

PERSPECTIVE

What is paradoxical lucidity? The answer begins with its definition

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Abstract

Paradoxical lucidity in dementia is a clinically significant but understudied phenomenon. A provisional definition was proposed by the 2018 National Institute on Aging expert workshop and published in *Alzheimer's and Dementia*. However, several conceptual features of this definition remain vague, creating barriers to robust clinical research. Here, we critically analyze the provisional definition and present a refined definition that can be applied in clinical research. The refined definition is based on an analytic process our research group recently undertook to operationalize paradoxical lucidity for our own study protocol. Our goal is to facilitate debate and potentially harmonize interpretations of paradoxical lucidity among research groups.

1 | INTRODUCTION

Eight years ago, Sarah, now 73, was diagnosed with dementia caused by Alzheimer's disease (AD). Initially, she conversed with others; over time, however, she developed more problems with communication. Now, Sarah no longer engages with, and often appears unaware of, her environment. Occasionally she speaks to her reflection in the mirror, but her words are unintelligible.

On a recent call with Sarah's physician, Sarah's spouse reported that she appeared comfortable but, in the past month, she has eaten less and has lost a significant amount of weight. There is a TV at the foot of Sarah's bed, and her spouse plays episodes of Rick Steves' European Travel program in the morning. Later, for much of the day, he plays classical music. Family members make frequent visits, and Sarah appears to brighten when she sees her sisters, children, and grandkids.

In the last week, Sarah has occasionally said things that were recognizable, startling her family. Most notably, on two occasions, she clearly and unexpectedly told her spouse, "I'm scared. I want you to come with me." These episodes unsettled him. He reported them to Sarah's physician, asking for advice. (This case is adapted from one of the author's [JK] clinical experiences.)

Stories like this—of persons living with severe dementia who communicate after the capacity to do so appears lost—are not uncommon. Case reports document how persons living with severe dementia exhibit episodes of cognitive improvement in response to music or familiar voices. These episodes are characterized by unexpected and dynamic changes in a person's communicative or behavioral abilities, such as spontaneous talking or prolonged eye contact, and are often observed shortly before death.¹⁻⁷ The neurobiological mechanism of these episodes, described as "paradoxical lucidity" in the clinical literature, is presently unknown.

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In 2018, the U.S. National Institute on Aging (NIA) held an expert workshop on paradoxical lucidity. The workshop participants—scientists and clinicians with expertise in dementia and memory care, psychiatry, brain injury, and consciousness science—provisionally defined paradoxical lucidity as an:

Episode of unexpected, spontaneous, meaningful, and relevant communication or connectedness in a patient who is assumed to have permanently lost the capacity for coherent verbal or behavioral interaction due to a progressive and pathophysiological dementing process [8, pg. 1107].

The workshop participants went on to identify paradoxical lucidity as a priority area for investigation, arguing that systematic study could “motivate reconsideration of paradigms of dementia” and highlight new avenues for therapy.^{8,9} Improved understanding of the neurobiology of paradoxical lucidity could also inform cognate fields investigating, for example, the recovery of consciousness following anesthesia, traumatic brain injury, or stroke. Anecdotally, episodes of paradoxical lucidity sometimes generate intense reactions for family and other caregivers. Therefore, the workshop participants concluded that there is a need to better understand both the phenomenon of paradoxical lucidity and its clinical significance. The NIA subsequently funded several multidisciplinary research projects to address these issues (see National Institutes of Health [NIH] RFA-AG-20-017).

The provisional definition of paradoxical lucidity that emerged from the NIA expert workshop is an important starting point for this exploratory research, as it facilitates a shared understanding of the phenomenon. However, the provisional definition also lacks specificity: What does “communication or connectedness” mean? What describes communication that is “spontaneous”? And when is communication or connectedness “meaningful and relevant”? Fruitful study of paradoxical lucidity may be difficult if these questions are ignored.

