

Psychosis-Related Matricide Associated With a Lesion of the Ventromedial Prefrontal Cortex

Gricel Orellana, MD, PhD, Luis Alvarado, MD, PhD, Carlos Muñoz-Neira, CPsych, Rodrigo Ávila, MD, Mario F. Méndez, MD, PhD, and Andrea Slachevsky, MD, PhD

Matricide, the killing of a mother by her biological child, is a rare event. We report a case of matricide associated with a woman who sustained a right ventromedial prefrontal lesion during surgery for nasal polyposis that was performed when she was 40 years old. After her surgery, she developed psychotic symptoms associated with the emergence of antisocial behavior. She committed matricide 22 years later. Neuropsychological evaluation showed decreased frontal-executive deficits, and magnetic resonance imaging revealed a lesion in the right gyrus rectus area of the ventromedial prefrontal region. This case suggests that a secondary psychotic syndrome associated with a lesion in the frontal neural network, which is disturbed in psychopathy, could facilitate homicidal behavior. Furthermore, this case has legal implications for the prosecution of murder associated with a brain lesion.

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Matricide, the killing of a mother by her biological child, is a rare event. It accounts for less than two percent of all U. S. homicides where there is a relationship between the victim and the offender.¹ Relatively little is known about those who commit matricide. Most cases are committed by sons, very rarely by daughters.² The few reports on those who commit matricide usually implicate psychological factors such as a high incidence of severe mental disorders, a

domineering maternal figure, a hostile-dependent relationship with the mother, and a passive or withdrawn father.³

Matricide represents an extreme form of psychopathy, since it implies a violation of one of the more elementary moral values and represents an extreme breakdown of empathy.⁴

Psychopathy is characterized by emotional dysfunction and antisocial behavior. Whether developmental or acquired, it is associated with dysfunction of a neural network that includes the prefrontal cortex, amygdalae, and temporal lobes.^{5,6} Acquired antisocial behavior in general, or acquired sociopathy, can occur in patients after prefrontal lesions.^{7,8} Matricide may be associated with antisocial behavior involving lesions in this neural network. To illustrate, the literature describes a case of matricide perpetrated by a man who sustained a brain injury from a tumor and its treatment. In this case, the authors suggested that bilateral amygdalae damage was the cause.⁹ In addition to an association with psychopathy, homicidal behavior can be caused by psychosis with or without psychopathic traits,¹⁰ and psychotic symptoms can occur in patients after prefrontal lesions.¹¹ Although an association between acquired psychopathy and psychotic symptoms with prefrontal lesions has been reported, to the best of

Dr. Orellana is Professor of Psychiatry, Departamento de Psiquiatría Oriente, Facultad de Medicina, Universidad de Chile, Santiago, Chile. Dr. Alvarado is Professor of Clinical Psychopathology at Departamento de Psicología, Facultad de Ciencias Sociales and Departamento de Psiquiatría Oriente, Facultad de Medicina, Universidad de Chile, Santiago, Chile. Mr. Muñoz-Neira is Neuropsychologist at Unidad de Neurología Cognitiva y Demencias, Servicio de Neurología, and Dr. Ávila is a Psychiatrist, Servicio de Psiquiatría, Hospital del Salvador, Santiago, Chile. Dr. Méndez is Professor of Neurology and Psychiatry, Departments of Neurology and Psychiatry and Biobehavioral Sciences, University of California at Los Angeles and V. A. Greater Los Angeles Healthcare Center, Los Angeles, CA. Dr. Slachevsky is Professor of Neurology at Departamento de Neurología Oriente and Programa de Farmacología Molecular y Clínica, ICBM, Facultad de Medicina, Universidad de Chile, Santiago, Chile and Neurologist at Unidad de Neurología Cognitiva y Demencias, Servicio de Neurología, Hospital del Salvador and Clínica Alemana, Santiago, Chile. The research was supported by Fondecyt Grant 1100975 (A.S., C.M.N.), Project PIA-Conicyt CIE-05 Grant (A.S.), and Grant R01AG034499–03 (M.M.). Address correspondence to: Andrea Slachevsky, Centro de Investigación Avanzada en Educación Universidad de Chile, Periodista José Carrasco Tapia N°75, Santiago, Chile. E-mail: aslachevsky@me.com.

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our knowledge, no cases specifically involving matricide have been described in patients with prefrontal lesions.

