Social Cognition And Caregiver Burden In Early Parkinson's Disease: Integrating The Emerging Indian Evidence

Debjani Sarkar
Institute of Management Study (Affiliated to Makaut University), Kolkata 700099, West Bengal

***Abstract*—Although the motor features of Parkinson's disease (PD) have been the hallmark of the condition, non-motor symptoms, in particular, deficits in social cognition, have also been identified as significant factors of functional ability, interpersonal relationships and quality of life. Social cognition is defined as the way in which social information is perceived, interpreted, and responded to in an appropriate manner and involves areas like emotion recognition, theory of mind, attributional processing, and social decision-making. These skills can be impaired at the onset of PD and sometimes before significant motor disability has occurred. Meanwhile, the multi-faceted and evolving nature of this disorder can cause significant caregiver burden for the psychological, emotional, social and practical strain. Previous studies have investigated social-cognitive impairment in PD patients and burden of caregivers separately, with few studies addressing the possible correlation between PD patients' social-cognitive impairments and caregivers' burden, especially at early stages of PD. The literature on social cognition and caregiver burden in early PD has been reviewed and synthesized, especially from the Indian context. It explores the key areas of social cognition that are impaired in PD, potential neurobiological and psychosocial pathways between social-cognitive impairments and caregiver experiences, and the role of disease severity, behavioral symptoms, cognition, and communication impairments and family factors on caregiver burden. The review also discusses methodological constraints of previous studies conducted in India and the need for culturally relevant assessment, longitudinal research, and combined patient–caregiver interventions. The understanding of correlation between social cognition and caregiver burden can help in early detection of non-motor difficulties and help in providing holistic family-centred PD care in India.**

***Index Terms*—Parkinson's disease; early Parkinson's disease; social cognition; theory of mind; emotion recognition; caregiver burden; caregiving; non-motor symptoms; India; psychosocial impact**

I. INTRODUCTION

Traditionally, PD is described as a progressive neurodegenerative disorder, characterized by the cardinal motor features: bradykinesia, rigidity, resting tremor, and postural instability. The modern concept of PD goes beyond motor dysfunction, however. A wide variety of non-motor symptoms include cognitive, neuropsychiatric, autonomic, sleep, sensory and affective symptoms that add significantly to disability and quality of life impairment (Poewe et al., 2017; Seppi et al., 2019). The prevalence of PD has risen significantly over the past few decades, and more than doubled from 1990 to 2016, driven by population ageing and other demographic and epidemiological factors (GBD 2016 Parkinson's Disease Collaborators, 2018). Importantly, several non-motor abnormalities can occur early in the clinical course of PD and, in some cases, can occur in the absence of any significant motor dysfunction (Poewe et al., 2017; Hussein et al., 2023). Thus, a disease that is perceived solely by its motor features may underestimate the disease's impact on function and interpersonal relationships.

There are some non-motor symptoms of PD that are not as easily detected but are also more salient and becoming known: these include social cognition difficulties. Social cognition is the way people think about and act to information about themselves and others. Partially overlapping skills encompassed by it are: Recognition and interpretation of emotions, theory of mind (ToM), empathy, attributional processing, perception of social cues and social problem-solving (Coundouris et al., 2019; Christidi et al., 2018). These processes are critical for social interaction on a daily basis, as being able to make an appropriate verbal or non-verbal response is not the only factor that ensures social interaction is successful,

the other person's intentions, emotional state, beliefs, and expectations are also important. Clinically, therefore, disturbances in these processes can be considered clinically relevant even in the face of a relatively normal neurological examination and global cognitive screening.

However, there has been a growing body of evidence that social-cognitive dysfunction is an effect of more than just advanced PD or dementia. Meta-analytical studies have shown reliable facial and verbal (emotional) recognition deficits, with higher impairments for negative emotions (Gray & Tickle-Degnen, 2010; Coundouris et al., 2019). Likewise, a meta-analysis of 18 studies with nondemented patients (Bora et al., 2015) found significant ToM impairments, with impairments in both verbal and visual paradigms, and a correlation between ToM and general cognitive dysfunction. Subsequent synthesis has clarified this picture, revealing signs of more marked impairments in cognitive ToM and affective ToM/cognitive empathy, while affective empathy may be more preserved, which indicates the multidimensionality of social cognition processes in PD (Coundouris et al., 2020). The description of a social cognition impairment must therefore be understood neither as a single impairment per se, but rather as a set of social-cognitive functions that can have different clinical and neuropsychological courses.

Further support is provided by evidence that is specific to early stages and onset of disease and the importance of studying social cognition prior to the emergence of severe disability. Seubert-Ravelo et al. (2021) found significant differences between patients with early onset PD without dementia and matched controls with respect to emotional processing, social reasoning, ToM and decision making. Similarly, previous studies have shown that advanced ToM deficits can be present in patients with relatively mild PD, suggesting that social-cognitive deficits may manifest during a time when the patient is still socially and occupationally functional, and functioning fairly well in their daily lives (Yu et al., 2012). The contemporary literature on neuroimaging also supports the role of widespread frontostriatal, basal-ganglia, limbic and cortical networks on social and emotional processing, suggesting a biologically plausible account of social cognition as an intrinsic aspect of the PD dysfunction and not just a secondary psychological response to chronic illness (Christidi et al., 2018).

These deficits are especially evident if PD is examined in the context of close interpersonal relationships. The ability to interpret facial expression, tone of voice, the context of a conversation, indirect communication, humour, irony and others' intentions are often required in social interactions. In some cases, a PD individual's inability to identify an emotion or predict another person's thoughts can make him or her seem insensitive, withdrawn, irritable, suspicious, or socially inappropriate, without being on purpose. These challenges can be exacerbated by hypomimia, decreased expressiveness in speech, executive dysfunction, depression, apathy, anxiety or other non-motor symptoms of PD, which can lead to miscommunications between the patient and family members. Importantly, not all social-cognitive difficulties mean deficits in social functioning overall; the impact of the social-cognitive difficulty may vary based on the severity, nature, compensatory strategies, interpersonal environment, and expectations of those involved.

This inter-personal component is very relevant to the burden of caregivers. Most often, informal carers are a spouse, or an adult child or other family member who helps to manage medication, assist with activities of daily living, mobility, appointments, behavioural changes and emotional support. The burden of caring can be physical, psychological, social, economic, sleep-related, and involve rearrangements of family and interpersonal roles. Motor disability is not the only factor affecting caregiver burden as found in reviews of the PD caregiving literature, which also indicate that non-motor and neuropsychiatric symptoms, patient quality of life, functional dependence, and caregiver psychological well-being all impact caregiver burden (Aamodt et al., 2024; Lesley et al., 2025). Finally, a recent systematic review and meta-analysis of over 30,000 people with PD and over 30,000 informal caregivers showed that neuropsychiatric symptoms in the individual with PD, as well as the caregiver's psychological distress, were the most strongly associated factors with caregiver burden (Sin et al., 2026). These results confirm the need to move away from a purely disease-centred approach to a dyadic approach in which patient's characteristics and caregiver experiences are taken into account.

This is a discussion that has to be enriched by the Indian context. Family caregiving continues to be a significant form of long-term care for individuals with chronic neurological conditions in India and caregiving may happen within a complex family, social, occupational, and financial life. Indian research has shown that there are significant caregiver challenges related to PD. Sanyal et al. (2015) conducted a community-based study of 150 Indian patients and their primary caregivers, concluding that social and financial issues affected a significant number of the caregivers as well as that the severity of the disease and motor disability played an important role in determining the caregiver burden. Jose et al. (2021) conducted a tertiary care study in South India and found that neuropsychiatric symptoms are prevalent in PD and were correlated with duration of care-giving and functional disability, which in turn correlates with the caregiver burden. Likewise, Goel et al. (2022), in their study on patients at a tertiary neurological centre in Puducherry, found that neuropsychiatric symptoms were seen in 86% of patients, 68.5% of caregivers found burden in caregiving and the burden of caregivers was strongly correlated with the overall neuropsychiatric symptom burden. In an Indian study, caregivers of 72 participants were also found to have tangible burden (Baby et al., 2021) and caregiver quality of life was shown to be important for the caregiving situation.

Meanwhile, India has been making significant methodological contributions to the evaluation of social cognition. Realising that social-cognitive assessment might be effected by cultural context and that instruments that are developed from Western populations might not necessarily possess equivalent ecological or construct validity in India, Mehta et al. (2011) developed and validated the Social Cognition Rating Tools in Indian Setting (SOCRATIS). This cultural sensitivity of measurement was then demonstrated by Siripurapu et al. (2023) in a study of 52 people with PD and 31 healthy controls in India. The investigators used SOCRATIS to find significant differences between the PD and controls in first order ToM, faux-pas recognition, and attributional bias. Importantly, the sample was composed of patients at different Hoehn and Yahr stages (1–4), so although the study was not specifically designed to determine the relationship between social cognition and caregiver burden, and to differentiate between early and late-stage disease, it was found that social-cognitive abnormalities are present in a clinically diverse PD sample (Siripurapu et al., 2023).