In this article, we critically analyze the provisional definition of paradoxical lucidity and present a refined definition to guide clinical research. This analysis reflects the process our research team recently undertook in designing our own study protocol on paradoxical lucidity. In designing our study, we needed to specify a priori inclusion and exclusion criteria, parameters for classification of paradoxical lucidity, and considerations for how to handle marginal cases of lucid behavior. We initially attempted to do this with the guidance of the provisional definition; however, we quickly realized that conceptual vagueness in the definition was an obstacle to designing a rigorous study. Our goal here, therefore, is to demonstrate how we addressed these issues, and to foster debate on procedures for defining paradoxical lucidity in future clinical research.

The history of Alzheimer's disease (or AD) is a story of scrutinizing and revising concepts in response to scientific advances and cultural transformations. Dementia itself has been characterized as a conundrum that resists definition and discovery¹⁰ and could be contingent on culturally embedded meaning and practices.^{11,12} Although lucid episodes might be familiar to clinicians, the basic concepts asso-

RESEARCH IN CONTEXT

1. **Systematic Review:** The overall goal of this article is to facilitate debate and potentially harmonize interpretations of paradoxical lucidity among research groups that are investigating this important yet understudied phenomenon. The authors reviewed the relevant literature on paradoxical lucidity in dementia. There are few systematic studies of this phenomenon; however, several recent publications present case reports and the theoretical implications of studying paradoxical lucidity. Relevant publications have been appropriately cited.
2. **Interpretation:** This article critiques the provisional definition of paradoxical lucidity, as described by the 2018 National Institute on Aging expert workshop on paradoxical lucidity and published in *Alzheimer's and Dementia*.
3. **Future Directions:** This article proposes a refined definition based on an analytic process that our research team recently undertook to operationalize paradoxical lucidity for our own study protocol. The article concludes by outlining our analytic process to guide other research groups designing future paradoxical lucidity studies.

ciated with paradoxical lucidity, like other novel psychological constructs, can be “diffuse and contradictory.”¹³ This can limit scientific inquiry and prevent comparisons across disparate research projects. Adopting a substantive definition at this nascent stage of science risks prematurely narrowing investigation into a phenomenon that is not yet well understood. Yet, productive research on paradoxical lucidity also requires procedures to clarify and coordinate terms for operationalization. This process is essential to creating generalizable knowledge. Scrutinizing the definition of paradoxical lucidity facilitates a shared understanding of the phenomenon and can enhance the value of knowledge generated from clinical research.

There are at least two approaches to refining the definition of paradoxical lucidity. One approach, used by Morris and Bulman,¹⁴ surveys extant literature to identify conceptual similarities, or “concept clusters,” in how paradoxical lucidity is described. This data-driven approach seeks consensus. It is useful for identifying the various ways clinicians or stakeholders use the term, but it is problematic for our purposes. Definitions in dementia research are already known to be amorphous.¹⁰ Thus identifying consensus in how clinicians define paradoxical lucidity risks reiterating ambiguity in an operational definition. An alternative approach, which we deploy here, uses theory-driven conceptual analysis to scrutinize the meaning and logic of terms used in the provisional yet authoritative definition advanced by the NIA expert workshop.⁸ This approach aims at coordinating nascent theory on paradoxical lucidity with plausible measurement procedures, a process that is commonly observed in other domains of science using physical theories.

First, we outline the kinds of populations in which paradoxical lucidity could be detected by scrutinizing three criteria found within the provisional definition. We then turn to critically analyzing the meanings of five key terms found within the provisional definition: *spontaneous*, *meaningful*, *relevant*, *communication*, and *connectedness*. To guide our analysis, we apply a basic distinction between the semantics and pragmatics of language. We suggest that this semantic-pragmatic distinction could clarify key terms and organize scientific methods for studying the various dimensions of paradoxical lucidity. We conclude by presenting a refined definition of paradoxical lucidity and outline our analytic process for other research groups to use in future studies.

2 | WHO CAN EXHIBIT PARADOXICAL LUCIDITY?