We report a patient who murdered her mother and attempted to murder another relative. She exhibited psychotic symptoms after a prefrontal lesion, and her case suggests that lesions in the prefrontal and related regions trigger expression of aggressiveness or criminal behavior as part of a secondary psychotic syndrome.

The patient gave consent in 2012 for the publication of her case. A month later, a Committee on Scientific Ethics of a Chilean Health Service (Comité de Ética Científico del Servicio de Salud Metropolitana Oriente) also approved publication.

Case Report

This right-handed woman in her 60s was admitted in 2009 to the Inpatient Unit of the Psychiatric Service at a hospital in Chile. She had attempted to kill a relative with whom she lived at the time. The patient had murdered her mother two years earlier.

The patient's behavioral changes began in 1985, after she had undergone otolaryngological surgery for nasal polyposis. Although the surgical report described complications involving a cerebrospinal fluid leak, neither postoperative neurological evaluation nor neuroimaging was performed. After her surgery, she experienced a salient behavioral change with the emergence of disruptive behavior. For instance, she wrote offensive letters to her best friend's father, refused to attend any birthday parties because she felt slighted by peers, and left her new job on the first day because a person had been impolite to her. Her social and interpersonal relationships exhibited a slow but steady decline. She was no longer able to keep her job and took only temporary housekeeping jobs or spent her time preaching in jails and penitentiaries.

Before her surgery, the patient was described as having a normal developmental and social history. Although reserved and shy, she was a responsible and brilliant student who performed very well in high school and college. Before 1985, she had no medical or psychiatric history. More precisely, there were no symptoms suggestive of psychotic disorder, aggressive or disruptive behavior, or substance abuse. Nevertheless, she had a very negative relationship with her mother, with whom she fought constantly.

In 1993, the patient developed visual hallucinations of a religious nature and some auditory hallu-

cinations. The diagnosis, decided on in an outpatient psychiatric consultation, was one of probable paranoid schizophrenia. She received antipsychotic medications but had poor medication compliance, leading to a worsening of her hallucinations. Based on her testimony, her religious and auditory hallucinations implored her to kill her mother as a sacrifice to God; it was these voices that pushed her to commit matricide. Associated with these hallucinations, she also had an anxiety disorder, bouts of extreme fear, and feelings of guilt. In addition, she had become convinced that killing her mother was the solution to her family's economic difficulties. Acting on her hallucinations and delusions, in 2007, she committed the homicide. She first attempted unsuccessfully to strangle her mother with a scarf and then drowned her in a bathtub the following day. A psychiatric evaluation concluded that the matricide was due to her psychotic disorder. The court declared her not guilty by reason of insanity (NGRI), and she was committed to a psychiatric facility. Her psychotic symptoms subsided under treatment with antipsychotic medication and, after one year, her psychiatrists deemed her fit for discharge.

In 2009, the patient had a relapse of visual and auditory hallucinations, this time prompting her to attempt the murder of another relative. She tried to kill the relative by poisoning her and then attempted to drown her in a bathtub. After this attempted homicide, a forensic psychiatrist concluded that the patient's homicidal behavior constituted a well-organized delusion. The court once again declared her NGRI and remanded her to psychiatric care.

The patient was assessed during her psychiatric hospitalization. The results of her physical and neurologic examinations, including cranial nerve, motor, reflex, and sensory testing, were normal. Regarding her psychopathologic status, she remained psychotic with visual hallucinations of a religious nature. The patient related that she was maintaining a dialogue with God in her diary. When questioned about the killing of her mother, she declared "I was worried because the water was so cold and, I thought, 'Poor Mommy, I should cover her mouth to prevent her from swallowing water.'" Despite this apparent display of concern, she did not express feelings of guilt for the matricide. When asked why she had attempted to kill another relative, the patient complained that she was treated as "the nanny of the house, being obliged to do all the cleaning, cooking

