Figure 1 Mental state, vital signs, and inflammation indicators of two elderly COVID-19 patients after double-lung transplantation. (a) Patient 1. (b) Patient 2. (———) High-sensitivity C-reactive protein. (———) Body temperature.

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Wernicke encephalopathy in patients with depression: A systematic review

Depression is a psychiatric disorder occurring most frequently in those who have significant health problems.[1–4] Depression is associated with high rates of health-care utilization and severe limitation in daily functioning.[3–5]

Poor intake of food is common in depression[6] and nutrition can play a key role in the onset and severity of depression.[7] In fact, a number of studies have shown an inverse association between thiamine (vitamin B1) levels and symptoms of depression in adults.[8]

A possible side-effect of prolonged vitamin B1 deficiency is Wernicke's encephalopathy (WE), a neuropsychiatric disorder characterized

Table 1 Demographic and clinical characteristics

Author	Sex	Age (years)	Lost weight/time	Etiology	Ataxia	Eye-movement disorder	Mental status change	MRI/CT	Thiamine treatment
Relatively uncomplicated depression									
Epstein, 1989	M	64	NA	Diarrhea and psychotic depression	+	+	+	MRI+	100 mg i.v., mildly impaired learning
Stone *et al.*, 2007	M	45	NA	Water fasting diet for 44 days in severe depression	+	+, nystagmus	+	MRI+	100 mg daily, not living independently
McCormick *et al.*, 2011	F	Mid-20s	13 kg/4 months	Post-partum depression, nausea and vomiting, borderline personality	+	+, nystagmus	+, unresponsive	MRI+	200 mg i.v., Korsakoff syndrome
Wang *et al.*, 2014	F	28	NA	Major depression and motor bike collision, vomiting, extreme slimming diet	+	+	+, deteriorated consciousness	MRI+	i.v., decreased levels of consciousness
Dias *et al.*, 2017	M	56	NA	Neglect of personal care in severe depression, food refusal	+	+	+ disoriented, somnolence	MRI+	500 mg i.v./day, resolved symptoms
Melchionda *et al.*, 2017	M	50	NA	Loss of a job followed by depression, reduced food intake	+	–	+	MRI–	200 mg i. v./3 × per day, complete resolution
Melchionda *et al.*, 2017	M	65	NA	Motor incoordination, confusion, and vomiting	+	+	+	MRI–	200 mg i. v./3 × per day, slow improvement
Odagaki *et al.*, 2018	M	38	20 kg	Depression, inability to move, cachexia due to weight loss	–	–	+	MRI–	No treatment, Korsakoff syndrome
Nikolakaros *et al.*, 2019	M	54	11 kg	Pain and weakness in the lower limbs, alcoholism 10 years prior to WE	+	–	+, memory loss, confabulations, disoriented	MRI+	Korsakoff syndrome
Complicated depression									
Andrade *et al.*, 2010	F	27	NA	Depression and anorexia nervosa	–	–	+	MRI+	NA
Shavit & Brown, 2013	M	48	NA	Suicidal ideations and depressive symptoms, found unconscious, diabetes mellitus, osteomyelitis, hemicolectomy, and scurvy	+	+, ophthalmoplegia and nystagmus	loss of consciousness	NA	200 mg i.v./ 3 × per day, remission
Nakashima *et al.*, 2013	M	43	NA	Depression with a suicide attempt, renal failure, total gastrectomy for gastric cancer	Obscured by lack of consciousness	NA	+, loss of consciousness	MRI+	500 mg/day, Korsakoff syndrome
Cocksedge & Flynn, 2014	M	68	36 kg/5 months	Lymphoma and chemotherapy, severe depression post-diagnosis and neuroglycopenia	+	–	+, short-term memory loss and confusion	NA	500 mg/2 × per day, complete resolution
Nikolakaros *et al.*, 2016	F	42	10 kg	Depression, hypogammaglobulinemia, pyelonephritis, pneumonia, and severe urticarial	–	–	+, memory loss	MRI+	Unknown, Korsakoff syndrome
Nikolakaros *et al.*, 2016	F	37	5 kg	Depression, gastroenteritis, and vomiting	+	–	+, memory and attention	MRI–	Unknown, Korsakoff syndrome
Melchionda *et al.*, 2017	F	55	NA	Gastrointestinal symptoms	+	+	–	CT–	200 mg i. v./3 × per day, slow improvement
Onishi *et al.*, 2018	M	79	NA	Depression and stomach cancer	–	–	+	CT–	100 mg i.v., resolution
Onishi *et al.*, 2018	F	76	NA	Depression and insomnia, pancreatic cancer, insomnia	+	–	+	NA	75 mg i.v., resolution
	F	33	7 kg		+	–		MRI+	

