

**Target Article**

# **An Ethics of Welfare for Patients Diagnosed as Vegetative With Covert Awareness**

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Recent research suggests that a minority of patients diagnosed as vegetative using traditional behavioral assessments may be covertly aware. One of the most pressing concerns with respect to these patients is their welfare. This article examines foundational issues concerning the application of a theory of welfare to these patients, and develops a research agenda with patient welfare as a central focus. We argue that patients diagnosed as vegetative with covert awareness likely have sentient interests, and because sentient interests are sufficient for moral status, others have an obligation to take the welfare interests of these patients seriously. However, we do not view sentient interests as necessary for moral status, and thus it is possible that vegetative patients who lack such interests have moral status for other reasons. We propose four areas in which future research is needed to guide the ethical treatment of these patients: the assessment and management of pain; the development of quality of life assessments; end-of-life decision making; and enriching the day-to-day lives of these patients.

**Keywords:** vegetative state, consciousness, fMRI, sentience, welfare

Since Jennett and Plum first coined the term “persistent vegetative state” in 1972 (Jennett and Plum 1972) to refer to patients who emerged from coma but remained unresponsive, several diagnostic categories have been developed to more carefully classify patients with disorders of consciousness. While the publication of the Multi-Society Task Force Report on the vegetative state (VS) in 1994 (Multi-Society Task Force 1994) and publication of the

Aspen Workgroup statement on the minimally conscious state (MCS) in 2002 (Giacino et al. 2002) have helped illuminate important differences between these diagnostic categories, it remains difficult to properly diagnose patients as either MCS or VS. The percentage of patients misdiagnosed as vegetative, for instance, has not changed substantially since the introduction of these categories (Schnakers et al. 2009). In fact, research has shown that approximately

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43% of patients initially diagnosed as vegetative demonstrate inconsistent but reproducible behavioral signs of awareness (Andrews et al. 1996; Childs et al. 1993).

More recently, studies have shown that some patients may be aware, despite appearing completely vegetative at the bedside. These patients, who repeatedly satisfy the behavioral diagnostic criteria for the vegetative state, can modulate their brain activity in response to commands issued by researchers. In a 2006 study by Owen and colleagues, a 23-year-old patient who had been clinically diagnosed as vegetative for approximately 1 year was able to imagine playing tennis and moving from room to room in her house, when instructed to do so by researchers; this produced unique hemodynamic changes in the supplementary motor area (SMA) and parahippocampal gyrus (PPA), respectively. This positive response to command-following indicated that this patient not only was aware, but retained some level of language comprehension, short-term memory, and other cognitive abilities (Fernandez-Espejo and Owen 2013).

In 2010, this mental imagery task was applied to 54 patients, 23 of whom were diagnosed as vegetative. Four vegetative patients (17%) were found to be capable of modulating their brain activity in response to commands. Each of these four had suffered a traumatic brain injury, and each had a clinical diagnosis of vegetative state at the time of scanning. Subsequent studies using functional magnetic resonance imaging (fMRI) (Fernandez-Espejo and Owen 2013; Naci and Owen 2013) have further refined this technique and yielded other examples of patients diagnosed as vegetative who demonstrate covert awareness.

Some of the patients who are able to modulate their brain activity in response to commands have also been able to respond accurately to biographical, “yes-or-no” questions. While communication with these patients using mental imagery (Bardin et al. 2011; Fernandez-Espejo and Owen 2013; Monti et al. 2010) or selective attention tasks (Naci and Owen 2013) has only been attempted in a limited number of studies, there is reason to be optimistic that over time more patients who have demonstrated covert awareness will be able to communicate with researchers.

The discovery of covert awareness in these patients raises a number of important issues. Much of the neuroethics literature concerning patients diagnosed as vegetative with covert awareness has focused on whether these patients are sufficiently aware and autonomous to participate in decision making regarding their own care (Fins and Schiff 2010; Wilkinson et al. 2009). While a framework for assessing decision-making capacity in these patients has been proposed (Peterson et al. 2013), there are practical obstacles that must be overcome before such an assessment tool can be implemented.

Less attention has been paid to issues pertaining to patient welfare. The discovery that some patients diagnosed as vegetative are aware may call into question many of our assumptions about what their lives are like, which, in turn, may force us to reexamine our treatment of these

patients. Determining how these patients are faring and, moreover, determining what interventions might help them to fare better, are of considerable importance both to the patients themselves and to those who care for them. While some have emphasized the importance of measuring patient quality of life (Johnson 2013; Klein and Russell 2013), little has been said in the way of developing a comprehensive research agenda with patient welfare as a central focus.

There are many competing theories of welfare, yet a common feature is the importance of prudential value: Something can promote individual welfare only insofar as it is good for or in the interest of that individual. In this article, we consider foundational issues necessary for developing a theory of welfare applicable to these patients, and set out a novel research agenda based on the idea that these patients have welfare interests that must be taken seriously by others. This article emanates from an interdisciplinary collaboration involving neuroscientists, neurologists, and philosophers exploring ethical issues in neuroimaging in patients who have suffered a severe brain injury (Weijer et al. 2014).

