



HAL
open science

Sawing the branch of near-death experience research: A critical analysis of Parnia et al.'s paper

Renaud Evrard, Erika Pratte, Thomas Rabeyron

► To cite this version:

Renaud Evrard, Erika Pratte, Thomas Rabeyron. Sawing the branch of near-death experience research: A critical analysis of Parnia et al.'s paper. *Annals of the New York Academy of Sciences*, 2022, 1515 (1), pp.5-9. 10.1111/nyas.14846 . hal-04106163

HAL Id: hal-04106163

<https://hal.univ-lorraine.fr/hal-04106163v1>

Submitted on 25 May 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Sawing the branch of near-death experience research: A critical analysis of Parnia et al.'s paper

Renaud Evrard¹  | Erika Pratte² | Thomas Rabeyron^{1,3,4}

¹Laboratory Interspy, Department of Psychology, University of Lorraine, Nancy, France

²University of Northampton School of Social Sciences, London, UK

³Institut Universitaire de France, Paris, France

⁴Honorary Research Fellow, University of Edinburgh, Edinburgh, UK

Correspondence

Renaud Evrard, Laboratory Interspy, Department of Psychology, University of Lorraine, 23 Boulevard Albert 1er, Nancy 54015, France.
Email: renaud.evrard@univ-lorraine.fr

Abstract

In their recent paper, Parnia and colleagues propose a new label for the near-death experience (NDE): recalled experience of death. They claimed NDEs are “authentic” only when an objective danger is present and that authentic NDEs have a proven core phenomenology. We consider that these claims are insufficiently supported by empirical data. NDEs appear as a continuum of heterogeneous experiences of consciousness precipitated by the disjunction of processes usually combined in normal mental activity. The “core phenomenology” of NDEs is also opened to several criticisms. Closeness to “real” death does not appear to be a decisive criterion for characterizing NDEs. The author’s adhesion to Raymond Moody’s NDE model produces a biased partition of this field of research that is unable to provide the basis for a consensus.

KEYWORDS

altered states of consciousness, death, near-death experiences, phenomenology

INTRODUCTION

Parnia and colleagues¹ recently proposed a new label for the near-death experience (NDE): recalled experience of death (RED). However, we do not share several of the opinions shared by these authors and the “consensus” they proposed is far from general. Indeed, their article proposes a very risky defensive strategy, which truncates the NDE phenomenon to avoid confronting what the last decades of research have revealed. The image that comes to mind is that of researchers sawing off the branch on which they are sitting, for fear that the whole forest will be felled by woodcutters. The motivations put forward to justify this strategy relate to two observations that we agree on: the phenomenological complexity of NDEs and the inadequacy of current research and clinical scales. However, we encourage retreating from alternatives that are insufficiently supported by empirical data.

CATEGORICAL AND DIMENSIONAL APPROACHES OF NDEs

For several decades, research on NDEs has relied on an ambiguous definition according to which NDEs are triggered by mortal danger

or when a person believes he or she is in a life-threatening situation. This vagueness poses a significant logical problem. Since the cognition of being mortally threatened is concomitant with the perception of such a threat, the definition should be reversed: NDE could be triggered by the conviction of facing a mortal danger which, contingently, may be sometimes actually present. In contrast to this principle, Parnia *et al.*¹ suggest that this definition should consider NDEs as “authentic” or “classical” only when an objective danger is present. This places the identification of the NDE on the side of a third-person perspective where, for example, a medical doctor would decide whether it was a real heart attack or a panic attack. Parnia *et al.*¹ invite strengthening the link between NDEs and “real” death, as if NDEs actually tell us something about the process of dying and not only about its psychological experience. However, even the cognition of being mortally threatened is not an invariant distinctive feature, despite its role as a powerful trigger in several cases.² In fact, some NDEs occur in contexts where the subject does not seem to have had the means to identify the lethal threat.³

This redesign of the definition goes hand in hand with the division of the field into two categories of experiences: authentic NDEs and NDE-like or “mislabelled NDEs”¹ (p. 16). Parnia *et al.*¹ (p. 10) describe a very degraded vision of the latter, which they reduce to being nothing more

than delusions (p. 15). These NDE-like experiences would represent a variety of human experiences that (p. 10 and 15):

- a. have no relation to death,
- b. are reported to occur during conscious states,
- c. have no or very superficial shared themes or features with RED,
- d. have no positive transformative effects.