Table 1. (*Continued*)

Author	Sex	Age (years)	Lost weight/ time	Etiology	Ataxia	Eye-movement disorder	Mental status change	MRI/ CT	Thiamine treatment
Nikolakaros et al., 2018				Total parenteral nutrition without thiamine, vomiting, diarrhea; depression, leukemia, cachexia (BMI = 16.9)			+, elevated mood, decreased sleep		Korsakoff syndrome
Nikolakaros et al., 2018	M	38	26 kg	Radioactive iodine for hyperthyroidism, weight loss	+	–	+, mild confusion	MRI–	Korsakoff syndrome
Nikolakaros et al., 2018	M	20	6 kg	Bacterial infection, vomiting, diarrhea	+	–	+, decreased need for sleep	NA	Korsakoff syndrome

+, symptom is present; –, symptom is absent; BMI, body mass index in kg/m^2; CT, computed tomography; F, female; M, male; MRI, magnetic resonance imaging; NA, not available.

by ataxia, muscle incoordination, memory loss, delirium, confusion, and ocular abnormalities. The classic triad of WE symptoms consists of ataxia, ocular abnormalities, and mental status change.[3] Although the most common cause of WE is vitamin B1 deficiency after severe alcoholism, other causes have also been described in the literature. As descriptions in the literature have not yet been reviewed in detail, and it is relatively unknown that malnutrition in depression can lead to WE, the aim of this study was to review the clinical characteristics of WE that have developed in the context of depression in the absence of an alcohol use disorder.

The methods, flow-chart of article selection, and references to all included case studies are presented in Appendix S1. We identified 21 case descriptions in the published literature. The average age in case descriptions was 47.2 years (SD: 16.7 years), with a range between 20 and 79 years, suggesting that both young and older patients with depression could be at risk for WE. In seven patients, diminished food intake was the primary etiology for WE in depression. In six patients, a loss of vitamins because of vomiting was the primary etiology of WE in depression. Three cases had diarrhea leading to WE, due to a loss of vitamins. Five patients had forms of cancer and a depression leading to WE, due to an increased demand for thiamine. In nine cases, weight loss was reported in detail, with an average weight loss of 14.9 kg (SD: 10.5 kg). All cases are reported in Table 1.

A full WE triad was present in eight out of 21 cases. This relative occurrence of WE cases presenting with a full triad following depression seems to be higher than that seen earlier in alcoholics with WE (16%).[3] In 20 out of 21 cases, mental status change, such as amnesia, loss of consciousness, or disorientation, was reported. In 16 out of 21 cases, ataxia was reported. Here, eight out of 21 cases were reported to show ocular signs. In 10 out of 15 case descriptions, MRI revealed radiological alterations in the thalamic area of the brain.

In 12 patients, treatment of WE was described in detail. Of importance, low levels of thiamine were given in five patients (<500 mg/day), possibly causing residual cognitive decline in three patients. Just one patient receiving higher doses of thiamine developed Korsakoff's syndrome. None of the patients received optimal thiamine dosing of three times 500 mg i.v. or i.m. per day.[9]

Depression is characterized by diminished or increased food intake.[8] Rapidly losing weight and somatic comorbidity can lead to severe complications of depression. Patients diagnosed with depression are at risk for malnutrition. Severe malnutrition can lead to WE. Nine cases reported WE in relatively uncomplicated depression, and 12 cases reported WE in depression with somatic comorbidity.

Patients diagnosed with WE should be treated with 500 mg of thiamine i.v. or i.m./three times per day, according to recent guidelines.[3,9] Korsakoff's syndrome, a chronic neuropsychiatric disorder, developed in three out of five WE patients receiving less than 500 mg thiamine per day. Of seven WE patients who received more than 500 mg per day, only one developed Korsakoff's syndrome.

A limitation of this review is that the diagnosis of depression was not substantiated with DSM classification in the majority of reports. The nature and extent of the depression is therefore not clear in the reviewed cases.