In reading what follows, the reader should bear in mind that respect for patient welfare and respect for patient autonomy are not mutually exclusive. In fact, it is reasonable to suppose that we have *prima facie* obligations to respect both the welfare and autonomy of vegetative patients who demonstrate covert awareness. Attending to welfare includes attending to autonomy, because it is through autonomous action that individuals are able to pursue their interests. However, we argue that when the information required for ascribing autonomy to a patient is absent (specifically, when it is unclear whether a patient has decision-making capacity), focusing on patient welfare provides valuable moral guidance about how a patient ought to be treated.

## THE MORAL SIGNIFICANCE OF SENTIENCE

Is it morally wrong to hit a baseball as hard as one can with a bat? Barring certain special circumstances, it is not. This is because baseballs are inanimate, insentient objects; they do not have needs, interests, well-being, or a good of their own that we might violate by acting in a certain way. It makes no difference to a baseball how it is treated. Conversely, it is morally wrong to hit a child as hard as one can with a bat. This is because children are not inanimate, insentient objects; they do have needs, interests, well-being, and a good of their own, which we might violate by acting in a certain way. It does make a difference to them how they are treated. The concept of moral status captures the difference between how we may treat things like baseballs, and how we must treat things like children. To have moral status is to be an entity toward which moral agents have, or can have, moral obligations. Moral status entails that we may not treat those who have it in any way we please; we are morally obliged to give weight in our

deliberations to their needs, interests, or well-being. Moreover, an entity with moral status matters for its own sake, and has interests such that the entity can be wronged through the violation of these interests. Whether patients diagnosed as vegetative with covert awareness have or lack moral status thus determines the extent to which their interests matter.

It is tempting to simply assume that these patients have moral status, based on the commonly held intuition that all human beings have moral status. However, the moral status of these patients is not a settled issue (Carlson and Kittay 2009). There is an extensive philosophical literature grappling with the very question of what characteristics can be used to justify assigning moral status. If the justification for treating living beings in certain ways rests on their possession or lack of certain intellectual attributes (e.g., self-consciousness, rationality, a “reflective mind”), this might allow for the treatment of human beings who lack these attributes in ways that would otherwise be unacceptable. Depending on one’s account of moral status, the fact that the patients under discussion are aware may not be sufficient to justify assigning them moral status. The difficulty here is that while the ability to command follow provides compelling evidence that these patients are aware, very little is known about the contents of their consciousness. What cognitive capacities do these patients possess? What are their experiences like, and what sort of experiences are these patients capable of?

One way to avoid this problem is to deny that moral status is based exclusively on attributes or properties of the individual, and instead argue that moral status emerges from an individual’s membership in a biological or social group. A popular version of this argument holds that all human beings have moral status by virtue of their membership in a “cognitively sophisticated species” (Finis 1995). Because self-consciousness and rationality are the norm for members of the human species, all members (even those who lack these characteristics) have moral status, by virtue of their species membership. The problem with this argument, however, lies in explaining why the moral status that comes from having morally significant properties (e.g., self-consciousness, rationality) should also be granted to individuals who lack those properties, simply because they possess a different set of properties (i.e., those sufficient for species membership).

Alternatively, one might simply lower the standards for the kinds of cognitive capacities necessary and sufficient for moral status. For example, in a famous passage, Jeremy Bentham argues that the ability to suffer, not the ability to reason or communicate, is the ultimate criterion of moral status (Bentham 1982). If an individual can experience pain (or more specifically, if an individual can have an experience that is unpleasant), others have a moral reason to avoid subjecting her to such experiences. To disregard another’s interest in experiencing pleasure or avoiding pain is to directly wrong her.

The idea that sentience is sufficient for having interests has been refined by contemporary philosophers. Singer

argues for a basic principle of equality, which he refers to as “the principle of equal consideration of interests.” This principle requires that the comparable interests of all sentient beings be given equal weight in moral deliberations. It does not mean that all sentient beings must be treated exactly alike, since different sentient beings may have different needs and interests that must be taken into consideration. It does mean that all beings who possess the relevant cognitive capacities (i.e., sentience) deserve equal consideration of those interests: “an interest is an interest, whosoever interest it may be” (Singer 2011).

Similarly, Regan argues that beings who are “the subject of a life” have moral status. These individuals possess, among other things, “an individual welfare in the sense that their experiential life fares well or ill for them”; this in turn gives them inherent value and requires that we respect their interests (Regan 1983). Similarly, Sumner argues that moral status is held by all beings with welfare; only agents for whom life can be satisfying or unsatisfying (for Sumner, all sentient creatures) have moral status (Sumner 1996). While these accounts differ in important ways, what they share is an emphasis on the importance of certain kinds of experience (i.e., pleasure and pain) that make a difference to the quality of our lives.