The provisional definition of paradoxical lucidity states that episodes can occur in people who are “assumed to have permanently lost the capacity for coherent verbal or behavioral interaction” because of a “progressive and pathophysiological dementing process” [8, pg. 1107]. Three criteria are specified here. People who can exhibit paradoxical lucidity will have (1) *a neurological condition* that is assumed (2) to *irreversibly* (3) *impair verbal or behavior interactions*. We address these criteria below.

2.1 | What is the neurological condition?

The first element is that individuals will have a “progressive and pathophysiological dementing process,” but the relevant diagnoses underlying paradoxical lucidity are not clearly specified. We assume, however, that this would include people diagnosed with any neurodegenerative disease that impairs communication or behavior, including AD and AD-related dementias (AD/ADRD). Some studies report lucid episodes in other clinical populations with neurological conditions, such as people with brain tumors, meningitis, schizoaffective disorder, and acquired brain injury.^{4,15} Nevertheless, pathology varies across these conditions and researchers must acknowledge potential confounds associated with this variance.

2.2 | What is the irreversibility criterion?

The provisional definition also specifies that impairments associated with the neurological condition are assumed to be permanent. If a person's impairments are reversible, she could have an episode of lucidity, but this would not meet the definition of paradoxical lucidity. Reversible impairments might be caused by delirium, cognitive changes due to drugs with anti-cholinergic properties, transient cognitive impairment associated with heart failure, or other reversible conditions leading to apparent non-communicative states.

Notably, this irreversibility criterion could result in conceptual tension as research on paradoxical lucidity unfolds. As the science of cognitive impairment advances, and the underlying neurobiology

is revealed, we may find that impairments previously assumed to be permanent, are, in fact, reversible. Indeed, one motivation for research into the neurobiology of paradoxical lucidity is to identify new avenues for therapy with the hope that AD/ADRD might one day be reversed. This highlights the importance of the clause “assumed to be” in the definition of paradoxical lucidity. We anticipate that these assumptions might change as more data on paradoxical lucidity are acquired.

2.3 | What impairments must be present?

The third, related element of the provisional definition is the impairment caused by the neurodegenerative disease. This involves both the type of impairment and the assumption that the impairment is permanent, as described above. People can exhibit paradoxical lucidity only if they have “lost the capacity for coherent verbal or behavioral interaction.” This phrase, “coherent verbal or behavioral interaction,” is vague. What should “interaction” and “coherent” mean? In addition, the disjunctive “or” suggests that a person could satisfy either verbal or behavioral features of the definition and be regarded as a possible candidate for exhibiting paradoxical lucidity.

One possible solution to the challenges raised by this tripartite definition is to use quantitative scales to identify the relevant kind and degree of impairments in the target population. For example, the speech and language subscale of the Dementia Severity Rating Scale^{16,17} evaluates caregivers' assessments of the severity of communication deficits. A subscale score ≥ 4 indicates significant impairment in verbal and nonverbal communication. Likewise, a Mini-Mental State Examination (MMSE) cutoff of ≤ 11 , often used as a shorthand for severe dementia in people with AD, might also provide greater specificity. These scales can track the severity of impairments over time. People exhibiting the relevant scores on these scales over time might be safely “assumed” to have impairments that qualify them as candidates for paradoxical lucidity.

2.4 | Must paradoxical lucidity always be terminal?

Finally, an element that is absent from the provisional definition is the specification of the lucid episode's proximity to death. A recent study by Batthyány and Greyson¹ suggests that over 90% of people with severe dementia who display a lucid episode may die within 7 days—with 41% dying within 1 to 2 days and 15% within 2 hours. These results are largely consistent with earlier reports that, among people with severe dementia, 41% of lucid episodes occur within 7 days of death.³ Such episodes occurring relatively close to death are sometimes called *terminal lucidity*. Does this mean that all cases of paradoxical lucidity must also be terminal?