In conclusion, depression is a risk factor for developing malnourishment. Malnourishment-related WE is a rare but severe and preventable consequence of depression, following starvation, vomiting, or diarrhea. WE can be fully prevented by supplying prophylactic thiamine given parenterally in patients with depression. After onset of symptoms, rapid treatment with high doses of thiamine is still a life-saving measure, directly influencing the core symptoms of WE.

Disclosure statement
There are no conflicts of interest for the author.

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Supporting information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Appendix S1. Supporting information.

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The September 11, 2001, terrorist attacks, media exposure, and psychotic experiences among Asian and Latino Americans

Research has indicated that traumatic events may be important for the occurrence/onset of psychotic experiences (PE),[1] that is, subclinical hallucinations and delusions similar to the symptoms of psychotic disorder but not as distressful, persistent, or impairing.[2] However, studies have yet to determine whether exposure to traumatic events via the media might be linked to PE. An earlier literature review found that traumatic media images were associated with an increased risk for poorer mental health.[3] Given this, we examined if exposure to media relating to the 11 September 2001 terrorist attacks (hereafter 9/11) was associated with reporting PE among Asians and Latinos in the general population in the USA.

Data were analyzed from 4624 participants in the National Latino and Asian American Study (NLAAS), a nationally representative, cross-sectional probability survey administered between May 2002 and November 2003. This sample comprised non-institutionalized residents of the coterminous United States who were at least 18 years of age and of Hispanic, Spanish, Latino, or Asian descent.[4] The Institutional Review Boards at the Cambridge Health Alliance, the University of Washington, and the University of Michigan approved sampling and consent procedures and informed consent was obtained from all participants. The 12-month occurrence of PE (hallucinations and delusions) was assessed with the World Health Organization's Composite International Diagnostic Interview psychosis screen.[5] To assess media exposure, respondents were asked: 'In the first weeks after the terrorist attacks, how much time, on average, did you spend each day getting information about the attacks from the media (e.g., TV, radio, newspapers, magazines, internet)?' The response options included: *None*; *Up to one hour*; *More than 1 hour, but up to 2 hours*; *More than 2 hours, but up to 4 hours*; *More than 4 hours, but up to 8 hours*; *More than 8 hours, but up to 12 hours*; and *More than 12 hours*.

Descriptive statistics of the study sample are presented in Table S1. Individuals with PE were more likely to have had both >8–12 h and >12 h of media exposure although the difference was only statistically significant for the latter (see Fig. S1). In a fully adjusted logistic regression analysis that examined a categorical measure of media exposure, more than 12 h of exposure was associated with three times higher odds of PE compared with 1–4 h exposure (Table 1, Model 4; full variable description and model results are presented in Table S2). When examining the association between media exposure as a continuous variable and PE, increasing media use was also associated with increased odds for PE (odds ratio [OR]: 1.22; 95% confidence interval [CI]: 1.04–1.43; Model 4, Table S3). The results were robust in sensitivity analyses where '0 hours' was used as the reference category and with adjustments for direct exposure (i.e., knowing someone who was injured/killed in the attacks).

The finding that the experience of more hours of 9/11 media exposure was linked to PE accords with research that shows that the events of 9/11 were associated with the onset of psychotic symptoms in some individuals.[6,7] It also supports the conclusion of an earlier literature review that there is a relation between disaster media coverage and worse psychological health.[3] Increased media coverage was linked to PE even after controlling for the presence of concurrent mental illness. Although our study has several limitations, including that we used cross-sectional data and were therefore not able to establish causality or the direction of the observed associations, and that the study sample was restricted to Asian and Latino Americans, possibly limiting the generalizability of our results, the finding that greater 9/11 terror-related media exposure was linked to PE is important, especially as the mental and physical health effects of 9/11 media exposure may have been long-lasting.[8] Given this, even though the mechanisms linking traumatic media exposure and PE remain uncertain, measures to reduce exposure to potentially traumatic media might be important for population mental health – including reducing incidence of PE. For example, media companies may consider reducing the frequency of graphic disaster-related imagery broadcast, and warning viewers before traumatic images are televised.[9] It might also be beneficial if the public is informed about the possible association between prolonged exposure to disaster-related media and poorer psychological health.[10] In this regard, traumatic media might also include natural disasters, hate crimes perpetrated by groups such as white nationalists/supremacists, mass shootings, and other depictions of violence. In addition, collecting information about exposure to both direct and indirect (media) forms of trauma may be important for formulating comprehensive treatment programs for individuals presenting with psychotic symptoms.

Disclosure statement

The authors declare no conflict of interest.

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