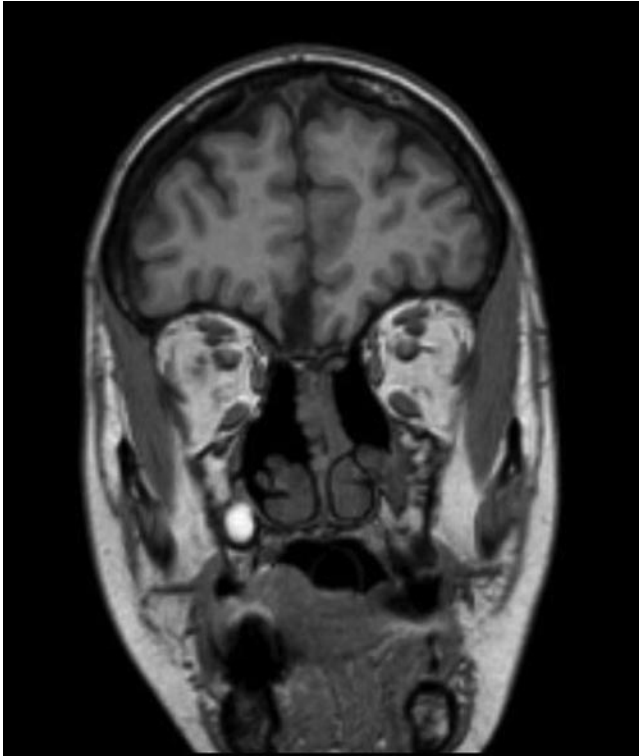


Figure 1. Brain nuclear magnetic resonance. T₁-weighted coronal view of the patient showing a homogeneous hypointense lesion in the right gyrus rectus in the prefrontal cortex. No other lesions were found.

and shopping. Besides, we had only my pension and no further money [on which] to live.” When describing the situation, the patient mimicked the voices of her mother and the other relative in a rather bizarre way.

Her laboratory and electroencephalographic studies were unremarkable with the exception of a magnetic resonance image (MRI) of the brain. There was a hypointense lesion on the T-weighted image involving the right gyrus rectus in the ventromedial prefrontal (VMPF) region (Fig. 1).

The patient underwent a neuropsychological evaluation with a special focus on the frontal lobes. The tests included the Modified Version of the Wisconsin Card Sorting Test, semantic and phonological verbal fluency tests, parts A and B of the Trail Making Test, and the Tower of London.¹² Further evaluation involved the Iowa Gambling Task (IGT), which can detect decision-making impairments in patients with VMPF and medial orbitofrontal (MOF) cortex damage,¹³ and assessment of social cognition and theory of mind, including the Reading the Mind in the Eyes Test, Revised Version,¹⁴ and Faux Pas Recognition Test (Adult Version).¹⁵ This

neuropsychological evaluation revealed only low performances in tests measuring planning and decision-making. Her performance on the IGT suggested poor decision-making capacity and a doing-knowing dissociation (e.g., whenever she chose a card from a high-risk deck, she indicated that she did not have to choose that card). An additional psychodiagnostic evaluation using the Rorschach test indicated a psychotic organization of personality with serious flaws in reality testing and judgment, and the Hare Psychopathy Checklist showed a sociopathic or pseudopsychopathic profile, Hare Factor 2 (Table 1).¹⁶

The patient was successfully treated for her psychotic symptoms. After discharge, she was assigned to a protected residence for psychiatric patients. Once free of psychotic symptoms, she agreed to the study and publication of her case.

Discussion

This is a unique patient who killed her mother and attempted to kill another relative in the context of a secondary psychotic disorder. Her behavioral changes occurred after having sustained an injury to her right VMPF region from an otolaryngological procedure. There is a prior report of two patients with frontal lobe damage resulting from nasal surgery.¹⁷ The study suggests that the damage to this critical part of the brain can result in a psychotic disorder with homicidal behavior.

There is evidence for the active role of the VMPF cortex in psychotic symptoms and delusions, as was evident in this patient. Neurologic patients with delusions could have bifrontal lesions or predominant involvement of the right hemisphere.¹⁸ Content-specific delusions have also been associated with prefrontal lesions.¹⁹ Lesions in the VMPF cortex may be associated with an impairment in source monitoring (i.e., the ability to distinguish the source of different types of memory) and in reality monitoring (i.e., the capacity to distinguish real events from imagined or internally generated thoughts).^{20–23} The VMPF cortex also appears to be responsible for the normal doubt-tag sensation and the intuitive, immediate feeling of rightness (FOR) that are part of monitoring the reality of a thought or belief.²⁴ The doubt tag and the FOR intervene in the process of judging whether a memory or a thought is plausible. The doubt tag results from an unconscious checking system that tags thoughts as doubtful and sends this information to a conscious monitoring process.²⁴ Al-

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Table 1 Neuropsychological Evaluation