Although most lucid episodes might occur close to death, it is also plausible that they can occur well before, but they remain poorly characterized. It is often the case that more people—family and professionals—are present with a person with dementia at the end of life and emotions can run high. Family or professionals might be primed

to observe lucid episodes in such contexts as compared to non-end-of-life settings. If so, non-terminal lucidity might be more prevalent than assumed. This could be a critical discovery in efforts to understand paradoxical lucidity.

Studying non-terminal lucidity could enrich paradoxical lucidity research, but it could also introduce complexities. For example, people with Lewy body dementia typically display waxing and waning attention or fluctuations in alertness and thinking. Without carefully operationalizing paradoxical lucidity, these events could be erroneously classified as lucid episodes. In general, we think terminal lucidity should be regarded as an instance of paradoxical lucidity, but not all instances of paradoxical lucidity should be regarded as terminal. Nevertheless, researchers will need to introduce quantitative scales, as described above, to confirm that a patient consistently lacks the capacity for verbal or behavioral interaction, thereby avoiding confounds in the detection of non-terminal cases.

3 | HOW CAN RESEARCHERS CLARIFY THE PROVISIONAL DEFINITION OF PARADOXICAL LUCIDITY?

The provisional definition of paradoxical lucidity describes the clinical presentation of lucid episodes. An episode of paradoxical lucidity is “unexpected, spontaneous, meaningful, and relevant communication or connectedness” [8, pg. 1107]. Clinicians or caregivers who have witnessed paradoxical lucidity may have an intuitive understanding of these criteria. Yet they also admit to multiple interpretations. In what follows, we outline various ways to make interpretations of these criteria rely less on intuition and more on rigorous conceptual analysis. We do not prescribe any particular interpretation. Rather, we outline plausible interpretations and procedures that researchers might adopt.

3.1 | What should “spontaneous” mean?

There are various ways that “spontaneous” could be interpreted. One interpretation is that something is spontaneous if it defies expectations. An episode of paradoxical lucidity is paradoxical precisely because it is unexpected in light of the standard view that neurodegeneration is irreversible. Although this is a plausible interpretation, it forces us to ask why both “spontaneous” and “unexpected” are included in the provisional definition. If spontaneous means nothing more than unexpected, parsimony requires removing one of these terms. But, as a general rule, we should not interpret any part of a definition in a way that would render it (or another part) redundant.

Another possible interpretation, then, is that something is “spontaneous” if it is idiopathic. Behavior is idiopathic when it is caused by an underlying pathology but presents in a *sui generis* fashion. The cause of the lucid behavior is regarded as internal to the person with dementia. Yet, because of the prolonged time, severity, and assumed permanence of the dementing process, the behavior is regarded as stochastic or unpredictable. Such behavior is often observed in other clinical

populations. People with idiopathic epilepsy, for example, show no observable brain disorders or lesions that predict seizure activity, but the causal mechanism is still attributed to underlying pathology, most likely a genetic predisposition. This interpretation of “spontaneous” highlights the unpredictability of paradoxical lucidity, consistent with the “unexpectedness” criterion, while also suggesting that there is an underlying, yet undiscovered, causal mechanism.

We favor this second interpretation of “spontaneous” because it gives the unexpected and spontaneity criteria distinct and operationalizable meanings. But this interpretation might also pose a puzzle. Behaviors associated with paradoxical lucidity could, in some cases at least, be prompted by an external stimulus. For instance, a person with severe dementia might exhibit lucidity while looking at an album of family photos. The external stimulus—in this example, the photo album—plays some role in facilitating the episode. Yet without a clear understanding of the neurobiological mechanism, it might be difficult to place the causal locus of lucidity internal or external to the person with dementia.

To address this issue, we suggest that researchers carefully delineate *neurobiological mechanisms* of lucidity from *environmental triggers*. In the photo album case, we might say that some undiscovered brain mechanism creates the causal conditions for the lucid episode, but exposure to the photo album ultimately triggers it. This distinction maintains the above-outlined interpretation of spontaneity while also avoiding puzzles as to where the causal mechanism of lucidity is located.

3.2 | What should “meaningful and relevant” mean?