We argue that the possession of sentience, the capacity for painful or pleasurable experiences, is a sufficient condition for moral status. Sentient beings have at least one kind of morally significant interest, specifically, the capacity to experience pleasure or pain, and it is through the promotion or violation of these interests that others are capable of affecting the welfare of these beings. On this account, all entities that are sentient have equal moral status; we leave open the possibility that certain nonsentient beings may also have moral status, on other grounds. (Mary Anne Warren, for example, offers a multiattribute account of moral status, wherein more than one condition may be sufficient for moral status [Warren 1997].)

Sentient interests are not the only kinds of interests that are morally significant. For example, Ronald Dworkin argues that satisfying “critical interests,” that is, the aims and hopes that provide meaning and coherence to our lives, is often more important than satisfying experiential interests (Dworkin 1993). By grounding moral status in sentience, we do not mean to suggest that experiential interests are the only morally significant interests. We merely argue that insofar as patients diagnosed as vegetative with covert awareness are sentient, we have a moral obligation to take their interests seriously. Sentient interests provide a useful example of the sorts of interests that are (at least partly) constitutive of an individual’s welfare, and that neuroimaging may be used to investigate.

#### **THE PRESENCE OF SENTIENCE IN PATIENTS WITH COVERT AWARENESS**

Awareness of internal and external stimuli (Salzen 1998) is often taken to be a benchmark of sentience. One must be

aware and able to form representations in order to experience a given stimulus as pleasurable or painful. This faculty allows human beings, and perhaps some animals, to integrate raw sensation with memory to form subjective sensory content. In nonhuman animals, this hypothesis allows us to interpret behavior as indicative of motivational affective states such as fear, hunger, pleasure, and pain. Those who are skeptical of animal consciousness suggest that while it might appear that certain behaviors or neurophysiological changes are indicative of experience, it is more likely that these are merely nociceptive responses to noxious stimuli and the affective component of sentience is absent. In that case, nonhuman animals would lack the faculty necessary to experience a sensation as painful or as pleasurable. A similar concern exists with regard to patients in the vegetative state. We might, for example, be skeptical that behavioral changes, such as withdrawal response to nail bed pressure, are truly indicative of the experience of pain. From a strict epistemological vantage point, the presence of behaviors characteristic of sentience does not itself entail the presence of sentience.

Clinicians generally confirm the affective component of sentience by appealing to subjective reports in otherwise healthy human beings. When a patient reports that a particular stimulus induces pain and behaves accordingly, it is generally believed that she is, in fact, in pain. For patients diagnosed as vegetative with covert awareness, who are capable of communication using fMRI, a similar appeal to self-report may be sufficient to confirm that the patient is in pain, even if the characteristic pain behaviors are absent. However, evaluating the presence of pain experience in patients diagnosed as vegetative with covert awareness who cannot communicate using fMRI will be more challenging. While some patients diagnosed as vegetative may demonstrate behaviors characteristic of pain experience (e.g., motor extension following painful stimulation), these are not necessarily indicative of painful experience. However, we can appeal to the neurological responses of these patients to painful stimulation. If a vegetative patient with covert awareness retains functional integrity within those brain areas normally associated with pain experience in healthy controls and demonstrates activation within the appropriate neuronal networks when presented with a painful stimulus (i.e., demonstrates the sensory and affective components of sentience, or neural correlates of pain), it is reasonable to conclude that the patient is indeed sentient.

Because this analysis of sentience is restricted to the clinical context, in which patient welfare is of primary concern, we argue that a reasonable assumption of the presence of sentience is sufficient to ground an obligation to treat a patient as sentient. The cost of analgesic or anesthetic treatment for vegetative patients with covert awareness is relatively low, especially when compared to the potential harm that may arise from failing to treat a patient capable of experiencing pain. Thus, if a vegetative patient with covert awareness satisfies the standards of evidence already described, even in the absence of self-reports of

pain, it is highly probable that she is sentient and should be treated accordingly.

In the next section, we examine the possibility of patients diagnosed as vegetative with covert awareness experiencing physical pain. By focusing on physical pain, we do not mean to suggest that pain is all there is to suffering. Indeed, there are many affective and cognitive states that go beyond physical pain (e.g., sadness, hopelessness, loss of identity), that may be subsumed under the broader notion of “suffering,” and that would certainly be relevant to the welfare of those beings who have the capacity to experience them. Nevertheless, our focus on physical pain is consistent with the majority of the neuroscientific and neuroethical literature, and, more importantly, consistent with an aspect of welfare that is likely to be highly relevant to these patients.

### PAIN: A MULTIDIMENSIONAL EXPERIENCE

The International Association for the Study of Pain (IASP) defines pain as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage” (IASP Taxonomy Working Group 2011). As this definition suggests, pain consists of both a physical component and an affective component: One senses a particular stimulus and finds the sensation unpleasant. The physical sensation may be external (e.g., pressure, temperature) or internal (e.g., aching, burning), while the affective experience may be distinguished by arousal or by qualitatively different emotions (e.g., anger, sadness, fear). Neither of these components, taken on its own, is an exhaustive model of pain. Rather, each is a dimension of the experience of pain. Accordingly, if an individual does not experience the putatively noxious stimulus as unpleasant or lacks the neurological machinery necessary for raw sensation, she would not be experiencing pain.