Cognitive Domain	Test	Patient's Performances
Cognitive Efficiency	Addenbrooke's Cognitive Examination-Revised	88/100
	WAIS ^a Full Scale IQ ^b :	104
Attention	WMS-III ^c Mental Control	23/40
Visuospatial Abilities	Copy of the Rey-Osterrieth Complex Figure	30/36 Type I
Working Memory	Digit Span Forward	7
	Digit Span Backward	4
Verbal Episodic Memory	CVLT - II ^d :	Free Recall
		43/47
		Long Delay Free Recall
Executive Function	WCST ^e	Long Delay Cued Recall
		11/16
		Categories:
		5/6
		Perseverative errors
		3
		Trail Making Test A
		63". 0 errors
		Trail Making Test B
		125". 0 errors
		Lexical Fluency (Letter A)
		8
		Semantic Fluency (Animals)
	14	
	Tower of London	
	Total Correct Score	
	1/10*	
	Total Move Score	
	107*	
	Rules Violation:	
	2*	
	Time Violation	
	7*	
	Initiation Time	
	79"*	
	Execution Time	
	896"*	
	Total Time	
	975"*	
Decision Making	IGT ^f	NET Total
		-4*
		NET 1
		0
		NET 2
		2
		NET 3
4		
	NET4	
	-4*	
	NET5	
	-6	
Social Cognition	Eye Mind Reading Test	30/36
	Faux Pas	75/80
Psychopathy	Hare Psychopathy Checklist-Revised	Total:
		31
		Factor 1 (Interpersonal/ Emotional)
	7	
	Factor 2 (Antisocial Life Style)	
	24*	

Results are expressed in raw score.

^a: WAIS = Wechsler's Adult Intelligence Scale

^b: IQ = Intelligence Quotient;

^c: WMS-III = Wechsler Memory Scale - Third Edition;

^d: CVLT - II = California Verbal Learning Test - Second Edition;

^e: WCST = Modified Version of the Wisconsin Card Sorting Test;

^f: IGT = Iowa Gambling Task.

*: Abnormal scores

though functional neuroimaging studies in patients with schizophrenia have shown limbic system involvement in religious delusions,^{25,26} other investigations suggest that our patient's VMPF lesion could have impaired the source monitoring and the FOR and resulted in an inability to challenge any false or paranoid beliefs that she might have had.²⁷

In addition, after the VMPF cortex injury, she began to display an array of antisocial behavior and failed to conform to social norms. She expressed some culpability for the way she killed her mother, but did not show remorse for the act of matricide itself. Her behavior indicated a lack of remorse or moral emotions linked to the welfare of others. Her behavioral changes were consistent with an acquired

sociopathy that may occur from right VMPF disease.^{13,28}

The timeline of her symptoms suggested that her right VMPF cortex lesion had led to her behavioral changes and the matricide. First, there was a temporal relationship between the surgical procedure and the emergence of psychotic symptoms associated with personality and behavioral changes. Second, the neuropsychological evaluation was consistent with an association of her lesion with dysfunction of the VMPF cortex. Investigators have described impairments in the IGT in patients with lesions in this area of the brain, including the gyrus rectus.²⁹ The doing-knowing dissociation observed during the IGT is characteristic of patients with prefrontal lesions in

whom an action program formulated in speech easily loses its regulatory role.³⁰ Finally, the topography of the lesion strongly suggested that it contributed to her crime. Loss of gray matter in prefrontal regions, especially in the dorsal gyrus rectus, has been correlated with some degree of psychopathy.³¹ Similar to the comportment of a psychopath, this patient displayed callous behavior and did not show guilt or any other emotion when relating her crime. The display of this sort of behavior is in accordance with disturbances in the appreciation of victim-based morality, and it corresponds to the harmful intent described in patients with VMPF cortex lesions.^{28,32,33} Indeed, the gyrus rectus and subgenual region are essential for the enactment of prosocial behavior driven by feelings of empathy and altruism.³⁴

In contrast to our patient, most cases of prefrontal lesions do not present with either a delusional disorder or sociopathy. There is no obvious explanation as to why some prefrontal lesions manifest in behavior disturbances and others do not.³⁵ There is no evidence of predisposing factors that could have led her to develop psychotic and sociopathic behavior after having acquired a prefrontal lesion.^{36,37} An alternative explanation could be the development of late-onset schizophrenia (LOS). LOS, however, does not start after a surgical procedure, is not associated with focal structural abnormalities, and usually lacks severe positive symptoms or prevalent episodes of hostility and aggression.^{38,39} Nevertheless, it is not possible to exclude entirely the coincident LOS with aggression.