“Meaningful” and “relevant” could have various interpretations depending upon a researcher’s approach to studying paradoxical lucidity. For conceptual organization, we suggest that “meaningful” and “relevant” can be overlaid with the familiar distinction in linguistics between semantics and pragmatics. Semantics concerns the structural properties of language, such as lexical relationships, grammatical categories, and syntax. Pragmatics, on the other hand, examines the use of language in social context.

Semantic and pragmatic aspects of language interact in complex ways,¹⁸ and there is debate regarding how—or whether—they can be distinguished.^{19,20} We suggest here that loosely distinguishing semantics from pragmatics may serve as a heuristic for interpreting “meaningful” and “relevant” in the provisional definition. However, as we shall also suggest, the “meaningful” and “relevant” criteria might also interact during classification of lucid episodes.

The semantics of language are measurable by the language sciences. Production of verbal language, for instance, requires competence in lexicon, grammar, and syntax, as well as the phonological capacity to utter words. These features of language can be quantified with the tools of language science. The concept of linguistic coherence, for example, incorporates various measurable syntactical elements of written or spoken language, and can be measured

with natural language processing in clinical and cognitively unimpaired populations.^{21,22} “Meaningful,” as used in the provisional definition, might therefore be understood to refer to the semantics of language. Communication or connectedness that is meaningful would be behavior consistent with lexical, grammatical, and syntactical convention. This interpretation captures instances of communication that we might regard as lucid—such as utterances with unexpected lexical competence or complexity—irrespective of social context.

Pragmatics pertains to the relationships between language and context. Pragmatics has several dimensions. Pragmatics can describe deixis: how elements of language, such as pronouns, refer to different persons or entities depending upon the time and place of their use.²³ Pragmatics can also describe non-referential functions of language, such as how individuals infer the traits of others, including social status or affective states, based on how they communicate.^{24,25} Pragmatic features of language thus bear on meaning, but in a different way than semantics.

To assemble the above points into an example, consider the utterance “tell the children to go away.” This utterance is semantically coherent; it is an utterance that is consistent with lexical, grammatical, and syntactical convention. Yet if a person says this when no children are present, the utterance may lack relevance to context. The term “relevant,” as used in the provisional definition of paradoxical lucidity, might therefore refer to the pragmatics of language. Communication or connectedness that is relevant would describe behavior that is contextually appropriate and can be analyzed with the tools of social sciences, such as linguistic anthropology, sociolinguistics, and social psychology.

Although the semantic-pragmatic distinction is instructive for understanding “meaningful” and “relevant” separately, this distinction raises questions about the relationship between these criteria. The provisional definition conjoins them with the term “and,” suggesting that communication or connectedness must be *both* meaningful *and* relevant in order to count as genuinely lucid behavior. Yet it is worth considering whether this is necessary for classification of paradoxical lucidity, or if it is too demanding.

Consider, for example, a non-communicative person with severe dementia who is attending his granddaughter’s 30th birthday party. He unexpectedly turns to his granddaughter, addresses her by name, and vividly recalls a time when they baked a cake together to mark the granddaughter’s 17th birthday. This grandfather has communicated in a way that not only satisfies the semantics of language, but also its pragmatics: his communication is meaningful and relevant to the particular social context. Now consider various scenarios in which the contextual features are changed. For instance, the grandfather might say the same things but at a birthday party for another resident of the memory-care facility in which he resides, a party his granddaughter is not attending. In such a case, the semantic features of communication are preserved, but some pragmatic coherence is lost. Subtypes of paradoxical lucidity might be characterized by this dissociation of semantics and pragmatics, or “meaningful” from “relevant” communication. Another subtype might be characterized by the conjunction of the two, as suggested by the provisional definition. We suggest that studying both manifestations of lucid behavior is important in this early stage of the science.

