other tumors and diseases more generally [14]. Hence, the authors' approach to social isolation/lack of social support and loneliness with respect to social cognition can be amplified by evaluating life stressor burden as well as passive, maladaptive coping strategy utilization.

A number of tests have been used to assess the domain of social cognition. These have commonly included the Facial Expression Recognition Test/FERT [15] and the Reading the Mind in the Eyes Test/RMET [16]. In addition, the Edinburg Social Cognition Test (ESCoT) was shown to be independent of measures of verbal comprehension and perceptual reasoning typical of primary neurocognitive domain tests [17]. Other tests that have been used to assess the social cognitive domain include the Ambiguous Intentions Hostility Questionnaire (AIHQ) [18], the Bell-Lysaker Emotion Recognition Task (BLERT) [19], the Penn Emotion Recognition Task (ER-40) [20], the Relationships Across Domains (RAD) [21], the Awareness of Social Inference Test (TASIT) [22,23], the Hinting Task [24], and the Trustworthiness Task [25], although the AIHQ, the RAD, and the Trustworthiness Task show limitations in their psychometric properties [26]. Future research should focus on the optimal social cognition tests to assess specific subdomains of social cognition with high levels of reliability and ecological validity.

The authors give examples of brain regions involved in social cognition, which they summarize in Table 1 of their article [1], showing that specific mapping is possible. For facial emotional recognition and perception, the examples of the fusiform face area and the amygdala can be extended to the occipital face area and the posterior superior temporal sulcus [27]. Similarly, with respect to prosody, it might be noted that the examples of the superior temporal gyrus and the inferior frontal gyrus can be extended to the middle temporal gyrus [28] and the orbitofrontal cortex [29]. In addition, with respect to the authors' denotation of the involvement of the temporoparietal junction, temporal pole, and precuneus in the Theory of Mind, the medial prefrontal cortex [30] and the amygdala also appear to play a role [31], though research related to the amygdala and social cognition has been variable, as noted by the authors [1]. With respect to empathy, the authors denote the dorsomedial prefrontal cortex/anterior cingulate cortex and the anterior insular cortex. These brain regions can be extended to the dorsolateral prefrontal cortex, the ventromedial prefrontal cortex, the posterior insular cortex, the amygdala, the temporoparietal junction, and the inferior frontal gyrus

[32–35]. As research continues to evolve, the brain regional networks related to the subdomains of social cognition will be further delineated.

With regard to neuroimaging and social cognitive tasks, a single-photon emission computed tomography/SPECT study reported differences in regional cortical blood flow (rCBF) in the context of a lexical decision task for negatively charged emotional words presented to persons with antisocial personality disorder and compared to persons with other mental health disorders and persons without mental health disorders. Persons with antisocial personality disorder showed an unanticipated increase in rCBF in the right and left frontal temporal regions and in the right and left deeper, contiguous regions involving the basal ganglia [36]. This finding may have been due to additional resources required to perform this task, as empathy is characteristically deficient in this group. With respect to the population of PWH, a functional MRI/fMRI study indicated hypoactivation of the left caudate, left dorsolateral prefrontal cortex, and bilateral ventral prefrontal cortices among PWH presented with a semantic event sequencing task based upon the Picture Arrangement/PA subtest of the Wechsler Adult Intelligence Scale/WAIS-III [37]. The WAIS-III PA subtest has been interpreted to be associated with social cognition [38], though this has not always been consistently verified [39]. Given the above, the literature indicates that empathy might be processed in brain regions known to be damaged by HIV (the basal ganglia and the prefrontal cortex) and would suggest that PWH may be disposed to deficits related to performing tasks in the social cognitive domain. More studies of this type are needed to reliably characterize the underlying brain substrates subserving performance in the social cognitive domain overall and its subdomains among PWH.

While social cognition has been increasingly investigated and recognized as a clinically significant cognitive domain in its own right, the terminology used to describe the components of the social cognitive domain continue to lack clarity and specificity [40]. Vance and Lee [1] put forward the areas of Facial Emotion Recognition/Perception, Prosody, Theory of Mind, and Empathy, which may be considered as subdomains of social cognition. A set of concepts has been proposed [41] based upon attribution theory regarding mental states that is comprised by the Self-Other Distinction, Mentalizing, Perspective-Taking, Visuospatial Perspective-Taking, "Level 1" Visuospatial Perceptive-Taking (i.e., in the sight of another person or not), Theory of Mind, and Empathy. If considered as subdomains of social cognition, these concepts overlap those identified by Vance and Lee [1] with respect to the Theory of Mind and empathy but amplify them with the potential subdomains of Self-Other Distinction, Mentalizing, and Perspective-Taking (including its visuospatial aspects and "Level I" aspects). Additional efforts such as these will help to support the

development of a common language to delineate the subdomains within social cognition, aiding in the standardization of the assessment of this clinically significant cognitive domain overall. We have also noted the parallel need to successfully separate the subdomains within the social cognitive domain through the use of specific assessment instruments that might be chosen for that purpose. Further development in profiling the performance across the subdomains of social cognition may well include evaluating these areas both by mean as well as by intra-individual variability (IIV) measures of performance [42]. Such an approach would provide the capacity to compare profile patterns of performance using both types of summary measures not only across the subdomains of social cognition but also from the domain of social cognition taken as a whole across the traditional neurocognitive domains.

In conclusion, the social cognitive domain interacts with what would be considered the traditional neurocognitive domains but is also independent of those domains. An important aspect of the independence of the social cognitive domain is its relationship to psychosocial context in terms not only of social support but also of life stressor burden and coping strategy utilization—each of which specifically map to clinical interventions (e.g., social support groups, stress management interventions, and coping skills enhancement training) that can be used to effectively improve social cognition. It will continue to be a priority objective to map social cognitive assessment instruments to specific subdomains of social cognition and to the activation of brain regional neural networks related to social cognition. Such research will help to improve the delineation of the functional neural networks that subservise social cognitive performance which, in turn, map to functional status in social abilities for which PWH have been reported to have deficiencies. Social cognition has been recognized as a Research Domain Criteria (RDoC) domain [43]. The linkage of research related to performance in the subdomains of social cognition with the further evolution of the brain regional neural networks involved will provide data that transcend diagnostic classifications and lead to a mechanistically based diagnostic nomenclature, which will advance the field. It should be noted that research on social cognition has important implications for policy-making in the general population [44] as well as specifically among PWH. In recent years, there has been an increasing interest in social cognition remediation interventions [45], though most studies have remained focused upon people with schizophrenia and with autistic spectrum disorders. The extension of such research on social cognition remediation interventions to PWH generally and particularly to older PWH represents an important area to be pursued in the future in order to achieve the translational impact of the research findings reported in the social cognitive domain.

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Conflicts of interest

Neither author reports any conflicts of interest.

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