In addition, this case raises two important questions concerning the legal implications of the prosecution of murder associated with a brain lesion. The first is how these neuropsychiatric cases are handled across different legal systems. The Chilean court twice declared the woman NGRI. Chilean law recognizes a psychological framework to declare a patient NGRI: perpetrators may recognize and understand their crime and its consequences, but may be insane because they are unable to restrain themselves from committing the crime. In the United States, the states differ in the application of the insanity defense, therefore we cannot conclude whether she would have been declared NGRI there. The second concern raised is related to how society manages a patient who commits a crime associated with brain lesions. Even if she had been declared not guilty due to her brain lesion, she could have been institutionalized rather

than released into the community. In these kinds of patients, prolonged institutionalization may be required, not for the sake for punishment, but for the purpose of protecting the patients and society from any possible danger.⁴⁰

In conclusion, this patient's lesion, by disrupting the neural circuits involved in psychopathy and aggression, may have provoked the expression of psychosis-related homicidal behavior.⁴¹ A right VMPF cortex lesion could convert a vulnerable subject, such as this patient with a probable schizoid or schizotypic personality, into someone exhibiting a lack of moral inhibition and engaging in murderous behavior.⁴² The relationship between right VMPF brain mechanisms and psychosis with homicidal behavior requires further investigation.

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References

1. Heide KM, Frei A: Matricide: a critique of the literature. *Trauma Violence Abuse* 11:3–17, 2010
2. Bourget D, Gagne P, Labelle ME: Parricide: a comparative study of matricide versus patricide. *J Am Acad Psychiatry Law* 35:306–12, 2007
3. d'Orban PT: Women who kill their children. *Br J Psychiatry* 134:560–71, 1979
4. Cheng Y, Chen C, Lin CP, et al: Love hurts: an fMRI study. *Neuroimage* 51:923–9, 2010
5. Fumagalli M, Priori A: Functional and clinical neuroanatomy of morality. *Brain* 135:2006–21, 2012
6. Blair RJ: Neuroimaging of psychopathy and antisocial behavior: a targeted review. *Curr Psychiatry Rep* 12:76–82, 2010
7. Blair KS, Newman C, Mitchell DG, et al: Differentiating among prefrontal substrates in psychopathy: neuropsychological test findings. *Neuropsychology* 20:153–65, 2006
8. Blair RJ, Cipolotti L: Impaired social response reversal: a case of 'acquired sociopathy'. *Brain* 123:1122–41, 2000
9. Kazuo Y, Hiroki F, Takamasa N, et al: Matricide of Asperger Syndrome caused by brain tumor (in Japanese). *Acta Criminol Med Legal Jpn* 72:1005–9, 2006
10. Nestor PG, Kimble M, Berman I, et al: Psychosis, psychopathy, and homicide: a preliminary neuropsychological inquiry. *Am J Psychiatry* 159:138–40, 2002
11. Coltheart M: The neuropsychology of delusions. *Ann N Y Acad Sci* 1191:16–26, 2010
12. Strauss E, Sherman EMS, Spreen O: *A Compendium of Neuropsychological Tests. Administration, Norms, and Commentary*. New York: Oxford University Press; 2006
13. Bechara A, Damasio AR, Damasio H, et al: Insensitivity to future consequences following damage to human prefrontal cortex. *Cognition* 50:7–15, 1994
14. Baron-Cohen S, Wheelwright S, Hill J, et al: The "Reading the Mind in the Eyes" Test revised version: a study with normal adults, and adults with Asperger syndrome or high-functioning autism. *J Child Psychol Psychiatry* 42:241–51, 2001