An additional aspect of the “relevant” criterion is that it might also shed light on the emotional dimensions of “meaningful” lucid episodes. Communication or connectedness might be regarded as meaningful according to the semantics of language, but lack of relevance might also diminish its emotional impact. A clinician who witnesses the above-described birthday celebration might find the grandparent’s behavior unusually lucid, perhaps even indicative of recovered memories. But the clinician is unlikely to feel the same emotional response as the granddaughter or a close family member. This highlights how observers could play a crucial role in specifying whether putatively lucid behaviors are “meaningful” and “relevant.” Observers who are present during the lucid episode can specify if the behavior is generally relevant to the immediate social context. But observers who are more intimately familiar with the person with dementia might also find deeper meaning in certain behaviors that reveal preserved fragments of memory or identity.

3.3 | What should “communication or connectedness” mean?

The disjunctive “or” implies that a person might display communication or connectedness and still be classified as exhibiting paradoxical lucidity; the person does not need to display both. We analyze these criteria separately below.

One key issue for the study of paradoxical lucidity is how narrow or broad the term “communication” should be defined. The plain meaning of the term suggests that communication involves the transfer of information from one individual to another. A person alone in a room who utters grammatical and fluently complex sentences does not communicate in this strict sense, as there is no transaction of information with another person. Non-verbal communication, such as a thumbs up or shaking of the head, is even more difficult to detect without the appropriate context. The “relevant” criterion, as described above, is thus baked into the concept of communication. The social context—including whether others are present—specifies, in part, whether a person has communicated verbally or nonverbally.

Given how little is known about paradoxical lucidity, we propose a more inclusive interpretation of “communication.” This interpretation would allow for verbal or non-verbal behavior that *could plausibly be regarded* as communication, whether it is between two or more people or done alone. A person with severe dementia who unexpectedly but consistently blinks in response to caregivers’ questions should be regarded as communicating just as much as a person who unexpectedly recites Keats’s “Ode to a Nightingale” by herself. Likewise, the target of communication needn’t be another, distinct person. For instance, one of us (JK) has encountered a person with severe dementia who frequently talks to her reflection in a mirror and another person with severe dementia who will speak to a robotic cat but who is otherwise non-communicative. All such behaviors strike us as plausible instances of communication for classification of paradoxical lucidity.

We should caution, however, that some non-verbal behaviors, like head shaking, might be difficult to interpret without an appropriate

social context. In an appropriate social context, head shaking could indicate the answer, “no,” to a yes-or-no question. But in other contexts, it might also indicate neck pains, an itch, or stereotypical behavior. We think that researchers should adopt an inclusive interpretation of “communication” to capture head shaking as a way to interact with other people. However, it will be important for researchers to clearly outline their rationale for classifying non-verbal behaviors as instances of paradoxical lucidity, especially if such behaviors might be better explained by confounds.

The “connectedness” criterion is more difficult to interpret. On one hand, connectedness could mean the degree to which a person with severe dementia is unexpectedly engaged with her environment. This sense of connectedness would capture unexpected goal-directed or environment-responsive behaviors such as dressing, preparing meals, crying in response to a home movie, or consistently locking eyes with others. This interpretation of “connectedness” broadens the scope of non-verbal behaviors that might serve as potential markers of paradoxical lucidity.

A different interpretation of “connectedness” might point to others’ *feelings of connection* to the person with dementia. As described above, the granddaughter who observes her grandfather unexpectedly recall her 17th birthday could experience a profound emotional reaction—a sense of *connection* to her grandfather—in a way that she did not feel immediately prior to the episode.

Although this interpretation might enrich the definition of paradoxical lucidity, it could deviate from its intended meaning. Presumably, the manifestation of connectedness should be detected in the person with dementia, not the observer. Moreover, even if it is detected in the observer, emotional connectedness will be grounded in subjective dispositions toward the person with dementia, which are difficult to evaluate experimentally. Nonetheless, interpreting connectedness in this way highlights the complex perspectives that observers—particularly close family and friends—might bring to the detection of paradoxical lucidity. Because the classification of paradoxical lucidity is, in part, dependent on the reports and perceptions of others, researchers should acknowledge and disentangle how these attitudes might bear on these observations.