Researchers typically recognize four levels of neurologic response to nociceptive stimuli, ranging from unconscious responses to the experience of pain and suffering. At the first level, monosynaptic reflex responses occur at the level of the spinal cord. At the second level, simple nociception occurs at the level of the thalamus. At the third level, subcortical nociceptive responses produce patterned behaviors (e.g., grimacing or crying) that appear similar to those that accompany conscious emotional responses. These responses are commonly seen in patients in a vegetative state, and are likely mediated at subcortical levels through synaptic connections between the thalamus and limbic system. Nociceptive stimulation is also known to elicit generalized autonomic responses (e.g., increased heart rate or blood pressure, sweating), which may be observed in patients in a persistent vegetative state (Multi-Society Task Force on PVS 1994). However, these motor and autonomic responses can occur in the absence of conscious awareness, and thus cannot be used to infer that the patient is experiencing pain. Patients in a vegetative state

are not believed to consciously experience pain or suffering (the fourth level), as the physiological correlates of pain experience occur at a cortical level through synapses connecting parietal cortical neurons with other areas of the cerebral cortex (anterior cingulate cortex [ACC] and prefrontal cortex) (Multi-Society Task Force on PVS 1994).

In healthy individuals, researchers have described a well-defined network of brain regions that consistently respond to noxious stimuli. This network, referred to as the “pain matrix,” is comprised of two subsystems: the lateral neuronal network and the medial neuronal network (Iannetti and Mouraux 2010). These networks correspond to the sensory-discriminative and affective-motivational dimensions of pain and thus provide the likely neural correlates for the different elements thereof. The lateral neuronal network, which encodes sensory-discriminative information, consists of the ventroposterior lateral nucleus of the thalamus, which outputs to the primary (S1) and the secondary somatosensory (S2) cortex (Mutschler et al. 2011). This network mediates an individual’s sense of the location, intensity, duration, and nature of painful stimuli. The medial network encodes the affective-motivational dimension; this corresponds to the feeling of unpleasantness and urge to avoid the stimuli responsible for the unpleasantness. This network consists of the anterior insula, the anterior cingulate cortex (ACC), and the prefrontal cortex (Wiech, Preissl, and Birbaumer 2001) and may also include the posterior cingulate cortex. While each of these neuronal networks is primarily responsible for a single dimension of pain experience (either sensory or affective), evidence suggests that they do not operate entirely in parallel and that some brain areas, such as the posterior cingulate cortex and the parietal cortex, may play a role in both sensory and affective dimensions of pain (Price 2002). In fact, a great deal of empirical research supports the notion that the sensory-discriminative and affective-motivational dimensions of pain can be dissociated (Hardcastle 1997; Rainville et al. 1999). Thus, when patients report that they feel pain but do not mind it, they are not revealing that they are somehow mistaken about their own experience, but rather that the lateral neuronal network is activated while the medial neuronal network is not (Kong et al. 2006).

Nevertheless, the fact that a minority of patients diagnosed as vegetative may retain covert awareness, as evinced by their ability to complete the mental imagery task, suggests they may also be capable of experiencing pain. Using positron emission tomography, researchers have examined cortical processing of noxious stimulation of the median nerve in a cohort of vegetative patients. These studies have consistently found significant activations in the midbrain, contralateral thalamus, and S1 (Boly et al. 2008; Laureys et al. 2002)—areas of the brain implicated in the lateral neuronal network—which suggests relatively preserved nociception and at least partial sensory-discriminative pain processing. Another study by Kassubeck and colleagues found that a broad pain-related cerebral network, including higher order associative areas,

can remain active in patients diagnosed as vegetative (Kassubeck et al. 2003). While these studies found the activated primary cortex functionally disconnected from higher order integrative brain regions (S2, posterior parietal, prefrontal, and premotor cortices) in patients diagnosed as vegetative, they found that MCS patients demonstrated neural activation similar to healthy controls and had preserved functional connectivity between S1 and a widespread cortical network, including the frontoparietal associative cortices.

These findings strongly suggest that MCS patients are able to experience pain. Conversely, vegetative patients, although they may demonstrate activation in the brain areas associated with pain, display an incomplete connectivity between these areas; this does not rule out residual pain perception but does make experiencing pain less likely. However, because thalamo-cortical activity within the frontoparietal network is thought to be characteristic of awareness (Noirhomme et al. 2010), it seems plausible that patients diagnosed as vegetative with covert awareness may in fact retain connectivity between the brain areas involved in experiencing pain. A recent fMRI study by Markl and colleagues scanned 30 patients who fulfilled all of the clinical criteria for the vegetative state and found that 15 showed activation in the sensory-discriminative part of the pain matrix when given a moderately painful electric shock. Fifteen patients also showed activation of brain areas involved in higher order processing of noxious stimuli (anterior cingulate cortex, anterior insula, S2), with about one-third of patients demonstrating pain-related responses in both the sensory and affective parts of the pain matrix (Markl et al. 2013). Moreover, the fact that MCS patients tend to have preserved pain experience suggests that there may be some correlation between conscious awareness and preserved functional connectivity of the pain matrix. Importantly, the presence of functional connectivity within the pain matrix may be dependent on patient etiology. Indeed, all of the patients who showed activation in the sensory and affective parts of the pain matrix in the Markl study had sustained nontraumatic brain injuries. However, MCS patients with preserved pain experience include patients with traumatic brain injury as well as those with nontraumatic brain injury (Boly et al. 2008). Further research is needed to determine the relationship between a patient’s etiology and her potential for pain experience, as well as the relationship between covert awareness and pain experience.