Table 1: Selected literature relevant to social cognition and caregiver burden in Parkinson's disease

Study	Setting/population	Principal focus	Major findings	Relevance to the present review
Mehta et al. (2011)	India; validation study	Development of SOCRATIS	Established culturally adapted measures of ToM, social perception, and attributional bias for the Indian context.	Provides an important methodological foundation for culturally appropriate assessment of social cognition in Indian populations.
Gray & Tickle-Degnen (2010)	34 comparisons; 1,295 participants	Emotion recognition in PD	Meta-analysis demonstrated a robust emotion-recognition deficit across facial and vocal modalities, particularly for negative emotions.	Establishes social-perceptual impairment as a reproducible feature of PD.
Bora et al. (2015)	18 studies; 487 nondemented PD patients and 459 controls	Theory of mind	Significant ToM impairment (d = 0.83), affecting both cognitive and affective tasks; greater impairment was associated with cognitive dysfunction.	Supports the clinical relevance of mental-state inference deficits even in nondemented PD.
Sanyal et al. (2015)	India; 150 PD patients/caregivers	Caregiver burden and predictors	Social/financial disruption was common; motor disability and disease severity were important contributors to caregiver burden.	Establishes the Indian evidence base for PD-related caregiver burden but does not evaluate social cognition.

Study	Setting/population	Principal focus	Major findings	Relevance to the present review
Coundouris et al. (2019)	79 studies; 1,987 PD participants	Social perception	Moderate impairment in emotion recognition ($g = -0.57$), broadly comparable across facial and prosodic modalities; deficits were generally greater for negative emotions.	Demonstrates that social-perceptual abnormalities are robust across multiple experimental paradigms.
Coundouris et al. (2020)	38 studies; 1,014 PD participants	Empathy and ToM	Significant deficits in cognitive ToM and affective ToM/cognitive empathy, but not affective empathy.	Highlights the domain-specific nature of social-cognitive impairment.
Seubert-Ravelo et al. (2021)	25 early-onset PD patients and 25 controls	Early-onset PD and social cognition	Significant differences were observed across emotional processing, social reasoning, ToM, and decision-making.	Provides direct evidence that social cognition may be affected early rather than only during advanced disease.
Baby et al. (2021)	India; 72 caregivers	Caregiver burden and quality of life	Mean Zarit burden score was 26.63 ± 17.09; caregiver burden was accompanied by measurable quality-of-life impact.	Adds Indian evidence for the caregiver component of the proposed patient–caregiver relationship.
Jose et al. (2021)	South India; 104 PD patients with informal caregivers	Neuropsychiatric symptoms and caregiver burden	At least one neuropsychiatric symptom occurred in 61.5%; neuropsychiatric symptoms, caregiving duration, functional disability, and sleep-related symptoms were associated with caregiver burden.	Demonstrates that non-motor/behavioural characteristics can be important determinants of caregiver burden in India.
Goel et al. (2022)	India; 73 patients and 145 caregivers	Neuropsychiatric symptoms, QoL and caregiver burden	86% of patients reported ≥1 neuropsychiatric symptom; 68.5% of caregivers reported burden; neuropsychiatric symptom burden was a strong predictor of caregiver burden.	Supports investigation of patient behavioural and interpersonal characteristics as contributors to caregiver experience.
Siripurapu et al. (2023)	AIIMS New Delhi; 52 PD patients and 31 controls	Multidomain social cognition in Indian PD	PD participants showed poorer first-order ToM and faux-pas recognition and greater externalizing attributional bias than controls.	Provides direct Indian evidence of social-cognitive impairment, but did not simultaneously examine caregiver burden.
Lesley et al. (2025)	Systematic review; 41 studies	Predictors of informal caregiver burden	Greater neuropsychiatric symptoms, poorer patient QoL, motor impact on ADLs, and poorer caregiver mental health were associated with greater burden.	Demonstrates that caregiver burden is multidimensional and extends beyond motor severity alone.
Sin et al. (2026)	66 studies; 30,533 people with PD and 30,419 caregivers	Comprehensive meta-analysis of caregiver burden	Greater disability, disease stage, motor/non-motor severity, caregiving time, psychological distress, and poor social support were associated with greater burden; neuropsychiatric	Provides the most recent synthesis supporting a multidimensional patient–caregiver framework while

Study	Setting/population	Principal focus	Major findings	Relevance to the present review
			symptoms and caregiver distress showed particularly strong associations.	leaving social cognition insufficiently studied.

All of this evidence together shows two lines of research that are reasonably solid, but mostly parallel. First, studies from other countries and the growing literature in India suggest that PD is associated with impairments in social perception, ToM, attributional processing, and other social-cognitive capacities. Second, Indian studies and international literature consistently documented that caregiver burden has been identified as a relevant correlate, along with motor disability, neuropsychiatric symptoms, functional dependence, patient quality of life, care giving time and caregiver psychological factors. But, these two domains have not been studied together in the patient-caregiver context, especially in those with early stage PD.

This is significant because a social-cognitive defect could be one way that seemingly small neurological or cognitive impairments are manifested in real-world interpersonal dysfunction. For instance, difficulty understanding emotional cues and understanding what others are thinking or feeling may lead to problems understanding what is being said or not being heard in a conversation, conflict with others, needing others to interpret interactions, and others feeling that they are apathetic and irritated or not being reciprocal. However, caregiver burden can also impact the interpretation of the social behaviour of patients and hence a bidirectional relationship can be involved. These are possibilities that can only be explored by studies that look at social cognition or caregiver burden alone.

However, the Indian social-cognition study conducted by Siripurapu et al. (2023) is informative in this respect as they have shown measurable abnormalities through a culturally adapted assessment battery, though the primary outcomes of the study were social-cognitive performance and patient quality of life and not experience of the caregiver. Similarly, the studies performed among Indians on care giving have mainly focused on motor severity, activities of daily living, neuropsychiatric symptoms, disease duration, and a patient's characteristics as a caregiver while not specifically looking at the patient's capacity to understand social information. The existing literature thus documents each element of the proposed relationship, but not enough data to say much about the direct connection between the elements.

The chasm is particularly relevant in the early PD. During this stage, people may have significant autonomy and continue to hold significant family, work and social roles. Thus, subtle emotion recognition, perspective taking, attribution or social decision-making problems can be experienced through others and not just through traditional indices of physical dependence. In the context of the present study, studying these changes together with the burden on the caregiver might be useful in determining if social-cognitive dysfunction plays a role in causing the caregiver burden on its own or in combination with motor disability, global cognitive status, mood symptoms and functional impairment. It might also help address the issue of whether caregiver burden is a direct result of more physical reliance on the caregiver or part of an interpersonal burden that is at least in part an effect of the non-motor dysfunction.

In this background, the current review focuses on the relationship between social cognition and caregiver burden in early PD and highlights the evidence base for India. The main idea is not that social-cognitive impairment is always responsible for caregiver burden, but rather the idea that social-cognitive impairment and caregiver burden can be meaningfully related through each of the following: patient–caregiver communication, behavioural interpretation, emotional reciprocity, relationship quality, and the overall psychosocial consequences of PD. The elucidation of this relationship may benefit more comprehensive assessment techniques in early PD and offer a context for future studies in India employing culturally responsive, dyadic, and longitudinal methods.

II. SOCIAL COGNITION IN PARKINSON'S DISEASE

Social cognition refers to the cognitive and affective mechanisms that enable people to process social information, interpret social action and mental state of other people, and produce appropriate social reactions or behaviour in the context. Social cognition is focused on processing social information as opposed to general cognitive information, like memory or attention. Social perception, emotion recognition, theory of mind (ToM), empathy, attributional processing, and social decision-making are some of the major components (Christidi et al., 2018). The functions of these abilities are crucial for the maintenance of reciprocal relationships, since daily social interactions require to recognize the emotions of others, to infer the thoughts or intentions of others, to distinguish between deliberate and unintentional action, and to adjust one's own reactions to the social situation.

Social-cognitive dysfunction is an important yet relatively unrecognized aspect of the non-motor phenotype in Parkinson's disease (PD). Past cognitive studies in PD have mainly centered on executive dysfunction, memory, visuospatial ability, attention and subsequently on dementia. However, there are growing data indicating that patients might have problems understanding social information despite limited overall cognitive impairment (Christidi et al., 2018; Coundouris et al., 2019). Social-cognitive abnormalities can have clinically important implications for communication, interpersonal reciprocity, occupational functioning and family relationships, and they can be missed by brief conventional cognitive screening tools.

2.1 Social cognition as a multidimensional construct in PD

Social cognition in PD must not be viewed as a simply monolithic skill. The cognitive and neural systems used for different components are partially overlapping but are distinct. Social perception refers to the ability to recognize and understand socially relevant signals such as facial expression, prosody, body posture and context. Theory of mind is the ability to assume other people's thoughts, feelings, ideas, and/or beliefs. Empathy is an emotional response to the emotional state of another person, and there is affective and cognitive empathy. Attributional processing refers to the process of understanding the causes of social events and behaviour; specifically, whether something is attributed to oneself, another person, or external factors (Christidi et al., 2018; Coundouris et al., 2020).

The componential perspective is significant because social-cognitive changes in PD are not consistent across social-cognitive domains. For instance, the patient may have difficulty recognizing facial expressions of emotion, yet have other aspects of emotional empathy. Difficulties in cognitive ToM also can coexist with more intact affective responsiveness. These dissociations suggest that social cognition should be measured with more than one measure (Coundouris et al., 2020).

2.2 Emotion recognition and social perception

One of the social-cognitive domains that is consistently studied in PD is emotion recognition. It is a skill that involves the extraction of emotional information from facial expressions, voice, gestures or socially salience information. Previous experimental research proposed that individuals with PD might be particularly impaired in their ability to recognize emotions such as fear, anger, sadness or disgust, with the degree of impairment differing depending on the task and modality employed (Gray & Tickle-Degnen, 2010).