4 | DISCUSSION

In this article, we critically analyzed the provisional definition of paradoxical lucidity outlined in the NIA expert workshop report.⁸ This analysis reflects the process our research team recently undertook to design our study on paradoxical lucidity. This process included specifying a priori inclusion and exclusion criteria, parameters for classification of paradoxical lucidity, and considerations for how to handle marginal cases of lucid behavior and revisions to the definition.

Table 1 outlines six questions that guided our analytic process. Column two outlines the rationale for each guiding question. Column three outlines our responses. These responses, in our view, clarify ambiguities in the provisional definition offered by Mashour et al.⁸ and allow us to move forward with our study. We acknowledge that the provi-

sional definition admits of multiple interpretations, and that our particular responses are open to revision and argument. Nonetheless, we believe that seeking conceptual clarity at this early stage of the science is critical. Other research groups studying paradoxical lucidity might therefore find this analytic process instructive as they conduct their own studies.

Our analysis raises several important questions. First, readers might wonder why we have chosen to focus on the clinical manifestation of paradoxical lucidity rather than the underlying neurobiology. After all, paradoxical lucidity highlights the possibility of network-level return of cognitive function in severe dementia, and focusing on neurobiology might reveal real therapeutic possibilities. We acknowledge that studying the underlying neurobiology is an important facet of the overall NIA research portfolio. However, we worry that focus on neurobiology prior to clearly defining the clinical presentation of paradoxical lucidity could generate methodological problems. The example of AD is instructive. For much of the 20th century, individuals were diagnosed with probable AD based on their clinical presentation. This case definition guided further research that has led to discovery of biomarkers—amyloid, tau, and neurodegeneration—that offer biologic explanations of the disease’s mechanisms. These biomarkers, in turn, are now informing clarifications to diagnostic nosology. Nonetheless, this process could not have started without a clear—albeit revisable—case definition of AD. Studying underlying neurobiology may eventually refine the behavioral correlates of paradoxical lucidity. But without a clear understanding of its clinical presentation, narrow focus on the underlying neurobiology is unlikely to be productive in this initial stage of research.

Second, some might argue that our conceptual analysis is premature. According to this view, refining the definition of paradoxical lucidity ought to be data-driven, akin to the survey methods used by Morris and Bulman.¹⁴ More data are needed to make substantive refinements that advance the field, not the theorizing we have outlined here. We agree that more data would be useful in this context. But it is a puzzle as to how researchers ought to gather these data without an initial definition that can be implemented in a study protocol. Our analysis reflects the real practical challenges that our team faced in designing our study, and the deep conceptual questions we will likely need to revisit as our study unfolds. Without this reflective exercise, our study would not get off the ground.

Finally, despite the potential benefit of our critical analysis, we acknowledge that much more empirical and theoretical work needs to be done. In the short term, we expect continued debate and refinement of the provisional definition reflecting ongoing accumulation of data from different study strategies. As we have laid out above, different but complementary methods—including those from the language sciences, the social sciences, and assessment of the underlying neurobiology—may provide a pluralistic understanding of paradoxical lucidity that ultimately refines definitions and measures. In the long term, scientists will eventually need to validate those measures. Validation studies may be difficult without extant reference tests of paradoxical lucidity to estimate sensitivity and specificity. Large scale, multi-site longitudinal observation or intervention studies might be most appropriate. The