While retained responses in the pain matrix, and pain-related activation in brain areas associated with emotional awareness and autonomic regulation of pain (i.e., the anterior cingulate cortex and anterior insula), do not prove conclusively that patients diagnosed as vegetative with covert awareness actually experience pain, they do provide reasonable evidence that these patients retain the capacity to do so. Importantly, the potential benefit to patients of acknowledging their sentience, as well as the potential harm of ignoring it, is considerable. This suggests that treating patients

diagnosed as vegetative with covert awareness as sentient is morally justified.

A further concern arises with respect to those patients who fail to demonstrate awareness through the mental imagery paradigm but who may nevertheless be sentient. A lack of response to the mental imagery task may result from a lack of awareness but may also result from the patient failing to understand instructions, falling asleep, or being unable to remain sufficiently still during scanning. Moreover, patients diagnosed as vegetative are highly heterogeneous and vary significantly in their ability to produce robust brain activity that can be detected with neuroimaging. As a result, we must be careful not to rule out the possibility that a patient is sentient simply because she has not demonstrated awareness. For example, a study by Yu and colleagues found that 24 of 44 patients diagnosed as vegetative demonstrated significant neural activation in response to the pain cries of others, with four demonstrating activation virtually identical to those of healthy subjects (Yu et al. 2013). These findings are consistent with the view that affective states (e.g., pain and pleasure) may be more basic elements of consciousness, as opposed to the more complex elements implied by cognitive awareness (e.g., attention, working memory, and language comprehension) (Panksepp 2005). We recognize that further research is needed to gain a better understanding of the minimal anatomical requirements for sentience and its relationship to awareness, especially because different structures may mediate pain experience when the structures that normally perform this function are damaged or destroyed (McCullagh 2004). While it remains an open question whether all vegetative patients should be treated as if they were sentient, this is an important issue in need of greater consideration. Indeed, vegetative patients with "covert sentience" who fail to demonstrate awareness may in fact be more vulnerable and receive less careful attention than those who are shown to be aware.

### FROM SENTIENCE TO WELFARE

As we have seen, the presence of sentience in patients diagnosed as vegetative with covert awareness gives them an interest in experiencing pleasure and avoiding pain, and we would be violating their moral status by ignoring these interests. Yet, for most, individual welfare consists of more than the presence of pleasure and the absence of pain (Sumner 1996). Emotional or intellectual experiences, significant relationships, creative expression, or the acquisition of knowledge might all contribute to an individual's welfare. Given the level of cognition vegetative patients with covert awareness are believed to retain, it seems possible that they may retain the capacity for experiences more complex than physical pain or pleasure, such as other affective states (e.g., sadness, fear, anger, contentment) or higher order interests (e.g., happiness, fulfillment), which require a more sophisticated level of cognitive function. The difficulty with these patients is that

we lack a clear sense of the nature of the contents of their consciousness. We are not suggesting that all patients diagnosed as vegetative with covert awareness do retain the capacity for emotional states, or higher-order interests. Rather, we argue that some of them might, and if they do, an ethics of welfare obligates us to take these interests seriously, consistent with their moral status. Further inquiry is thus needed on two fronts: first, to determine what kinds of interests these patients may have, and second, what actions should be taken by health care workers, family, and other caregivers to promote their welfare in light of these interests.

### IMPLICATIONS OF AN ETHICS OF WELFARE AND DIRECTIONS FOR FURTHER RESEARCH

How might adopting an ethics of welfare perspective shape our moral obligations to patients diagnosed as vegetative with covert awareness? We provisionally outline four areas of inquiry in which future research is required.

#### The Prevention and Treatment of Pain

Insofar as patients in the vegetative state are unaware, they are incapable of experiencing pain. Thus, patients who are believed to be in the vegetative state are often treated as if they cannot experience pain. This is obviously unacceptable for patients diagnosed as vegetative with covert awareness, who likely do experience pain. If such patients are capable of experiencing the affective dimension of pain, it is imperative that this capacity not be ignored.