This result was subsequently confirmed by meta analysis. In a synthesis of 34 comparisons of 1295 participants, Gray and Tickle-Degnen (2010) found an overall lack in emotion recognition, not only for facial, but also for vocal stimuli in PD. Their results indicated that this wasn't limited to a single sensory modality and particularly manifested for negative emotions. In an even larger meta-analysis of 79 studies, Coundouris et al. (2019) found a moderate decline in social perceptual functioning in PD. Importantly, deficits were seen in both the facial and prosodic emotion-recognition tasks, with greater difficulties noted in the tasks involving explicit recognition of the emotional states and in the negative emotion-recognition tasks.

So the importance of emotion recognition in the clinic is the potential impact on regular communication. The ability to communicate non-verbally is very important for human interaction, where the cues one conveys are not in words. It is possible, therefore, that verbal communication could be preserved, but interpretations of anger, sadness, fear, disappointment or positive

affect could result in inappropriate responses. Furthermore, PD can influence the expression of emotion when it comes to facial muscle activity (hypomimia) and changes in prosodic variation, which could cause a discrepancy between the patient's internal emotional state and the outward expression. Thus, problems with the transmission and interpretation of social-emotional information can affect interpersonal communication in PD.

2.3 Theory of mind in Parkinson's disease

Another domain of social cognition in PD for which there is extensive research is theory of mind. It enables an individual to take the perspective of another mental state, and it gives a person the ability to recognize the beliefs, knowledge, intentions and emotions of another person that are not directly observable. ToM can be subdivided into cognitive ToM (beliefs, intentions), and affective ToM (emotional state, affective state).

Meta-analytic evidence suggests that ToM deficits are a critical aspect of PD. The meta-analysis conducted by Bora et al. (2015) on 18 studies revealed significant ToM deficits in 487 healthy nondemented individuals with PD compared with 459 of healthy controls. Verbal and visual impairments were present on both the verbals and the visuals—such as faux-pas recognition and "reading the mind from the eyes" tasks. ToM impairment was also correlated with general cognitive dysfunction, with this impairment being significant enough that it could be a factor in successful mental-state attribution. Importantly, the results show that having problems in understanding the mental states of others cannot be regarded as a purely PD dementia symptom.

Subsequent studies have given a more differentiated understanding of ToM. In a review of 38 studies, Coundouris et al. (2020) found significant cognitive ToM deficits and an overlapping construct, affective ToM/cognitive empathy. They failed, however, to find a significant overall difference between those with PD and controls in terms of affective empathy. In PD, this distinction implies that there are some aspects of understanding another person's mental/emotional state that may be more fragile than the ability to experience or react to another person's emotion.

Maggi et al. (2022) conducted another meta-analysis to explore neuropsychological and clinical associations with cognitive and affective ToM. The age, impaired global cognitive functioning, executive dysfunction and language performance were associated with cognitive ToM deficits, while global cognition, attention/working memory and language performance, decision-making and other generative abilities were related to impaired affective ToM. Intriguingly, the meta-analysis failed to discover consistent links between ToM impairment and a number of traditional clinical and neuropsychiatric variables, suggesting that social-cognitive deficits are not necessarily a mirror image of the severity of motor symptoms or psychiatric symptoms.

2.4 Empathy, attribution, and interpretation of social events

The other important aspect of social cognition is empathy. Cognitive empathy involves understanding another person's perspective or emotional state, while affective empathy is more directly related to emotional reactivity to another person's experience. It seems that these components are vulnerable in different ways in PD. Meta-analysis by Coundouris et al. (2020) showed that cognition empathy (CE) and affective ToM was impaired, while affective empathy (AE) was more preserved. This separation can have implications for patient–caregiver relationships because an individual might feel the same emotions toward another person, but not be able to correctly guess what that person is thinking or feeling.

However, PD may also have an impact on how the information is processed attributively. People may blame themselves, the other person, or the situation for the unwanted social interaction. Abnormal attributional tendencies can impact social understanding and then lead to emotional and behavioural reactions. This is especially true of Indian evidence. In a study which employed culturally adapted Social Cognition Rating Tools in Indian Setting (SOCRATIS), Siripurapu et al. (2023) found that individuals with PD scored significantly lower on first order ToM and faux-pas recognition compared to healthy controls and were more inclined to attribute the attributional bias externally. These findings serve as evidence that social-cognitive changes in PD do not only involve emotion recognition and ToM, but also social causality.

2.5 Neural basis of social-cognitive impairment

Social cognition is a complexity in terms of neurobiology since social-cognitive performance

relies on several interacting, distributed brain networks, not on a single anatomical region. Frontostriatal circuits are of particular interest because they play a role in executive control, decision making, behavioural regulation and the integration of contextual information. Other regions of the brain that are involved in mental state attribution and emotional processing include the temporoparietal regions, medial prefrontal areas, orbitofrontal circuitry, amygdala-related systems, and other limbic structures (Christidi et al., 2018).

This degeneration can thus affect social cognition indirectly as well as directly. Dopamine-related alterations in executive functioning, reward processing, motivational behaviour and cognitive flexibility can make processing socially relevant information less efficient. Meanwhile, the limbic and cortical networks could be impaired and impact on emotional salience and social signal interpretation. Coundouris et al. (2019) also found a relationship between social-perceptual impairment with some clinical factors such as dopaminergic medication, deep brain stimulation and side of motor symptom onset, but these must not be seen as indications of a simple medication-dependent mechanism.

Based on this evidence, the present model posits that social cognition in PD is generated by interaction between motor and non-motor pathology, executive and attentional resources, emotional processing, and distributed cortico–subcortical networks. This model also accounts, to a large extent, for the variability of social-cognitive aspects that can be found across apparently comparable motor diseases.

2.6 Relationship between social cognition and broader cognitive functioning

Another question is whether social-cognitive deficits are a specific side effect of PD, or are more likely to be secondary to other cognitive impairments. The evidence available is consistent with this, both possibilities are in play. Previous meta-analysis research consistently found correlations between ToM and general cognitive functions such as executive functioning, working memory, processing speed, language and global cognition (Bora et al., 2015; Maggi et al., 2022). Likewise, cognitive differences between cognitively preserved patients and cognitively impaired patients with PD indicate that the greater the global cognitive impaired the greater the social-cognitive impaired the greater (Sáez-Francàs et al., 2020).

However, this relationship is not entirely accounted for by global cognition. There are individuals with PD who do not have dementia or substantial cognitive impairment who can be shown to have measurable deficits in emotion recognition or ToM. This is especially relevant for early PD as subtle social-cognitive deficits may not be clinically apparent in a brief cognitive screen and with a traditional motor evaluation. Therefore social cognition may be a meaningful domain that can be assessed independently from more traditional neuropsychological measures.

2.7 Social cognition and everyday interpersonal functioning

But only the extent to which laboratory-determined social cognition deficits relate to actual changes in everyday function will prove of practical significance. Thus a relation with biological and clinical plausibility exists, but the evidence for this is not as clear as the evidence for group-level impairments in experimental social-cognitive tasks. There are several factors that affect social behaviour: Mood, Motivation, personality, Executive control, Motor expression, Communication ability, Family environment and Social expectations. Thus, an individual who fails on a ToM or an emotion-recognition test does not necessarily have clinically relevant interpersonal dysfunction.

This is of special importance when thinking about the outcomes of caregivers. In an independent social setting, a lack of recognition of another person's emotion may be compensated for; however, in a close caring relationship with frequent interaction, problem solving and emotional demands a lack of recognition could become more significant. Genuine social-cognitive problems, however, may not be the only factor driving caregiver perceptions of social behaviour, as depression, apathy, motor disability, fatigue, or communication difficulties also can play a role. Therefore, it is important to explore the role of social cognition in interpersonal problems as part of a greater clinical picture rather than alone.

In general, the literature lays the foundation for the multidimensionality and clinical relevance of social cognition in PD. The most convincing evidence is for the impairments in emotion recognition and ToM, and there is emerging evidence for abnormalities in

attributional processing and related social functions. However, there are many uncertainties about the timing and development of these abnormalities, whether they stand alone from the larger cognitive deficits, and their implications for functional social interactions in real-world settings. These uncertainties are particularly relevant in early PD as the social-cognitive changes are relatively small, but may take place in advance of significant physical dependence. It is important to understand how these changes are experienced and perceived within the caregiving relationship, as this is a key next step in the development of a more comprehensive account of the psychosocial burden of PD.

III. SOCIAL-COGNITIVE DYSFUNCTION IN EARLY PARKINSON'S DISEASE

Traditionally, the clinical aspects of PD have focussed on the onset and development of motor symptoms. However, research is now emerging that there are important non-motor changes that can happen from the earliest stages of the disorder, even prior to the onset of significant functional dependence. Social cognition is especially relevant in this regard since it facilitates the understanding of emotions, intentions, beliefs, social behaviors and situations. It is possible that abnormalities in these processes can manifest in a person's interactions with others before they are detected as a typical cognitive impairment of PD. Recently, a large systematic review of 191 social-cognitive behavioral and neuroimaging studies suggested that abnormalities are a major part of the non-motor phenotype of PD, though they vary based on domain and stage of disease (Yeshua et al., 2026).

There is a degree of qualification needed here for the concept of early Parkinson's disease, as various operational definitions have been used in studies, such as newly diagnosed cases, disease duration of < 4 years or < 5 years, Hoehn and Yahr stages 1-2, or relatively preserved functional status. This heterogeneity would make it difficult to compare studies directly. However, there is a consistent body of evidence from cohorts defined as early or newly diagnosed PD that social-cognitive dysfunction can be identified before dementia, and in some cases, independently of the traditional mild cognitive impairment (MCI), and that this dysfunction is not caused by typical MCI. This is especially relevant to the psychosocial impact of PD as these subtle interpersonal abnormalities can happen at a point where the patient is still active in their family, workplace and community.