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15. Stone VE, Baron-Cohen S, Knight RT: Frontal lobe contributions to theory of mind. *J Cogn Neurosci* 10:640–56, 1998
16. Hare RD: Psychopathy: a clinical and forensic overview. *Psychiatr Clin North Am* 29:709–24, 2006
17. Scharpf J, Dean R, Stultz T, *et al*: The magnetic resonance imaging profile of occult intracranial violations as a result of sinus surgery. *Am J Otolaryngol* 26:411–4, 2005
18. Devinsky O: Delusional misidentifications and duplications: right brain lesions, left brain delusions. *Neurology* 72:80–7, 2009
19. Malloy PF, Richardson ED: The frontal lobes and content-specific delusions. *J Neuropsychiatry Clin Neurosci* 6:455–66, 1994
20. Gilboa A, Alain C, He Y, *et al*: Ventromedial prefrontal cortex lesions produce early functional alterations during remote memory retrieval. *J Neurosci* 29:4871–81, 2009
21. Kopelman MD: Varieties of confabulation and delusion. *Cogn Neuropsychiatry* 15:14–37, 2010
22. Johnson MK, Hashtroudi S, Lindsay DS: Source monitoring. *Psychol Bull* 114:3–28, 1993
23. Ferchiou A, Schurhoff F, Bulzacka E, *et al*: Source monitoring: general presentation and review of literature in schizophrenia (in French). *Encephale* 36:326–33, 2010
24. Turner M, Coltheart M: Confabulation and delusion: a common monitoring framework. *Cogn Neuropsychiatry* 15:346–76, 2010
25. Puri BK, Lekh SK, Nijran KS, *et al*: SPECT neuroimaging in schizophrenia with religious delusions. *Int J Psychophysiol* 40:143–8, 2001
26. Taber KH, Hurley RA: Neuroimaging in schizophrenia: misattributions and religious delusions. *J Neuropsychiatry Clin Neurosci* 19:iv-4, 2007
27. Gilboa A, Alain C, Stuss DT, *et al*: Mechanisms of spontaneous confabulations: a strategic retrieval account. *Brain* 129:1399–414, 2006
28. Mendez MF: The unique predisposition to criminal violations in frontotemporal dementia. *J Am Acad Psychiatry Law* 38:318–23, 2010
29. Bechara A, Tranel D, Damasio H: Characterization of the decision-making deficit of patients with ventromedial prefrontal cortex lesions. *Brain* 123:2189–202, 2000
30. Luria A: Higher Cortical Functions in Man (ed 2). New York: Basic Books, 1980
31. de Oliveira-Souza R, Hare RD, Bramati IE, *et al*: Psychopathy as a disorder of the moral brain: fronto-temporo-limbic grey matter reductions demonstrated by voxel-based morphometry. *Neuroimage* 40:1202–13, 2008
32. Young L, Bechara A, Tranel D, *et al*: Damage to ventromedial prefrontal cortex impairs judgment of harmful intent. *Neuron* 65:845–51, 2010
33. Greene JD, Sommerville RB, Nystrom LE, *et al*: An fMRI investigation of emotional engagement in moral judgment. *Science* 293:2105–8, 2001
34. Moll J, Krueger F, Zahn R, *et al*: Human fronto-mesolimbic networks guide decisions about charitable donation. *Proc Natl Acad Sci USA* 103:15623–8, 2006
35. Mataro M, Jurado MA, Garcia-Sanchez C, *et al*: Long-term effects of bilateral frontal brain lesion: 60 years after injury with an iron bar. *Arch Neurol* 58:1139–42, 2001
36. Palomo T, Kostrzewa RM, Beninger RJ, *et al*: Genetic variation and shared biological susceptibility underlying comorbidity in neuropsychiatry. *Neurotoxicity Res* 12:29–42, 2007
37. Kim E, Lauterbach EC, Reeve A, *et al*: Neuropsychiatric complications of traumatic brain injury: a critical review of the literature (a report by the ANPA Committee on Research). *J Neuropsychiatry Clin Neurosci* 19:106–27, 2007
38. Howard R, Rabins PV, Seeman MV, *et al*: Late-onset schizophrenia and very-late-onset schizophrenia-like psychosis: an international consensus. The International Late-Onset Schizophrenia Group. *Am J Psychiatry* 157:172–8, 2000
39. Vahia IV, Palmer BW, Depp C, *et al*: Is late-onset schizophrenia a subtype of schizophrenia? *Acta Psychiatr Scand* 122:414–26, 2010
40. Greene J, Cohen J: For the law, neuroscience changes nothing and everything. *Phil Trans R Soc Lond Series B Biol Sci* 359:1775–85, 2004
41. Mendez MF, Shapira JS: Altered emotional morality in frontotemporal dementia. *Cogn Neuropsychiatry* 14:165–79, 2009
42. Lyketsos CG: Lessons from neuropsychiatry. *J Neuropsychiatry Clin Neurosci* 18:445–9, 2006