Detecting and assessing pain in noncommunicative patients with disorders of consciousness is extremely challenging. In the acute stage, pain can be caused by fractures, soft tissue injuries, or invasive treatment procedures. In the chronic stage, pain may result from spasticity, pressure sores, soft tissue ischemia, or peripheral nerve injury. Recently validated pain scales, such as the Nociception Coma Scale Revised (NCS-R), are able to assess behavioral responses to noxious stimuli with a high degree of accuracy and sensitivity and suggest that both MCS and vegetative patients display pain behaviors (e.g., grimacing) much more frequently in the presence of nociceptive stimuli than non-nociceptive stimuli (Chatelle et al. 2012). While the lack of a behavioral response does not mean that the patient is not experiencing pain, the sustained presence of pain behaviors in the absence of stimulation could reflect the presence of chronic pain. Simply acknowledging that a patient is capable of experiencing pain and taking steps to minimize pain (as well as being observant of behaviors which may be indicative of pain experience) are critical to respecting the sentient interests of the patients.

While some have argued in favor of administering analgesics to all vegetative and minimally conscious patients (Schnakers and Zasler 2007), others disagree with this recommendation. Systematic use of narcotic analgesics in patients who are unable to communicate could lead to undesired sedation or underestimation of awareness.

Other patients could experience hyperalgesia and require aggressive analgesic treatment (Laureys and Boly 2007). Because appropriate pain management is of major concern, further research is needed to develop evidence-based guidelines for the treatment of pain in these patients, including potential differences between patients' experience of nociceptive versus neuropathic pain. However, it seems clear that when subjecting these patients to procedures known to cause pain in conscious individuals, preventive measures (e.g., the provision of a mild analgesic such as acetaminophen) should be taken.

We suggest that, whenever possible, behavioral assessments be supplemented with fMRI-based communication using the mental imagery task to gain a clearer understanding of the patient's experience of pain. As technology advance, regular monitoring of a patient's pain experience using the mental imagery task, or other selective attention tasks, may become more feasible. This may help caregivers in the monitoring of pain behavior, prevent over- or undermedication, and inform a set of best practices for preventing and treating pain in these patients. Wager and colleagues (Wager et al. 2013) have recently identified a pattern of fMRI activity across brain regions, a "neurologic signature of pain," associated with the experience of heat-induced pain. Indeed, if such a neurologic signature could be applied to patients diagnosed as vegetative with covert awareness, it might prove useful in justifying the ascription of painful experiences to patients who are unable to communicate effectively. Further research into the correlation between the neural processing of pain in patients diagnosed as minimally conscious or vegetative and the behaviors characteristic of pain may also help to increase our understanding of how they experience pain (Schnakers et al. 2010).

### Developing a Quality-of-Life Instrument

"Quality of life" (QoL) may be interpreted in a number of ways. In some contexts, QoL is viewed as equivalent to an individual's "subjective well-being," that is, the individual's cognitive and affective evaluation of life. QoL may also be understood as a measure of achievement in domains constituent of "a good life" (e.g., employment, health, relationships). Lastly, QoL may refer to the desirability of a certain health status, based on the values and standards of a given population. Indicators of QoL may be both objective and subjective and typically incorporate various dimensions of an individual's life (e.g., physical, emotional, and social aspects) (Dijkers 2004).

Health-related quality of life (HRQoL) instruments are designed to measure how a patient's life is affected by disease or disability and its treatment; these may be generic (i.e., focusing on physical, social, or mental health problems common to a broad range of diseases or disabilities) or disease specific (i.e., sensitive to the unique difficulties associated with certain diseases or disabilities). However, there have been a number of questions raised about the applicability of both generic and disease-specific measures

of HRQoL to patients with traumatic brain injury, including issues with the reliability of self-report, as well as inadequate coverage of salient domains (Bullinger and the TBI Consensus Group 2002; Dijkers 2004).

First, the patients under consideration are limited to "yes" or "no" responses and are capable of answering only a small number of questions in each imaging session. As such, traditional assessment batteries, which may require more complex responses and involve dozens of questions, may be of limited use. A suitable QoL instrument for minimally conscious and vegetative patients will have to accommodate these limitations and be designed to provide a reasonably reliable assessment using only a limited number of questions.

Second, while some research suggests that there is little difference between patients who have suffered traumatic brain injury and healthy controls in the value assigned to particular domains of life (e.g., relationships with others, health and personal safety, self-expression) (Dijkers 2004), other research suggests that the values and interests of patients living with disability can change significantly postinjury (Albrecht and Devlieger 1999). After a life-altering event, individuals may adjust their perspectives, expectations, and values as they learn to live with their disability (Franulic et al. 2004). The potential for this so-called "response shift" means that the interests these patients expressed to others preinjury may no longer be consistent with the interests they possess postinjury. Attempting to evaluate patient welfare on the basis of dimensions that are no longer relevant might provide an inaccurate assessment of QoL; this is a shortcoming of existing HRQoL assessments (and QoL assessments more generally) for patients with brain injury. It seems a mistake to evaluate the welfare of minimally conscious or vegetative patients according to the same standard applied to healthy adult humans. Jeff McMahan, for instance, argues that it should suffice for patients with severe cognitive limitations to do as well "by reference to the standard set by their own nature as we are doing by reference to the standard set by our nature" (McMahan 2009, 257). Thus, a minimally conscious or vegetative patient may be doing well even if she falls below the level of welfare that would be acceptable for a healthy adult. Determining which dimensions of welfare (physical, intellectual, emotional, social, environmental) are most relevant and how satisfaction within these dimensions correlates with the overall welfare of the patients, though challenging, is critical to developing a useful QoL instrument.