3.1 Early social-cognitive changes: evidence beyond advanced disease

The role of social cognition in early PD is supported by studies showing that these abnormalities are not present in advanced disease or dementia. Czernecki et al. (2021) compared 109 patients with idiopathic PD for the last 4 years to healthy patients with the Mini-Social Cognition and Emotional Assessment. Significant socio-emotional impairment was found in about 30% of the PD sample and social-cognition impairment alone occurred more frequently than MCI alone. Both emotion identification and theory of mind (ToM) were affected. In particular, the researchers found no evidence that disease severity, age, years of education, dopamine replacement therapy or overall cognitive efficiency affected general social-cognitive dysfunction. Based on this, the authors suggested that social-cognitive dysfunction may be a meaningful clinical manifestation of mild cognitive disturbance in early PD, but the concept of "mild social cognition impairment" is not sufficiently validated (Czernecki et al., 2021).

There is one other early PD cohort that provides a complementary perspective. Dodich et al. 2022 studied 45 people with PD, with half of the group having a Movement Disorder Society Level II cognitive classification of cognitively unimpaired (PD-CU) and half having a PD-MCI classification. These findings revealed emotion recognition and mental-state attribution deficits in PD, particularly among those with MCI that were related to emotion recognition. Importantly, the deficits in emotional and intention attribution were also present in the cognitively unimpaired PD group, compared to healthy controls. Five of 9 patients with poor performance in social-cognitive tasks were considered cognitively unimpaired. Therefore, we should consider social-cognitive abnormalities as an early and partially independent cognitive pathway that may include social cognition as a possible early component of neuropsychological impairment in PD (Dodich et al., 2022).

Another unique model is early-onset PD, in which patients may hold key occupational and family positions for many years after a PD diagnosis. This

study by Seubert-Ravelo et al. (2021) examined four social-cognitive domains – emotional processing, social reasoning, ToM, and decision-making – in 25 nondemented individuals with early-onset PD, alongside 25 healthy controls matched for age, gender, ethnicity, and education. The PD group scored significantly lower in all of the domains studied, and large effect sizes were reported for some of the comparisons. Importantly, most differences were still significant when controlling for general cognitive performance, while decision-making was more strongly related to general cognitive ability. The results indicate that social-cognitive impairments in PD do not necessarily stem from global cognitive deficits (Seubert-Ravelo et al., 2021).

Combined these studies suggest that social-cognitive impairments may begin to manifest relatively early in PD. However, the present evidence does not justify the assumption that in all newly diagnosed patients social-cognitive impairments will occur or that these impairments will be present in all domains at once. There are a variety of factors which affect prevalence estimates, including: sample characteristics, disease definition, task selection, normative criteria, and assessment of specific aspects of social cognition. A recent systematic review by Yeshua et al. (2026) also highlighted the relative consistency of results for negative emotions recognition and the greater variability for empathy and ToM, and that some aspects are more salient for MCI and more advanced disease.

3.2 Emotion recognition in the early stage of PD

Perhaps the most consistently reported social-perceptual difficulty that accompanies PD is emotion recognition. Effective communication relies in large part on the ability to read the face, listen for tone and inflection, and interpret gestures and cues as well as the context of the emotional state of another person. The processes that underlie these can be impaired even if the person's general language comprehension and memory are relatively intact.

This observation is supported by the evidence from a meta-analysis. The synthesis of 79 studies by Coundouris et al. (2019) revealed overall moderate impairment in emotion recognition in PD compared to controls. This effect was very comparable in both facial and vocal modalities, rejecting the possibility of explanation in terms of the perceptual effects of facial immobility or hypomimia alone. Fear and anger are some of the emotions that have been especially susceptible to many studies. The results suggest that PD does not only affect the expression of emotions but that it can also affect the processing or interpretation of socially relevant emotional material (Coundouris et al., 2019).

This is consistent with this pattern, and evidence for young populations confirms it. Among the study participants (Dodich et al., 2022), the recognition of emotions by the PD patients was significantly impaired, and the group difference was significantly explained by negative emotions like fear and sadness. Importantly, however, the level of impairment varied by cognitive status, such that the PD-MCI participants were more impaired than cognitively unimpaired patients on some measures of emotion recognition. This discovery implies that both disease-related social-cognitive alterations and the general cognitive apparatus of the person can affect emotion processing (Dodich et al., 2022).

The perception of emotional information can also influence the expression of emotions in the context of illness. The underproduction or undersensitivity of emotional signals can be influenced by hypomimia (limited movement in the face), monotonous speech and changes in prosody (the inflection of speech). Thus, individuals can be seen to have both deficits in expressing emotions in an intelligible way and problems in understanding others' emotional communication. Such reciprocally interactive changes can have ramifications for interpersonal interactions, and may be particularly relevant in the context of intimate family relationships, in which the caregiver depends on nuances of verbal and non-verbal signals to know what the patient needs and how he is feeling.

3.3 Theory of mind and mental-state attribution

Theory of mind is an understanding that other people have their own thoughts, feelings, and beliefs, which may differ from one's own. It's especially important when things are unclear, when communication is indirect, when things have been misunderstood, when something is said in a sarcastic tone, when it is deceptive, when there are conflicting viewpoints. Another important dimension of social-cognitive dysfunction that has been emerging in early PD is ToM abnormalities.

Bora et al. (2015) showed that there was a significant impairment of ToM in nondemented PD, both in cognitive and affective ToM. The following studies have supported this position on the issue of the unity of ToM. Coundouris et al. (2020) reported that cognitive ToM and affective ToM/cognitive empathy were significantly impaired, while affective empathy did not seem to be very different. These dissociations indicate that patients may still be able to emotionally connect to someone else, but they may not be as good at depicting or thinking about what the person is thinking.

Studies at the initial stage are particularly important in this regard. Czernecki et al. (2021) found that patients were impaired in both emotion identification and ToM within 4 years after diagnosis, and Dodich et al. (2022) reported emotion and intention attribution deficits among PD participants who were cognitively unimpaired. Similarly, deficits in both ToM and social reasoning were observed in early-onset PD by Seubert-Ravelo et al. (2021). Together, these findings indicate that it is possible that a person's capacity to make inferences about the thoughts, feelings, attitudes and traits of others could be impaired prior to the onset of serious global cognitive impairments (Czernecki et al., 2021; Dodich et al., 2022; Seubert-Ravelo et al., 2021).

Importantly, executive functioning, language, working memory, attention and general cognitive efficiency affect ToM performance. In a meta analysis by Maggi et al. (2022), cognitive ToM was linked to various neuropsychological areas, including executive functions, global cognition, language, attention/working memory. The results indicate that cognitive abnormalities in ToM do not seem to be a complete failure of social cognitive functioning but may arise from a combination of specific social cognitive processes and more general cognitive resources. Therefore, social cognition needs to be analysed along with the traditional neuropsychological abilities.

3.4 Is early social-cognitive dysfunction independent of global cognition?

One of the key remaining issues in early PD is the social cognition issue – how social and general cognition work together. The evidence available indicates that social cognition is not wholly separate from general cognition nor can it be reduced to it. Executive processes must include the ability to consider the point of view of another person, to dislodge one's own point of view, to incorporate context, to adjust interpretations in response to change. Performance on complex social tasks can also be affected by memory and language. Patients with PD-MCI are thus predicted to have more widespread social-cognitive impairments.

There are, however, a number of studies showing that social-cognitive abnormalities may occur in patients with normal cognition. Czernecki et al. (2021) found that social-cognition impairment is not always accompanied by another type of cognitive problem, while Dodich et al. (2022) found social-cognitive abnormalities in a subgroup they defined as cognitively unimpaired. In a similar analysis, Seubert-Ravelo et al. (2021) showed that many differences between early-onset PD and controls persisted following correction for global cognitive performance. The findings of these observations suggest that using a standardised cognitive screening score is not appropriate to determine social-cognitive dysfunction. This difference makes a difference. Brief instruments like the Montreal Cognitive Assessment can be helpful to detect global cognitive impairment, but are not able to fully assess social perception, ToM, attributional reasoning or complex interpersonal decision making. Thus, social cognition may go undiagnosed if neurological testing is limited to motor function and general cognitive tests. Addition of specific social-cognitive tests may uncover areas of difficulty that would not otherwise be identified, especially in patients who inform that there are slight changes in interpersonal or communication skills.

3.5 Relationship with motor severity, mood, and dopaminergic treatment

Another important characteristic of early social-cognitive impairment is its imperfect A further crucial feature of early social-cognitive impairments is their association with traditional measures of PD severity is sub-optimal. If social cognition only happened downstream from motor disability, one might think that motor disease severity would be tightly linked to decreasing social-cognitive scores. There is not a consistent amount of evidence for this simple relationship.

In a young cohort of PD patients, Czernecki et al. (2021) did not find any relationship between the

disease severity and social-cognitive performances. In the study by Siripurapu et al. (2023) in India, age, sex, level of education, depression score, Montreal Cognitive Assessment performance, levodopa-equivalent daily dose and number of PD medications did not predict the main measures of social cognition, although the study was not limited to early-stage disease. The study still showed that there were major differences between the Indian PD patients and healthy controls in the 1st order ToM, faux-pas recognition, and attributional bias. These results support the notion that social cognition is a multidimensional construct, which cannot be reliably determined from motor severity or medication exposure.