At no point do they discuss empirical data contradicting their categorical view. For example, Owens and colleagues compared the medical records of 58 people who had had an NDE, checking the circumstances of its onset.⁴ They found that the accounts did not differ sufficiently between those whose lives had been genuinely endangered and those who were not. The intensity and content scores on the NDE scale were very close. Recently, the Coma Science Group (www.coma.uliege.be) confirmed these results with 190 new cases.⁵ NDEs occurring during sleep, meditation, drug or alcohol use, or simple syncope were within the same magnitude as NDEs associated with serious organic disorders, that is, according to their inappropriate terminology, in “traumatic contexts.” NDE-like events also produced positive transformation effects.

Therefore, there is no clear-cut phenomenological difference supporting (c) and (d) that justifies this strict division. When Parnia *et al.*¹ (p. 10) call for a separate classification and investigation of authentic and NDE-like experiences, they are in contradiction of many studies underlying the heterogeneity of experiences labeled as NDEs; this suggests the hypothesis of a *continuum* of NDEs. They are, indeed, triggered in situations where the mortal threat takes multiple forms, subjective and/or objective. Thinking about NDEs in a fully dimensional way allows to integrate a larger part of the collected data and to build bridges between several fields of interest. Thus, the clinical practice with psychotraumas invites us to consider peritraumatic dissociation in the face of a frightening affect, up to forms integrating out-of-body experiences or other transcendental elements.^{6,7}

Sabom already proposed distinguishing acute dying experiences from “true” NDEs,⁸ while Evrard *et al.* showed that they were probably one and the same experience.⁹ Noyes and Kletti⁶ (p. 108) have also shown that the most transcendental elements arise when the circumstances of the experience do not allow the individual—by all appearances—to escape his mortal fate via the absence of opportunities or through capitulation. However, Holden argues that this hypothetical sequence does not account for cases where individuals simultaneously experience a struggle for survival in the here-and-now and a detachment into the elsewhere.¹⁰

An integration of these two hypotheses could be achieved by considering that the NDE is a heterogeneous experience of consciousness precipitated by the disjunction of processes usually combined in normal mental activity.¹¹ Thus, conditioning NDEs on a prerequisite period of loss-of-consciousness¹ (p. 4) is already a faulty claim: it rejects models that make NDE an altered state of consciousness via possible amplifications of consciousness (hyperalertness) combined with forms of dissociation.

CORE PHENOMENOLOGY OF NDES

Parnia *et al.*¹ (p. 3) argue that authentic NDEs have a proven core phenomenology. They focus on:

1. a relation with death,
2. a sense of transcendence,
3. ineffability,
4. positive transformative effects (related to meaning and purpose to life),
5. severity of illness that leads to loss of consciousness,
6. absence of features of other coma-related experiences (such as conventional dreams, delirium, and delusions, in the intensive care unit or elsewhere).

This allows the authors to schematize their conception¹ (p. 8): an RED needs first an objective life-threatening situation or a critical illness, then a loss of consciousness, followed by transcendental features in its narrative arc. But there are no empirical studies that support this phenomenological pattern. Indeed, most studies use Greyson’s scale,¹² which the authors themselves disapprove¹ (p. 16) as it extends the phenomenological horizon of NDE and does not allow for the distinction between “authentic NDEs” and “a broad range of other heterogeneous human experiences that occur in non ‘near-death’ circumstances.” They argue that the scale was not designed to be applied in certain borderline situations, which implies that its discriminative properties are weak. For example, they suggest that psychedelic experiences could be considered as false positives.¹³

Each of these criteria, taken individually, is open to criticism. The “relation with death” is a vague notion: someone who thinks they have reached the last moment of their life, for example, in front of a firing squad, is in relation with death and can experience an NDE, as already reported and analyzed extensively in the 19th century.¹⁴ However, Parnia *et al.*¹ (p. 10) deny that NDE-like experiences have any “relationship with death.” So, if it is about death not as a subjective experience of dying but as a physiological and irreversible form of thanatosis, point (1) seems perfectly redundant with point (5) on the “severity of illness,” since it is each time about biologically authenticating a critical threat.