TABLE 1 Conceptual analysis of the definition of paradoxical lucidity

| Question | Rationale for question | Our research team's interpretation |
|---------------------------------------|---|---|
| Who can display paradoxical lucidity? | Scrutinizing three criteria in the provisional definition regarding plausible candidates (eg., (1) type of neurological condition; (2) the irreversibility of the condition; and (3) the associated impairments) can specify inclusion and exclusion criteria. | <ul style="list-style-type: none"> • Candidates should have AD/ADRD with pre-specified criteria to confirm the diagnosis and the degree of impairment (eg, a Dementia Severity Rating Scale speech and language score ≥ 4 and an MMSE score of ≤ 11). • Paradoxical lucidity might involve terminal and non-terminal cases. |
| What should spontaneous mean? | Scrutinizing "spontaneous" specifies the scope of measurement; a broad definition will classify more behaviors as spontaneous, while a narrow definition will classify less. | <ul style="list-style-type: none"> • Communication or behavior is "spontaneous" if it is idiopathic; namely, it is caused by an underlying pathology but is presently unpredictable. • The spontaneity criterion picks out behaviors that conflict with the impairments that are assumed to be permanent in the inclusion criteria. |
| What should meaningful mean? | Scrutinizing "meaningful" specifies criteria for classification of paradoxical lucidity; in what sense must the communication or behavior be meaningful, and to whom? Answers to these questions may alter the research strategy. | <ul style="list-style-type: none"> • Communication or behavior is "meaningful" if it coheres with the semantics of language; meaning, it is grammatical and obeys lexical conventions. |
| What should relevant mean? | Scrutinizing "relevant" specifies criteria for classification of paradoxical lucidity; in what sense must the communication or behavior be relevant, and to whom? Answers to these questions may alter the research strategy. | <ul style="list-style-type: none"> • Communication or behavior is "relevant" if it is consistent with the pragmatics of language; meaning, it displays a sensitivity to social context (eg., saying "happy birthday" to a person on her birthday). |
| What should communication mean? | Scrutinizing "communication" specifies the scope of behaviors that should be regarded as communication. Communication may be verbal or nonverbal. Communication may also require transaction of information between two people. Different research strategies may be needed to detect each form of communication. | <ul style="list-style-type: none"> • "Communication" is verbal or nonverbal behavior that could plausibly be regarded as communication even if an observer/interlocutor is not present; Information need not be exchanged between two or more people in order for the behavior to be regarded as communication. • Social context must be examined carefully to confirm whether nonverbal behavior should be regarded as communication. |
| What should connectedness mean? | Scrutinizing "connectedness" specifies the scope of behaviors that should be regarded as displaying connection. In what ways do people display connectedness? To what should the person with dementia be connected (eg., a task or an environmental stimulus)? Should observers' internal feelings of connectedness bear on the classification of putatively lucid behaviors? | <ul style="list-style-type: none"> • Behavior displays "connectedness" if the person with dementia is attuned to, or interactive with, the environment in a way that she was not before the lucid episode; this may be goal-directed behavior (eg., dressing on one's own) or environment-responsive behavior (eg., crying in response to family photos). • Communication or behavior might also display "connectedness" if an observer expresses feelings of connection to the person with dementia upon observing the lucid behavior. This interpretation, however, should not supersede detection of goal-directed or environment-responsive behavior. |

Abbreviations: AD/ADRD, Alzheimer's disease and Alzheimer's disease related dementias; MMSE, Mini-Mental State Examination.

NIA and other funding agencies might consider strategic investments in these short- and long-term goals.

5 | CONCLUSION

Paradoxical lucidity is an emerging but poorly understood phenomenon in people with severe dementia. Systematic investigation

could shed light on its clinical manifestation and underlying neurobiology, which may pave the way for novel therapies that reverse impairments caused by neurodegenerative diseases. Nevertheless, the clinical construct of paradoxical lucidity is not well characterized. This limits progress in this nascent stage of research.

In this article, we critically analyzed the provisional definition of paradoxical lucidity offered by the NIA expert workshop.⁸ We argued that the definition contains various basic concepts that require greater

clarification. While refraining from prescribing any substantive definition, we offered a refined definition and several procedural recommendations for analyzing the provisional definition. Other research groups might find our analytic process instructive as they design their own study protocols on paradoxical lucidity.

Our overall goal is to encourage researchers to think carefully about the relationship between basic concepts within the provisional definition and how paradoxical lucidity is measured. Continued debate on these issues may facilitate a shared understanding of paradoxical lucidity across research programs and ultimately enhance the quality of the science.

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