The effect of dopaminergic therapy is especially complicated. Previous research has yielded inconclusive findings, and the association may vary by social-cognitive domain measured. A recent experimental study that investigated ToM in patients with motor fluctuations revealed that acute levodopa does not correct impaired ToM, whereas emotional resonance, which exhibited a different pattern of dopaminergic modulation, was accounted for by impaired ToM (Yeshua et al., 2026). This study helped to illustrate an important postulate, that social cognition may include multiple processes, some of which are sensitive to different neurotransmitters and not just dopamine, and that these processes can be measured separately.

The consideration of the mood and neuropsychiatric symptoms is also necessary. Depression, apathy, anxiety and impulse-control symptoms could all impact attention, motivation, interpretation of social information and interpersonal behavior independently. Therefore, a socially-cognitive deficit that is observed does not necessarily indicate PD neuropathology. Studies controlling for mood, executive function and general cognition are thus of special interest for elucidating the specific role of social cognition.

3.6 Possible mechanisms underlying early social-cognitive dysfunction

Development of social-cognitive dysfunction at a relatively early age of PD is in line with the disease being a multi-system disease and with the PD network. Social cognition relies on three networks of the frontal, limbic, temporoparietal, and frontostriatal regions that are connected to emotional salience, executive control, mental-state attribution, and behavioural regulation. The changes in these interdependent systems can thus impact social processing functions even with relatively mild motor symptoms (Christidi et al., 2018; Yeshua et al., 2026).

A particular role for the frontostriatal contribution is suggested since executive flexibility and inhibition are key to successful social reasoning. An individual needs to filter out a prior interpretation, think about other interpretations, take in contextual information and choose an appropriate social response. The dopaminergic dysfunction in frontostriatal systems may thus impact social cognition indirectly by affecting executive resources, reward processing and behaviour regulation. Additional involvement of the limbic system can also impact the salience and meaning of emotional signs.

However, there is no evidence that there is only one anatomical or neurochemical explanation. Yeshua et al. (2026) found significant methodological and neurobiological variability in the literature in their 2026 systematic review and also identified that literature on neuroimaging research involving complex social-cognitive functions is still relatively scarce. This emerging picture is thus seen as a distributed network disorder, with different aspects of social cognition being compromised via somewhat different mechanisms.

3.7 The Indian perspective and relevance to early PD

Considerable importance of evidence base in India is crucial as social cognition is shaped by cultural expectations, communication conventions, social norms, and interpretative context. Mehta et al. (2011) created the Social Cognition Rating Tools in Indian setting (SOCRATIS) to meet the need for culturally appropriate assessment. This is particularly relevant when assessing subtle social-cognitive changes in Indian patients as instruments developed in other cultural environments may have language, contextual or normative biases.

Siripurapu et al. (2023) then applied SOCRATIS to 52 PD patients and 31 healthy controls and found that the PD group had impaired first-order ToM and externalizing attributional biases and impaired faux-pas recognition. The authors also noted that several traditional demographic, depressive, global cognitive, and medication factors did not predict the social-cognition measures. The findings of this study are

significant evidence from India that the assessment battery might be culturally adapted to quantify social cognition in a PD objectively. Results of this study, however, do not allow direct conclusions to be drawn on the prevalence or course of social-cognitive dysfunction in early Indian PD, since patients from the whole disease spectrum were included.

It is a consequence of this restriction that has implications for the general issue of caregiver burden. Social-cognitive difficulties can manifest in rather subtle ways early in the disease, including an inability to understand the emotions of others, a lack of sensitivity to others' thoughts and feelings, a tendency to blame external events and circumstances, or reacting to interpersonal interactions in inappropriate ways. These challenges can lead to an unrecognized physical addiction, but can also impact the nature and timeliness of relationships with caregivers and patients. It is not yet clear whether these changes are correlated with actual health-care burden experienced by caregivers, especially in Indian populations.

3.8 Clinical significance of recognizing social cognition early

Recognition of social-cognitive dysfunction during early PD has implications beyond Social-cognitive impairment has not just been described but has consequences for social functioning in early PD. Early identification may aid the clinician in identifying motor expression differences, mood differences, executive dysfunction, or true problems with interpretation of social information. It may also help to ensure better communication with patients and families around changes in behaviour which could be interpreted as a change in personality, intentional blindness or indifference.

The difference is especially significant because interpersonal problems may arise prior to the need for significant assistance with activities of daily living. A person might be able to walk around independently and have an intact cognitive function that allows them to handle a lot of everyday activities without problems, but feel unable to grasp the emotions of another person or the meaning of socially ambiguous scenarios.

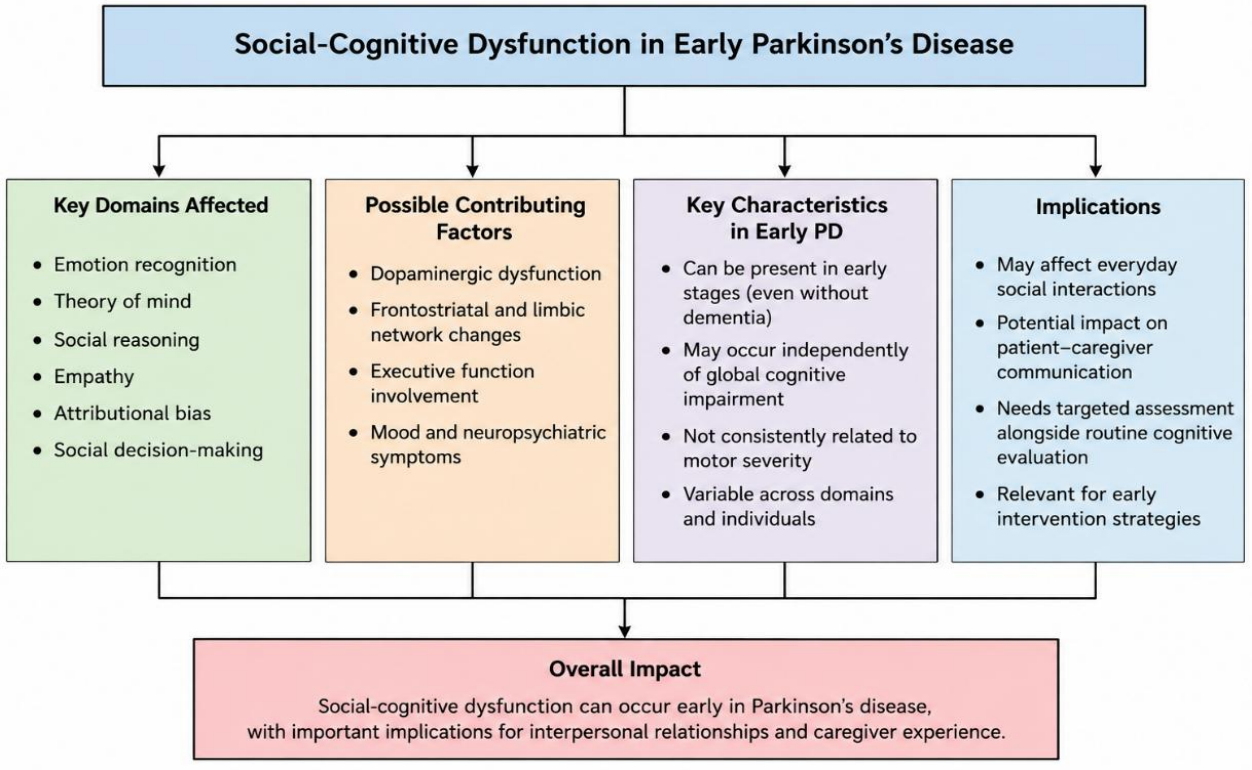


Figure 1: Conceptual Framework of Social-Cognitive Dysfunction in Early Parkinson's Disease

When these miscommunications repeat at even relatively light levels of physical care, it may be emotionally emotionally demanding for family members. This offers a plausible mechanism whereby

early non-motor dysfunction may play a role in caregiver experience.

However, most existing literature is of a cross sectional and experimental nature. This finding of a social-cognitive deficit does not prove that this deficit leads to a greater burden for the caregiver, and does not prove that this burden is greater than that of the motor disability, depression, apathy, executive dysfunction or other neuropsychiatric symptoms. To determine whether early social-cognitive dysfunction is associated with later interpersonal problems or caregiver burden, a longitudinal or dyadic study is needed.

The evidence available thus indicates a possible role for social-cognitive dysfunction in the early stages of PD, and it is seen in some patients without obvious motor dysfunction or conventional MCI. Emotion recognition and ToM are the most studied domains while attributional reasoning, social reasoning, empathy and decision-making need further investigation. Indian literature has started to develop culturally appropriate assessment and have begun to show abnormalities of social-cognitive functions in PD but there is limited evidence of the connection between early social-cognitive abnormalities and outcomes for caregivers. The unresolved intersection at the same time offers good reason to explore the interaction between social cognition and caregiver burden, as compared to considering them as distinct outcomes of Parkinson's disease.

IV. CAREGIVER BURDEN IN PARKINSON'S DISEASE

The progressive motor, cognitive, behavioural and emotional effects of PD do not just impact the individual with the disorder but can have a significant effect on the lives of family members who are providing continuous care. Caregiver burden is defined as the physical, psychological, social and financial impact of providing care for an individual with chronic condition or disability (Aamodt et al., 2024). Burden can come from support with mobility, medication administration, personal care, medical appointments, household and/or management of behavioural or emotional changes in PD. It is important to note that burden among caregivers does not correspond to the quantity of care received. It is a subjective experience of a caregiver and is dependent on patient-associated needs as well as the caregiver's psychological, social, and contextual resources (Aamodt et al., 2024; Lesley et al., 2025).