Points (2) and (3) insist on the mystical aspects of the experience, even though these may occur in other conditions of consciousness.¹⁵ As shown above, it is a real problem to elevate these elements as singularities that define the NDE, as they come in very different forms from one individual to another depending on the context of occurrence. Ineffability, for example, is in stark contrast to the astonishing enhancement of cognitive abilities found in many of the NDE cases collected by the University of Virginia: 45% find their thinking clearer than usual, 37% find it faster, 29% say it is more logical, and 19% say they have better control over their thinking¹⁶ (p. 386).

One aspect of this supposed phenomenology of authentic NDE is even more problematic: the claim that authentic NDEs have positive transformative aftereffects. This argument is not new. As one of the coauthors of the Parnia *et al.* paper wrote decades ago: “Some

researchers have gone so far as to argue that if the person was not 'transformed' by their NDE, it was not a 'true' NDE¹⁷ (p. 129). Van Lommel,¹⁸ for example, uses these aftereffects to distinguish genuine NDEs from hallucinations caused by DMT, a hallucinogenic.¹³

The first and most important observation is that not all people who experienced an NDE report personality transformation. There is nothing systematic about this. While two thirds of them indeed report changes, the remaining third come close to death without change.^{17,19} Moreover, while average trends emerge, the observed impacts do not apply uniformly to all individuals.²⁰ Finally, there is still a lack of rigorous prospective studies comparing these repercussions with those already affecting people who have come close to death without an NDE.²¹ To take this aftermath of NDEs as a distinctive phenomenological feature of authentic NDEs is to mix a specific experience of consciousness with an evolution subject to cultural, sociological, and clinical factors.²² Parnia *et al.*'s assertion, besides being empirically unfounded, could reinforce a conformism to certain idealistic values associated with the prototype implicitly defended by these authors.¹

This self-proclaimed consensus conceals one of the great difficulties of this field of research: the difficulty of defining NDE precisely. In the space of a decade, four models have been proposed.^{12,23–25} They were not the first and others have been developed since.²⁶ These models are not superimposable. Rather, they act in the manner of a "description-construction,"²⁷ that is, in a performative way to disseminate a prototype to which witnesses and researchers will then conform more or less.

For example, the discovery of negative NDEs has shown that a part of the accounts had been scotomized in a space biased toward overpositivization of these experiences.²⁸ In their article, Parnia *et al.*¹ (p. 15) even claim to exclude these negative NDEs, which they claim should only be attributed to delirium and delusions in intensive care unit. Historical and contemporary research has shown, since the scientific collection of cases by Heim,²⁹ that a large proportion of NDEs were presented as altered states of consciousness that enhanced the perceptual, cognitive, and motor abilities of individuals, allowing them to perform certain intellectual and/or motor performances to which they attributed the action that saved them.⁹ However, such elements do not appear in any of the scales describing NDEs, except in the model of Noyes and Slymen, where these elements are present in more than the majority of the testimonies of their sample of 189 individuals, 89% of whom had their NDE during an accident.²³

Besides, in a well-argued manner, Parnia and colleagues also show¹ (p. 48) that certain artificially induced visual illusions produced by neurostimulation or experimental devices are only vague approximations of NDE experiences, which are mistakenly, for unscientific reasons, labeled as explaining some portion of NDE or out-of-body experience (OBE).

Rather than distinguish one part of the NDE spectrum as being solely representative of the whole class, it seems more relevant to construct a multidimensional model whose factors and interactions will be studied. While the transcendent factor, manifested through various mystical elements, is interesting, it is far from being present in all cases where individuals confront death. Noyes and Kletti⁶ also add two

factors: depersonalization and hyperalertness, which together account for other essential elements of the experience that Parnia *et al.* attempted to exclude.¹ These characteristics can be found in completely different situations, for example, in athletes practicing extreme sports.³⁰ But these crossings can provide with avenues of understanding, particularly as regards what is happening at the metabolic level.³¹ If they are to be discriminated, it is through a theoretically guided scale whose psychometric properties will have been well validated by comparing several groups, allowing discriminating analyses.