Further complicating matters is the fact that even if an assessment battery that reflects the interests of these patients can be devised and administered, we might have reason to doubt the reliability of the answers patients provide. For example, if a patient can communicate, we have strong reasons for treating self-reports about pain as reliable; the neurophysiological evidence in support of sentience is reasonably robust, but, more importantly, self-report is the closest we can get to direct knowledge of an individual's experience. Similarly, it seems that we can be

reasonably confident that self-reports of emotions or other affective experiences (e.g., sadness, fear, boredom) are also accurate (Sharon et al. 2013). We may, however, be less confident in self-reports of experiences that require higher order cognitive ability (e.g., “life-satisfaction,” which requires an analysis of one’s current situation in light of past experiences and future prospects, as opposed to “contentment,” which requires only a reflection on one’s current state).

We might, therefore, seek to develop a QoL instrument that focuses on more fundamental and immediate components of patient welfare, such as positive and negative affective states. Positive affective states may be physical (e.g., pleasurable physical contact, taste, or smell), mental (e.g., listening to a favorite song), or emotional (e.g., companionship). Similarly, negative affective states may be physical (e.g., pain or illness), or emotional (e.g., sadness, boredom). While affective states may constitute only one aspect of these patients’ overall welfare, they are undoubtedly a fundamental one. Moreover, we can be confident of a patient’s self-report of these states. Naturally, assessments that only consider the affective dimensions of the patient’s experience will not provide the same comprehensive picture of QoL as traditional assessments, so their limited scope should be taken into consideration when used to inform decision making on the patient’s behalf. Nevertheless, they provide an important starting point for evaluating the efficacy of potential treatment protocols and help to provide a basic understanding of the subjective experiences of these patients.

Assessing the QoL of patients who cannot communicate presents additional challenges. Research involving stroke patients found that the QoL ratings given by proxies were typically in close agreement with those given by patients and similar to those given by the proxies of other noncommunicative patients (Sneeuw et al. 1997). However, research involving patients with dementia has shown that proxies tend to give lower ratings of QoL when compared to the patients themselves (Moyle et al. 2012). Further research is therefore needed to determine the appropriate role of proxies in assessing QoL in patients diagnosed as vegetative with covert awareness.

Klein and Russell (2013) have proposed the use of certain objective measures as a proxy for the subjective experiences of these patients. A paradigm example of this sort of objective measure is the neurological signature for pain being developed by Wager and colleagues; the presence of such a response would act as a proxy for a patient’s self-report of pain (Wager et al. 2013). These objective measures may provide proxy decision makers with useful information about a patient’s subjective experience (Naci et al. 2014). Further research is needed, however, to determine not only whether these objective measures provide an accurate representation of a patient’s subjective experiences, but also whether the interests that these objective measures supposedly represent are consistent with the patient’s actual welfare interests.

While developing an appropriate QoL instrument for patients diagnosed as vegetative with covert awareness will no doubt prove difficult, it will provide an important opportunity to better understand how these patients perceive the quality of their lives. Knowing which dimensions of life they find satisfactory and which unsatisfactory will prove invaluable in shaping the ongoing care of these patients and help others to be better proxy decision makers. It may also provide a means of assessing patient progress by providing a baseline of well-being against which later QoL assessments can be compared and can help to illuminate those therapies that most improve QoL. This will in turn help to promote the most effective use of scarce health care resources. Future research should focus on developing a practical QoL instrument that targets salient aspects of these patients’ subjective welfare, in order to provide a clearer evaluation of their subjective experience.

### End-of-Life Decision Making

One particular issue that emerges from discussions of quality of life and has garnered a great deal of attention in the neuroethics literature is how the discovery of awareness ought to affect withdrawal of life-sustaining treatment (Kahane and Savulescu 2009; Wilkinson, Kahane, and Savulescu 2008). While evidence of awareness is thought by some to be a reason not to withdraw life-sustaining treatment, others have argued that awareness *simpliciter* does not constitute a good reason to keep the patient alive and may even generate a moral obligation not to do so. Kahane and Savulescu argue that “even if [in] using fMRI we can establish that brain-damaged patients still enjoy phenomenal consciousness and a significant measure of sapience, terminating these patients’ lives might be morally *required*, not merely permissible” (Kahane and Savulescu 2009, 21).

This claim might be interpreted in various ways. First, the authors may merely be suggesting that if vegetative patients are capable of suffering, then they may have an interest in not continuing to receive life-sustaining treatment. Taken at face value, this claim appears consistent with our own analysis; if, in fact, withdrawal of life-sustaining treatment is consistent with the patient’s own interests, we would have good reason to act in accordance with these interests.