The burden of PD is more complicated than other diseases since it has physical impairment consequences that are visible to others, and non-motor impairment consequences that are not so obvious. Depression, anxiety, apathy, sleep disturbances, cognitive impairment, hallucinations, irritability and other neuropsychiatric symptoms can add to the burden of motor disability and be more challenging to manage than motor disability. In a recent systematic review and meta-analysis of 49 studies and 5,387 caregivers, the burden was generally mild to moderate, and the longer the disease course, the higher the burden, as were negative emotional symptoms and cognitive impairment (Zhao et al., 2024).

4.1 Major determinants of caregiver burden

An important aspect of caregiver burden is patient-related factors. Functional dependence and motor symptom limitations may increase the number and severity of the care that needs to be provided. But the evidence from recent times indicates that changes in motor skills are not sufficient to account for caregiver experience. Lesley et al. (2025) found in a systematic review of 41 studies that motor symptoms, neuropsychiatric symptoms (more severe) and patient quality of life (poorer) were important factors impacting on the patient's burden on the caregiver. Perhaps surprisingly, general cognitive function or the presence of just motor symptoms was not a consistent predictor of burden, suggesting that specific clinical features are important to consider when assessing burden beyond just general indicators of disease severity.

Neuropsychiatric symptoms seem to be significant. Changes in mood such as depression, anxiety, apathy, irritability, psychosis and others may increase the need for supervision and may affect the established interpersonal roles. In 2026, a systematic review and meta-analysis of 30,000 people with PD and their caregivers, and 66 studies, revealed that the factors with the strongest association with caregiver burden were neuropsychiatric symptom severity and caregiver psychological distress. Other factors associated with higher burden were greater disability, more severe motor and non-motor symptoms, longer disease duration, more hours spent caregiving per day, older

caregivers' age, and lower social support (Sin et al., 2026).

Childcare provider attributes are also important. Perceived demands of the caregiving role may be exacerbated by psychological distress, depression, poor social support and more time spent providing care. This relationship may be two-way: When a caregiver is caring for someone with significant illness-related challenges, it may lead to greater stress for the caregiver, and when the caregiver psychological well-being is poor, it can result in decreased coping resources and perceived burden (Aamodt et al., 2024; Sin et al., 2026). Thus, the concept of caregiver burden needs to be viewed not as an end result of disease severity in the patient, but as a part of the patient–caregiver dyad.

4.2 Neuropsychiatric symptoms and caregiver experience

Since neuropsychiatric effects can affect interpersonal interactions (and not necessarily lead to significant physical dependence), it is particularly important in the context of this review. This correlation between neuropsychiatric symptoms and higher burden on caregivers has been observed in numerous studies. In a study from tertiary level centre in South India, Jose et al. (2021) identified that 61.5% of 104 patients had at least one neuropsychiatric symptom. Neuropsychiatric symptoms, length of time providing care, functional ability and sleep-related symptoms were associated with caregiver burden.

In a similar study in India of patients with PD and their caregivers, Goel et al. (2022) found neuropsychiatric symptoms were present in 86% of the patients and 68% of the caregivers felt that there was a disease burden, while 55% of the caregivers had depression. The overall neuropsychiatric symptom burden was found to be particularly associated with caregiver burden in regression analysis. The results are significant because they suggest that caregiver strain might relate closely with the patient's behavioral and emotional presentation and not just by physical constraint.

4.3 Caregiver burden in the Indian context

Evidence from India is in general representative of multi-dimensionality of care, but also highlights the significance of social and economic context. In a community-based study with 150 individuals with PD in India, Sanyal et al. (2015), reported that about 60–80% of caregivers suffered from disruption of social and financial status. Patient motor disability and severity of the disease were important factors associated with caregiver burden and stress, and caregiver anxiety and depression were also linked with caregiver burden scores.

The results should be viewed in the context of Indian care-giving culture, where family members frequently provide extensive long-term care. How the demands of PD are experienced may be influenced by the organization of family responsibilities, the availability of formal support services, financial resources, caregiver employment and social expectations. The studies conducted in India, however, are still limited in number and are mostly cross-sectional, thereby it is challenging to understand the time courses of change in caregiver burden and how subtle patient behaviours play a role in this process.

Table 2: Selected evidence on caregiver burden in Parkinson's disease

Study	Population / setting	Principal findings	Relevance
Sanyal et al. (2015)	150 PD patients/caregivers, India	Social and financial disruption occurred in ~60–80% of caregivers; motor disability and disease severity were important contributors to burden.	Demonstrates the social, financial, and physical dimensions of caregiver burden in an Indian population.
Jose et al. (2021)	104 PD patients with caregivers, South India	Neuropsychiatric symptoms occurred frequently and were associated with caregiver burden along with caregiving duration, functional ability, and sleep-related symptoms.	Highlights the contribution of non-motor and behavioural symptoms to caregiver experience in India.
Goel et al. (2022)	Indian tertiary-care cohort	86% of patients reported ≥1 neuropsychiatric symptom; 68% of caregivers perceived burden; neuropsychiatric symptom burden was strongly associated with caregiver burden.	Strengthens evidence that behavioural symptoms may be important determinants of caregiver strain.

Study	Population / setting	Principal findings	Relevance
Aamodt et al. (2024)	114 studies; scoping review	Caregiver burden reflects physical, emotional, social, and financial effects of caregiving and is influenced by both patient and caregiver factors.	Provides a multidimensional framework for understanding burden in PD.
Zhao et al. (2024)	49 studies; 5,387 caregivers	Burden was generally mild-to-moderate; longer disease duration, greater severity, negative emotions, and cognitive impairment were associated with greater burden.	Provides quantitative synthesis of major caregiver-burden correlates.
Lesley et al. (2025)	41 quantitative studies	Greater impact of motor symptoms on daily activities, greater neuropsychiatric symptoms, poorer patient quality of life, and poorer caregiver mental health predicted greater burden.	Indicates that burden cannot be explained by motor disease alone.
Sin et al. (2026)	66 studies; 30,419 caregivers	Greater disability and disease severity, neuropsychiatric symptoms, caregiving time, psychological distress, older caregiver age, and poorer social support were associated with greater burden.	Supports a multidimensional patient–caregiver model and emphasizes caregiver-level factors.

4.4 Implications for early Parkinson's disease

The majority of caregiver-burden research has been conducted in the context of established or moderately advanced PD in which functional dependence can be seen as a straightforward explanation for the heightened burden of caregiving. This emphasis can make it easy to overlook the subtle, non-motor and interpersonal changes that happen in early PD and could lead to caregiver challenges. Early PD can lead to depression, apathy, changes in communication, problems with cognitively processing information or interpreting social information, but the individual may be fairly independent in their mobility and self-care. These symptoms may not need the same amount of practical support but can be highly demanding on family members emotionally and relationally.

This is of special significance to the current review. Current evidence suggest that caregiver burden is linked to behavioral, neuropsychiatric, cognitive and interpersonal dimensions of PD and that studies of social cognition show that this dimension can be impaired relatively early in the disease. However, few studies of caregivers focus on social-cognitive skills directly. It is not yet known if problems with emotion recognition, theory of mind, attributional processing, or social reasoning cause caregiver burden in addition to motor disability, general cognitive status, mood and other neuropsychiatric issues. This hitherto untapped interface is crucial to comprehend as a relational rather than simply a dependent product.

V. LINKING PATIENT SOCIAL COGNITION WITH CAREGIVER BURDEN

Social cognition and caregiver burden in PD are linked and are areas of emerging interest as both are closely related to day-to-day interpersonal functioning. In addition to motor disability, caregiver burden has been found to be associated with non-motor (Lesley et al., 2025; Aamodt et al., 2024) and cognitive and behavioural-manifestations. One of the less obvious mechanisms in which patient-related problems get translated into caregiver distress is social-cognition. There is, however, limited literature available and most published research is cross-sectional or from small populations.

Social-cognitive skills affect the quality and reciprocity of the patient–caregiver interaction. The caregiver needs to continuously interpret the facial expression, tone of voice, intentions, preferences, emotional responses and reactions of the patient to changing situations. On the other hand, the patient needs to see and respond to the emotional and behavioral cues from the caregiver. This reciprocal process can be disrupted by difficulties in emotion recognition, theory of mind (ToM), empathy or attributional processing. If a patient can't recognise that a caregiver is upset they may not change their behaviour or respond emotionally as expected. For instance, in a routine situation, misinterpretation of what another person wants to say could lead to more

misunderstandings. These processes can even create interpersonal conflict when the patient's physical addiction is not that great.

The relationship can be clearly demonstrated in an empirical study by Phillips et al. (2018) on patients suffering from Parkinson's disease, Alzheimer's disease, and their caregivers. Poor ability to detect emotions, decreased empathy and increased neuropsychiatric symptoms were related to the PD participants' caregiver burden and depression. Importantly, the caregivers themselves often were not aware of the patient's emotion recognition deficits, and lower awareness of emotion recognition deficits was correlated with higher caregiver burden and depressive symptoms. Whilst only 17 people with PD were included, and the findings should be treated with great caution, there was direct evidence for abnormalities in social-emotional processing that may have consequences for caregivers.

Another potential route is through theory of mind. Successful caregiving requires constant mental state interpretation, both by the caregiver and by the patient, as the caregiver tries to figure out what the person in the patient's care needs or wants to do, and the patient tries to interpret what the caregiver wants and/or feels. In a pilot study examining 12 patients with PD-MCI and their caregivers, Giguère-Rancourt et al. (2021) found that the patients and caregivers' self-reported assessments of their spatial memory were significantly different, even though it was similar for the majority of them. Cognitive ToM was significantly associated with caregiver distress, but the severity of psychiatric symptoms in the patient was more strongly associated with the overall levels of caregiver burden. The study is especially relevant as it illustrates the possibility of a link between social-cognitive ability and caregiver experience and also illustrates the fact that social cognition is not independent from neuropsychiatric factors.