MOODY'S SYNDROME AS A PROTOTYPE

The question of the (non-)conformity of the NDE-like phenomenology betrays the explicit model to which the authors adhere. While the main representation equates NDEs with the original descriptions of American psychiatrist Raymond Moody, it seems more relevant to speak of a "Moody syndrome" than of "the essence of the narrative arc of the original transcendent experiences described in 1975"¹ (p. 3).³² From his observations, Moody identified 15 themes, those most frequently associated with these experiences, while specifying that these are neither invariants nor elements specific to NDEs, and that no two accounts combine these elements in the same way.³³

While the Moody syndrome has attained some popular success, Greyson¹² constructed his scale relying also on the work of Noyes and Kletti,⁶ who used a different sample population and their Accident Experience Questionnaire. This empirical mix is not without question. Indeed, only 26% of the Noyes and Kletti sample had mystical experience, whereas the Greyson scale has many items evoking transcendence and the paranormal. The weight given to one or the other aspect should result, in the end, in the construction of a contextual representation of the NDE. Moreover, Moody's syndrome is a clear departure from the models of its many predecessors, which are generally overlooked.^{14,34}

What to do with experiences that deviate from the prototype in this way? An example has been given by Moody³⁵ (pp. 100–101) who himself dismissed the NDE experiences by soldiers on the battlefield. Although intense, these experiences were often not marked by transcendent features (such as the tunnel, the realm of light, etc.). Moreover, these soldiers were afraid of dying in battle, but their health was not always in danger. They did not necessarily lose consciousness and were still capable of action, unlike the cardiac arrest patients lying in hospital beds.¹⁸ Gabbard and Twenlow even described an NDE with OBE and mystical features by a young recruit at boot camp, when he dropped a grenade which he did not know was fake.³⁶ Moody preferred to ignore soldiers' NDEs. However, the works of Sullivan³⁷ and more recently of Goza³⁸ have shown that these experiences (renamed Combat-related NDEs) cover the whole spectrum of NDEs, from a simple feeling of peace to heavenly extensions. Two soldiers explained that they felt time slow down to such an extent that they could see bullets coming toward them,³⁷ showing a possible evolutionary advantage presented by these altered states of consciousness.⁹

CONCLUSION

Parnia *et al.* propose a categorical model of NDEs as a confrontation of the individual with his/her true death, leading to a form of transcendence with positive long-term effects.¹ They fail to realize that while this does exist for some individuals, generalizing it as a paragon of NDE makes it a chimera that excludes valid research already done and all the methodologies and scales currently employed, but also most of the individuals who currently identify their experience with NDE. In wishing to defend itself from certain neuroscientific reductionisms, this approach throws psychological and psychodynamic approaches into the same bathwater.³⁹

This choice seems to be guided by a medical vision (“pathophysiological”¹ (p. 3)) of the NDE in the third person, judging the experience of dying in the light of its putative physiological counterpart. The subjective aspects are, therefore, crushed and instrumentalized. Instead of opening the door to more rigorous and better-defined research, this approach implicitly leads to the promotion of a flawed model: the “Moody syndrome.”³² This model uniquely instrumentalizes NDEs as evidence of life after death instead of considering them simply for what they are. They may well teach us new things about the relationship between the mind and the brain, drawing on its last resources under extreme conditions.⁹ However, these experiences connect to many other experiences of altered states of consciousness and share many of their characteristics. To deny these overlaps by decreeing that they are superficial or artificial is a form of regression, not scientific exploration.

Parnia *et al.* would have been better advised to cautiously hypothesize that NDEs occurring under conditions that will, in retrospect, be confirmed as truly lethal, and which bring together the core elements of sense of transcendence and ineffability, can be distinguished in the moment and in the long term from related experiences to which they are assimilated. Are these perimortem experiences really separate? Currently, the empirical evidence says no. Consequently, it still seems too early to assert one model of NDEs as ready to prevail over all others. Like the authors,¹ we call for new phenomenological research that, based on 150 years of scientific study, can shape the creation of a scale assessing the specific and nonspecific elements of the NDE continuum. Adding a method of analysis that also considers situational and cultural aspects will be able to explain the contextual variation of NDEs. There is still a long way to procure such a competitive model. Only then will researchers be justified in persuading their colleagues of the standard model and guidelines to be applied in NDE research.