Yet implicit in this claim is the notion that the lives of patients diagnosed as vegetative with covert awareness are not, in fact, worth living. Kahane and Savulescu argue that even if we could be relatively certain that the patients were not suffering but experienced “highly pleasant states of consciousness,” this may be an insufficient reason to sustain their lives. Their reasoning seems to be as follows: An individual’s well-being is influenced by experiential interests (i.e., pleasure and the absence of pain), desiderative interests (i.e., the satisfaction of desires), and objective interests (i.e., intrinsically good experiences, such as gaining knowledge). Patients diagnosed as vegetative with covert awareness may be able to satisfy their experiential

interests; however, their desiderative and objective interests, to the extent that they have them, are likely to be frustrated by their condition. Thus, the authors conclude, even if an individual's experiential interests are satisfied, "it is not clear that such possible benefits in themselves generate a strong interest in continuing to exist" (Kahane and Savulescu 2009, 15). Moreover, they argue, the presence of sophisticated cognitive abilities should make us more ready to withdraw treatment, not less. If a patient retains the capacity for desiderative and objective interests, interests that they are likely incapable of satisfying, their continued existence is "more meaningless and degrading than to lose consciousness completely" (14).

There are, however, a number of reasons to avoid making assumptions about the worth of a patient's life without first inquiring into their welfare. First, studies have demonstrated that healthy individuals overestimate the degree to which a particular ailment will diminish quality of life and that this may lead to an unduly pessimistic evaluation of the welfare of patients diagnosed as vegetative with covert awareness (the so-called "disability paradox") (Albrecht and Devlieger 1999). Second, there is evidence to suggest that persons with disabilities tend to experience a fairly high level of welfare (Albrecht and Devlieger 1999). Other studies have shown that while patients with traumatic brain injury typically report a lower level of satisfaction than comparable groups of healthy individuals, the difference is relatively small (Dijkers 2004). A recent study by Bruno and colleagues surveyed a group of 65 patients with locked-in syndrome, 72% of whom indicated that they were happy (Bruno et al. 2011). Similarly, Lulé and colleagues found that patients with locked-in syndrome had perceptions of personal health, well-being, and life satisfaction that were often discordant with their objective health status and disability (Lulé et al. 2009). While it is an open question whether these results are generalizable to patients diagnosed as vegetative with covert awareness, they underscore the need for caution when making assumptions about the welfare of these patients.

Further research is needed to develop an appropriate theory of welfare for patients diagnosed as vegetative with covert awareness before speculating on the worth of their lives. It is only when such a theory has been developed, when we have an understanding of what it means for the lives of these patients to go well, that we can say with any confidence whether continuing to receive life-sustaining treatment is consistent with their welfare. However, even if such a theory is developed, it will require a further argument to show that the patient's welfare should be the determining factor in the decision to continue or withdraw life-sustaining treatment.

### **Enriching the Lives of Vegetative Patients With Covert Awareness**

One of the primary reasons why the discovery of covert awareness in patients previously diagnosed as vegetative is important is because it raises the possibility of

interaction. A positive result on the mental imagery task means that the patient possesses some degree of awareness. Further, it indicates that the patient possesses at least some degree of auditory processing, language comprehension, short-term memory, and executive function. The fact that a patient retains these cognitive faculties is likely to alter her interaction with others and may lead to a more positive and fulfilling social experience. Even if patients are unable to communicate directly with those around them, the recognition of covert awareness likely means that they will be treated as persons, and this may increase their welfare. An ethics of welfare requires that we take the welfare of such patients seriously and interact with them in ways that reinforce their personhood, for instance, by actively including them in social interactions and inquiring into their needs and interests.

How might caretakers improve the day-to-day lives of these patients? Determining what interests and values patients have will obviously go a long way toward helping enrich the overall quality of their lives. Playing the music or television programs they enjoy can have a significant impact on their welfare. Since these patients are capable of processing language and may retain higher cognitive abilities, intellectual stimulation (e.g., engaging in conversation, reading aloud) may be seen as an important consideration for caretakers. The ways in which a patient's life might be enriched are numerous. The point of this discussion is to emphasize that a moral framework that takes seriously the interests of these patients must go beyond minimizing painful stimuli and consider the ways in which we might act to benefit these patients. Further research is needed to determine concrete and effective ways to accomplish this task.

### **CONCLUSION**

A minority of patients diagnosed as vegetative at the bedside are capable of command following using neuroimaging and are thus aware. While much has been written about the importance of assessing decision-making capacity in these patients, less attention has been paid to their actual welfare. We claim that because they are aware, these patients may be capable of experiences that contribute to or detract from their welfare. Moreover, because these patients are likely sentient (e.g., capable of experiencing pain), they have moral status, which obligates others to take their welfare interests seriously. We suggest that the welfare interests of these patients may go beyond their sentient interests, however, and propose a research agenda that takes seriously these broader potential interests. The assessment and management of pain, the development of a quality-of-life assessment, end-of-life decision making, and ways of enhancing the day-to-day experiences of these patients are all important areas in which further research is needed. While a great deal of work remains to be done, we believe that this research agenda highlights important questions, which will foster a greater understanding of

covert awareness, enhance the welfare of current patients, and improve the treatment of patients in the future.

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