The potential relationship, therefore, can be considered as a multifactorial relationship, instead of direct. Caregiver burden may be mediated by social-cognitive impairments. Firstly, problems with emotional recognition or interpretation of intentions can raise the communication errors. Secondly, there may be ongoing confusion over causal attributions for specific behaviours. Third, if the person is less cognitively empathetic and/or has less ToM, they may perceive less reciprocity in the relationship. Fourth, social-cognitive impairments can occur with other problems, including apathy, depression, anxiety, irritability, or executive functioning impairments, creating the risk of exacerbating interpersonal problems. Lastly, caregivers who fail to understand them as symptoms of PD may misinterpret them as intentional or a personality shift, leading to greater frustration and emotional burden (Phillips et al., 2018; Aamodt et al., 2024).

This framework aligns with the wider literature on caregiver research which shows that non-motor and neuropsychiatric symptoms can be significant factors in burden. When multiple patient factors are taken into account at the same time, reviews have indicated that depression, apathy, cognitive impairment, psychosis, behavioral changes and impaired patient quality of life can be important contributors to caregiver strain, sometimes more so than motor symptoms (Aamodt et al., 2024; Lesley et al., 2025). Social cognition could partially fall into these domains, but should not be equated with them. For instance, one patient may have an intact global cognition but be unable to read others' emotions or grasp others' perspectives. On the other hand, a patient with significant neuropsychiatric symptoms could also cause high level of caregiver burden without having a measurable social-cognitive deficit.

It is unclear whether the relationship is direct or indirect as well. Confined to the conclusions of the most available studies, social cognition and caregiver burden are measured once, and not related to causality. Social-cognitive challenges can also play a role in burden but caregiver stress can also affect how the patient's behavior is interpreted, how caregivers communicate with patients, and how they feel about their relationship. A bidirectional model may thus be better suited: increased patient social-cognitive dysfunction may lead to greater interpersonal demands; the greater distress may lead to decreased tolerance, effectiveness of interpersonal communication, and available coping resources. Prospective studies of the two people in the patient-caregiver dyad would be required to establish the trajectory of these processes.

It is a particularly relevant question in early PD. Patients' mobility and/or basic activities of daily living may be largely preserved in early stages, thereby under-estimating the dependency that may occur to the family member. However, subtle impairments in

emotion recognition, ToM, attribution or social decision-making can still have a negative impact on relationships with spouse, parents, and/or other close friends and relatives. Therefore caregiver burden in early PD may not be a direct measure of the amount of physical care provided, but rather of the emotional and inter-personal demands needed to keep communicating and make up for the non-motor impairments.

The Indian context is of special interest. Social-cognitive abnormalities have been separately confirmed in PD in Indian studies (Sanyal et al., 2015), as have substantial caregiver burden related to motor, functional and neuropsychiatric factors (Goel et al., 2022; Siripurapu et al., 2023). Nevertheless, patient social cognition and caregiver burden has been infrequently assessed. This is an important omission as cultural norms about family roles, communication, emotional expression and caregiving can affect the way social cognitive problems are experienced and addressed. This relationship can be studied in a more systematic way in Indian population with the availability of culturally adapted social cognition measures like SOCRATIS (Mehta et al., 2011).

The overall evidence presented here indicates that a plausible but less well-established relationship exists between patient social cognition and caregiver burden in PD. Small studies indicate direct links between emotion recognition deficits, ToM impairments and caregiver distress/burden; the broader caregiver literature highlights the roles of cognitive and neuropsychiatric findings. It is unclear whether social-cognitive dysfunction is a significant independent factor of caregiver burden, beyond the motor severity, cognition, depression, apathy, disease duration and functional dependence. Studies conducted in a culturally appropriate manner between the Indian patient and the caregiver in early PD, especially, will greatly enhance the understanding of the interpersonal impact of the disease.

VI. THE INDIAN EVIDENCE: CURRENT KNOWLEDGE AND RESEARCH GAPS

Although the Indian literature related to PD has grown significant, the studies related to social cognition and burden of care have taken different trajectories. Existing research has shown that there are measurable social-cognitive impairments in PD among Indian patients and significant physical, psychological, social and financial burden among caregivers. But, with few comparative studies looking into whether these two phenomena are directly correlated, especially in the early stages of the disease.

Mehta et al. (2011) have developed Social Cognition Rating Tools in Indian Setting (SOCRATIS) which is an important contribution in the field of social-cognition research in India. The battery was culturally adapted for the purpose of measuring theory of mind (ToM), social perception, and attributional bias, without losing the underlying psychological constructs. The study highlighted the cultural context of social cognition and showed acceptable content and known-groups validity of the adapted measures. This work is of significant relevance to PD research due to the availability of an assessment framework which had been developed for Indian people and not just those from Western cultural backgrounds (Mehta et al., 2011).

Consequent evidence has started to show social-cognitive abnormalities in Indian PD patients. Siripurapu et al. (2023) compared 52 PD patients and 31 healthy controls in a case-control design, assessing various aspects of social cognition through SOCRATIS. Participants with PD had poorer ToM first-order and poorer faux-pas recognition and higher externalizing attributional bias compared to controls. Importantly, several clinical variables frequently considered, such as age, education, depression, global cognitive status, levodopa-equivalent dose and number of PD medications, did not predict the main social-cognition indices. The study thus offers direct evidence for meaningful social cognitive impairments in Indian PD – however, due to a cross-sectional design and the broader disease stage sample, the study cannot draw conclusions about social cognitive impairments in early-stage disease or progression (Siripurapu et al., 2023).

Research in India on cognition also shows that PD demonstrates some evidence of cognitive dissimilarity during relatively early stages of PD. In their study conducted at AIIMS comparing PD with mild cognitive impairment (PD-MCI), PD with normal cognition, and healthy controls, Chaudhary et al (2020) have found impairments in the attention, memory, executive and visuospatial domains of PD-MCI. The findings are of relevance although social cognition was not directly assessed, since there is a

possibility for the executive and cognitive processes to affect social-cognitive performance. Therefore, it is important to note that future research in India should be able to differentiate between social-cognitive impairment and global cognitive dysfunction rather than equating the two (Chaudhary et al., 2020).

The evidence base for care-giving in India is a little more developed in the literature. In a community-based study involving 150 PD patients and their caregivers, Sanyal et al. (2015) found that PD-related motor impairments and disease severity were significant factors that contributed to caregiver burden, and that the social and financial lives of caregivers were significantly disrupted. Caregiver burden was also found to be associated with anxiety and depressive symptoms; thus, caregiver burden encompasses more than the task of helping with physical disability (Sanyal et al., 2015).

Indian studies have since identified the role of non-motor and neuropsychiatric symptoms. In a tertiary care centre, Kerala, Jose et al. (2021) found neuropsychiatric symptoms in 61.5% of 104 patients, with depression, irritability, anxiety and apathy being the common symptoms observed. Determinants of caregiver burden were identified as neuropsychiatric symptoms, duration of caregiving, functional ability and sleep-related symptoms. In a similar study, Goel et al. (2022) observed that neuropsychiatric symptoms occurred frequently in an Indian cohort of persons with PD and they observed a strong correlation between neuropsychiatric symptom burden and caregiver burden. In India, these studies suggest that motor disability is not the only determinant of caregiver experience but also the behavioural and emotional symptoms of PD (Jose et al., 2021; Goel et al., 2022).

In addition to quantitative investigations, Indian research is done qualitatively to depict lived aspects of caregiving. These themes emerging from the narrative interviews with 10 female caregivers in Delhi are persistent caregivers' burden, changed family dynamics, ambiguity about the disease course, loss of identity of the caregivers, and the need for respite (Bhasin and Bharadwaj, 2021). The study is small and qualitative, but highlights the need to avoid reducing caregiver burden to a numeric value of care provided. The interpersonal and existential implications of the caregiving role might also be as significant when it comes to the impact of PD on families (Bhasin & Bharadwaj, 2021).

Table 3: Current Indian evidence and the unresolved interface

Area	Current Indian evidence	Principal limitation
Social-cognition assessment	SOCRATIS provides culturally adapted assessment of ToM, social perception, and attributional bias (Mehta et al., 2011).	Limited application specifically to PD and early-stage populations.
Social cognition in PD	Indian PD patients have demonstrated deficits in ToM, faux-pas recognition, and attributional processing (Siripurapu et al., 2023).	Primarily cross-sectional; relationship with caregiver outcomes was not examined.
Cognition in PD	Indian studies have documented executive, attentional, memory, and visuospatial abnormalities, including in PD-MCI (Chaudhary et al., 2020).	Social cognition was not incorporated into the cognitive framework.
Caregiver burden	Indian studies consistently report caregiver burden associated with motor disability, disease severity, functional impairment, and neuropsychiatric symptoms (Sanyal et al., 2015; Jose et al., 2021; Goel et al., 2022).	Social-cognitive characteristics of the patient are rarely assessed.
Lived caregiver experience	Qualitative evidence indicates substantial emotional, relational, and identity-related consequences of caregiving (Bhasin & Bharadwaj, 2021).	Small, geographically restricted samples limit generalizability.
Patient–caregiver relationship	Evidence suggests that behavioural and cognitive characteristics can influence caregiver experience.	Direct examination of social cognition and caregiver burden in the same dyad remains scarce.