AUTHOR CONTRIBUTIONS

R.E. drafted the original manuscript. E.P. and T.R. revised it.

COMPETING INTERESTS

The authors declare no competing interests.

PEER REVIEW

The peer review history for this article is available at: <https://publons.com/publon/10.1111/nyas.14846>.

ORCID

Renaud Evrard  <https://orcid.org/0000-0003-3717-666X>

REFERENCES

- Parnia, S., Post, S. G., Lee, M. T., Lyubomirsky, S., Aufderheide, T. P., Deakin, C. D., Greyson, B., Long, J., Gonzales, A. M., Huppert, E. L., Dickinson, A., Mayer, S., Locicero, B., Levin, J., Bossis, A., Worthington, E., Fenwick, P., & Shirazi, T. K. (2022). Guidelines and standards for the study of death and recalled experiences of death—A multidisciplinary consensus statement and proposed future directions. *Annals of the New York Academy of Sciences*, 1511(1), 5–21.
- Facco, E., & Agrillo, C. (2012). Near-death-like experiences without life-threatening conditions or brain disorders: A hypothesis from a case report. *Frontiers in Psychology*, 3, 490.
- Zingrone, N. L., & Alvarado, C. S. (2009). Pleasurable Western adult near-death experiences: Features, circumstances, and incidence. In J. M. Holden, B. Greyson, & D. James (Eds.), *The handbook of near-death experiences: Thirty years of investigation* (pp. 17–40). Santa Barbara, CA: Praeger/ABC-Clío.
- Owens, J. E., Cook, E. W., & Stevenson, I. (1990). Features of “near-death experience” in relation to whether or not patients were near death. *Lancet*, 336, 1175–1177.
- Charland-Verville, V., Jourdan, J.-P., Thonnard, M., Ledoux, D., Donneau, A.-F., Quertemont, E., & Laureys, S. (2014). Near-death experiences in non-life-threatening events and coma of different etiologies. *Frontiers of Human Neurosciences*, 8, 203.
- Noyes, R., & Kletti, R. (1976). Depersonalization in the face of life-threatening danger: An interpretation. *Omega*, 7, 103–114.
- Roisin, J. (2009). La sortie du corps et autres expériences extrêmes en situation de traumatisme. *Revue Francophone Du Stress Et Du Trauma*, 9(2), 71–79.
- Sabom, M. (2008). The acute dying experience. *Journal of Near-Death Studies*, 26(3), 181–218.
- Evrard, R., Toutain, C., Glazier, J. W., & Le Maléfan, P. (2019). The energy of despair: Do near-death experiences have a evolutionary value? *Psychology of Consciousness: Theory, Research, and Practice*, 6(2), 184–199.
- Holden, J. M. (2009). Veridical perception in near-death experiences. In J. M. Holden, B. Greyson, & D. James (Eds.), *The handbook of near-death experiences. Thirty years of investigation* (pp. 185–211). Santa Barbara, CA: Praeger.
- Evrard, R. (2020). Se battre ET fuir: La disjonction dans les expériences de mort imminente. *Etudes Sur La Mort*, 153, 123–133.
- Greyson, B. (1983). The near-death experience scale: Construction, reliability and validity. *Journal of Nervous and Mental Disease*, 171, 369–375.
- Timmermann, C., Roseman, L., Williams, L., Erritzoe, D., Martial, C., Cassol, H., Laureys, S., Nutt, D., & Carhart-Harris, R. (2018). DMT models the near-death experience. *Frontiers in Psychology*, 9, 1424.
- Alvarado, C. S. (2011). Panoramic memory, affect, and sensations of detachment in the dying: Discussions published in France, 1889–1903. *Journal of Near-Death Studies*, 30(2), 65–82.
- Wulff, D. M. (2014). Mystical experiences. In E. Cardeña, S. J. Lynn, & S. Krippner (Eds.), *Varieties of anomalous experience: Examining the scientific evidence* (pp. 369–408). American Psychological Association.
- Kelly, E. F., Kelly, E. W., Crabtree, A., Gauld, A., Grosso, M., & Greyson, B. (2007). *Irreducible mind: Toward a psychology for the 21st century*. Lanham, MD: Rowman & Littlefield.
- Fenwick, P., & Fenwick, E. (1995). *The truth in the light*. London: Headline.
- Van Lommel, P. (2010). *Consciousness beyond life: The science of near-death experience*. HarperOne.
- Noyes, R. (1980). Attitude change following near-death experiences. *Psychiatry*, 43(3), 234–242.