6.1 Major research gaps

The most significant discrepancy is the lack of integrated studies of patient–caregiver that include both social cognition and caregiver burden at the same time. Social cognition has been shown to be abnormal in PD in the Indian literature and several patient-

related factors have been shown to be associated with caregiver burden. It is not yet known which of these (emotion recognition, ToM, social reasoning, or attributional processing) explains caregiver burden independently of motor severity, functional dependence, and general cognition, depression, apathy, and other neuropsychiatric symptoms.

A second gap relates to early PD. Many Indian caregiver literature has been focused on patients with established disease and social-cognition literature in India has not been adequately targeted on newly diagnosed or well-defined early stage PD. This restricts the ability to appreciate if there exists any significant physical reliance before major inter-personal challenges. The presence of social-cognitive deficits in early PD have already been shown in several international studies, even in some patients that do not have conventional MCI (Czernecki et al., 2021; Dodich et al., 2022).

A third is that methodological diversity. There are variations in the definition of disease stage, measures of cognition and burden, characteristics of the caregiver, and clinical co-variates. Most of the studies in India are cross-sectional and hence it's difficult to draw a temporal or causal inference. This is especially relevant for the proposed social cognition–caregiver relationship as there may be bidirectional influences between caregiver burden and interpersonal functioning over time.

Last but not least, there is a need for more cultural and regional diversity. Although some important works are available in the Indian literature from various parts like Delhi, Kolkata, Kerala, and Puducherry, there is a significant linguistic, socioeconomic, familial, and healthcare-system diversity in the country. Any conclusions made from one centre or from one region's population may not be applicable to other Indian families with PD. Future studies should thus use culturally sensitive tools, sample from diverse geographic areas, engage patients and family members, and have a longitudinal setting.

In general, the evidence from India supports two conclusions: (1) Social-cognitive dysfunction is a measurable part of PD, and (2) the burden of PD is a substantial multidimensional burden for the caregiver. An interesting unanswered question is whether and how these phenomena interact in the same patient–caregiver relationship, especially early in the course of PD. This can help bridge the gap between a predominant symptom-based approach to Indian PD research to a more comprehensive picture at the interpersonal and family levels of the disease's consequences.

VII. METHODOLOGICAL CONSIDERATIONS AND FUTURE RESEARCH DIRECTIONS

There are a number of methodological limitations in the literature on social cognition and caregiver burden in PD. Many of the studies that are available are cross-sectional, which makes it difficult to determine if social-cognitive problems come before the onset of caregiver burden, occur at the same time as caregiver burden, or occur later as other disease-related issues arise. It is thus important to have longitudinal designs to assess if early difficulties in emotion recognition, theory of mind (ToM), attributional processing, or other areas of functioning predict later increases in caregiver burden (Czernecki et al., 2021; Lesley et al., 2025).

Secondly, the study populations and outcome measures are not homogeneous. The definition of “early PD” differs widely across studies, with researchers using a range of measures from duration of disease, Hoehn and Yahr stage, age at diagnosis or cognitive status. Like that, there have been a number of emotion-recognition, ToM, empathy and attributional tasks used to assess social cognition, as well as a variety of burden or quality-of-life scales used to measure caregiver burden. This methodological difference makes it difficult to compare results across studies and leads to varying estimates of impairment (Coundouris et al., 2019; Maggi et al., 2022).

Future studies should follow a dyadic patient-caregiver design with the patient having measures of social cognition and caregiver burden separately measured. Importantly, studies should control for potential confounders such as motor severity, disease duration, executive functioning, global cognition, depression, anxiety, apathy, sleep disturbances, medications and activities of daily living. This adjustment would allow for determination of the unique explanatory value of social cognition beyond known factors associated with caregiver burden (Aamodt et al., 2024; Sin et al., 2026).

There is a need to pay greater attention to cultural and linguistic validity in the Indian context. SOCRATIS is

an important first step toward culturally appropriate social-cognitive assessment, and its use in other Indian languages, in different educational groups, socioeconomic conditions, and geographical regions is recommended (Mehta et al., 2011). Future studies should also add other variables reflecting relationship quality, communication, coping with the patient and perceived social support, which might moderate the patient social cognition/caregiver burden relationship. Development of prospective multicentre Indian cohorts, starting from, or close to the time of PD diagnosis, would be a particularly valuable direction. Specific social-cognitive domains might be early indicators of later interpersonal problems and/or caregiver strain, as assessed repeatedly. Further understanding of the neural and cognitive mechanisms associated with these links could be gained by integrating behavioral assessment with neuropsychological testing and, if possible, neuroimaging.

Lastly, intervention studies should extend beyond the motor symptoms. Once there is greater evidence of a meaningful relationship between social-cognitive difficulties and caregiver burden, it may be possible to assess interventions for the social-cognitive difficulties including psychoeducation, communication strategies, caregiver training, cognitive-social rehabilitation and relationship-focused approaches in combination with the standard neurological intervention. But at this stage, there is not enough evidence to conclude that there is a causal link between the two; the most immediate need is to investigate the strength of the association, its direction and the clinical relevance of the links through proper longitudinal and culture-sensitive research.

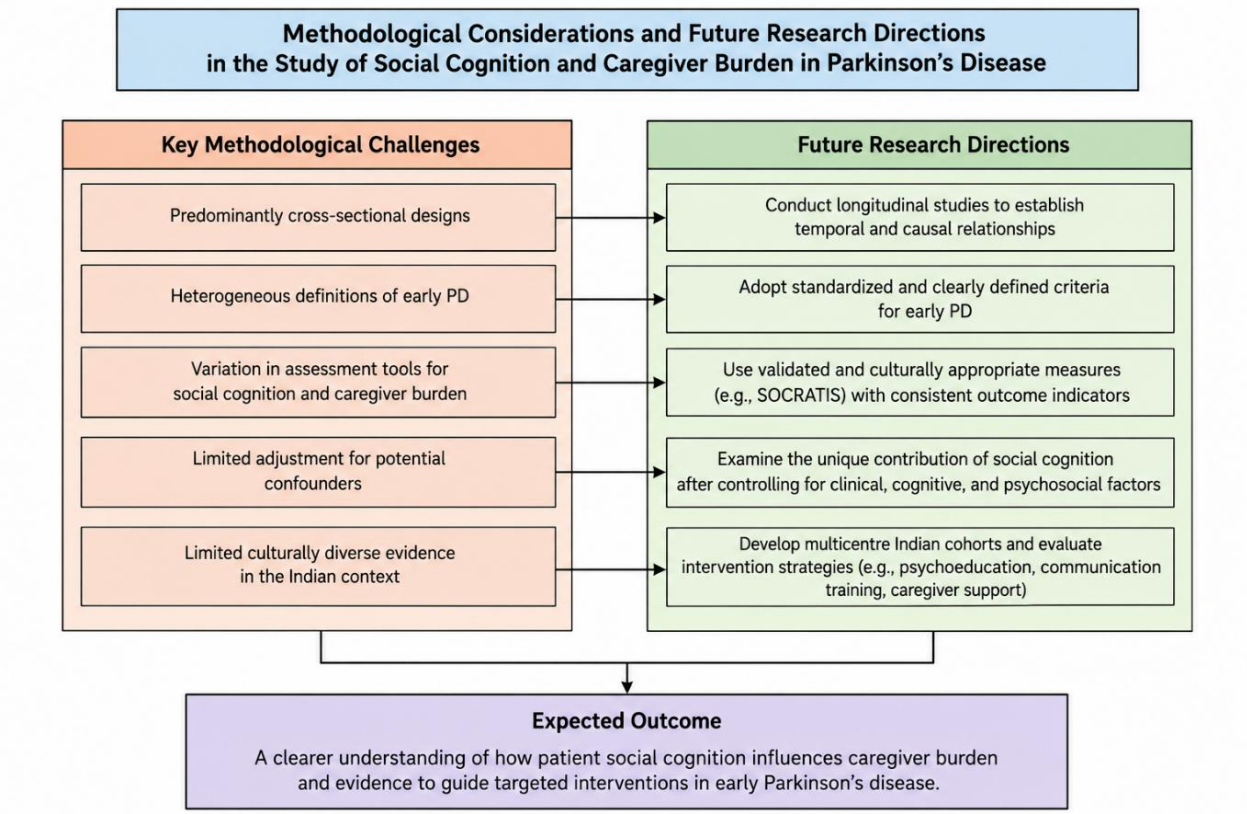


Figure 2: Methodological Challenges and Future Research Directions for Investigating Social Cognition and Caregiver Burden in Parkinson's Disease

VIII. CONCLUSION

Social-cognitive dysfunction is an emerging non-motor symptom of PD that has been reported to be abnormal in emotion recognition, theory of mind, attributional processing, empathy, and social reasoning. Notably, recent findings suggest that these challenges are present in early PD, even in people

without dementia or significant global cognitive deficits. Alongside motor disability, cognitive, behavioural, neuropsychiatric and psychosocial symptoms of the disease are also important factors to consider for caregiver burden.

There is a lack of much research on the intersection of these two areas, especially in India. While evidence of social-cognitive abnormalities in PD has been found independently in studies conducted across India, there is limited evidence addressing the association between the two within the same patient–caregiver dyad. Social-cognitive problems have a potential role in interpersonal miscommunications, decreased reciprocity and higher emotional needs of caregivers, but there is no evidence of a direct cause-and-effect link.

Longitudinal, dyadic and culturally sensitive studies of early PD should thus be prioritized in future research. Establishing that social cognition contributes to caregiver burden independent of the motor symptoms of PD will expand knowledge of PD beyond just a motor disorder to one that has significant interpersonal and family level consequences.

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