20. Noyes, R., Fenwick, P., Holden, J. M., & Christian, R. (2009). Aftereffects of pleasurable Western adult near-death experiences. In J. M. Holden, B. Greyson, & D. James (Eds.), *The handbook of near-death experiences. Thirty years of investigation* (pp. 41–62). Santa Barbara, CA: Praeger/ABC-CLIO.
21. Evrard, R. (2013). Répercussions psychologiques des « souvenirs » de la mort propre: Une critique des travaux du Dr Pim van Lommel. *Études Sur La Mort*, 143, 159–172.
22. Knoblauch, H., Schmied, I., & Schnettler, B. (2001). Different kinds of near-death experience: A report on a survey of near-death experiences in Germany. *Journal of Near-Death Studies*, 20(1), 15–29.
23. Noyes, R., & Slymen, D. (1979). The subjective response to life-threatening danger. *Omega*, 9, 313–321.
24. Ring, K. (1980). *Life at death: A scientific investigation of the near-death experience*. New York: Coward, McCann & Geoghegan.
25. Sabom, M. (1982). *Recollections of death: A medical investigation*. New York: Harper & Row.
26. Martial, C., Simon, J., Puttaert, N., Gosseries, O., Charland-Verville, V., Nyssen, A. S., Greyson, B., Laureys, S., & Cassol, H. (2020). The Near-Death Experience Content (NDE-C) scale: Development and psychometric validation. *Consciousness and Cognition*, 86, 103049.
27. Méheust, B. (1999). *Somnambulisme et médiumnité*, 2 vol. Institut Synthélabo.
28. Bush, N. E. (2009). Distressing Western near-death experiences: Finding a way through the abyss. In J. M. Holden, B. Greyson, & D. James (Eds.), *Handbook of near-death experiences: Thirty years of investigation* (pp. 63–96). Santa Barbara, CA: Praeger/ABC-CLIO.
29. Heim, A. (1892). Notizen über den Tod durch Absturz. *Jahrbuch Des Schweizer Alpenclub*, 27, 327–337.
30. Buckley, R. (2014). Slow time perception can be learned. *Frontiers in Psychology*, 5(209). <https://doi.org/10.3389/fpsyg.2014.00209>
31. Arstila, V. (2012). Time slows down during accidents. *Frontiers in Psychology*, 3(196). <https://doi.org/10.3389/fpsyg.2012.00196>
32. Larcher, H. (2005). Le trépas. *Études Sur La Mort*, 41(128), 19–31.
33. Moody, R. (1975). *Life after life*. Atlanta, GA: Mockingbird Books.
34. Evrard, R., Lazrak, N., Laurent, M., Toutain, C., & Le Maléfan, P. (2018). Du « moi vif » des noyés à l'expérience de mort imminente: Approche clinique d'une énigme médico-psychologique à partir d'un nouveau cas. *Annales Médico-Psychologiques*, 176, 189–198.
35. Moody, R. (1988). *The light beyond*. New York: Bantam Books.
36. Gabbard, G. O., & Twemlow, S. W. (1991). Do "near death experiences" occur only near-death?-Revisited. *Journal of Near-Death Studies*, 10, 41–47.
37. Sullivan, R. M. (1984). Combat-related near-death experiences: A preliminary investigation. *Anabiosis*, 4(2), 143–152.
38. Goza, T. H. (2011). *Combat near-death experiences: An exploratory, mixed-methods study*. Dissertation thesis in philosophy. University of North Texas.
39. Rabeyron, T., & Bergs, A. (2020). Clinique des expériences de mort imminente: Du vécu agonistique aux formes extrêmes de symbolisation. *L'Évolution Psychiatrique*, 85(3), 407–426.

How to cite this article: Evrard, R., Pratte, E., & Rabeyron, T. (2022). Sawing the branch of near-death experience research: A critical analysis of Parnia et al.'s paper. *Ann NY Acad Sci.* 1–5. <https://doi.org/10.1111/nyas.14846>