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BRIEF REPORT

Non-suicidal self-injury among women hospitalised for anorexia nervosa

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Abstract

Introduction Non-suicidal self-injury (NSSI) is frequent in eating disorders (ED). The aim of this study was to describe NSSI among subjects hospitalised for anorexia nervosa (AN) who self-harm and factors associated with NSSI in this population.
Methods This study was part of a larger French longitudinal multi-centre study. Two hundred and two women with AN were recruited from inpatient treatment facilities for ED from 2009 to 2011. All participants fulfilled the DSM-5 diagnostic criteria of AN. Subjects with and without NSSI were compared for clinical characteristics and comorbidities in bivariate analyses. Logistic regression analysis was then used to identify factors associated with NSSI.
Results The mean age of the sample was 20.8 years (±6.6). The mean BMI was 14.3 (±1.5). Overall 36.1% had self-harmed in the past 6 months. The main factors that triggered NSSI were a feeling of physical or psychological unease (45.2%), feelings of anger (24.7%), an attempt to relieve discomfort (19.2%), and low self-esteem (16.4%). Lifetime major depressive disorder, suicide attempts and eating concerns were independently associated with NSSI.
Discussion ED symptoms were linked to NSSI, but psychiatric history also played a key role. This is consistent with hypotheses of common underlying transdiagnostic mechanisms linking emotional dysregulation to NSSI and ED.
Level of evidence Level III, well-designed cohort or case–control analytic studies.

Keywords Anorexia nervosa · Non-suicidal self-injury · Mood disorders · Suicide

Introduction

Suicide prevention is a major public health issue worldwide. Over 800 000 people die by suicide each year, accounting for about 1.4% of all deaths. It is the second leading cause of death among 15 – 29 years. Longitudinal studies indicate that non-suicidal self-injury (NSSI) precedes suicide attempt, especially among females and individuals with depressive symptoms, or diagnosed with borderline personality disorder or mood disorder. NSSI is defined as intentionally inflicting injury that results in immediate tissue damage, performed without suicidal intent and not socially sanctioned within one's culture, and not performed for display (it excludes extreme tattooing or body piercing,

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body modification for example). NSSI includes cutting, pin-scratching, burning, and self-hitting. Even if the majority of people who engage in NSSI do not go on to attempt suicide, the literature shows that NSSI serves as a gateway for suicidal behaviours.

NSSI is frequent in anorexia nervosa (AN) [1, 2]. A meta-analysis by Amiri and Khan found on average 29% (CI 21–38%) with a lifetime history of NSSI among individuals diagnosed with AN [2]. In the setting of eating disorders (ED), NSSI has been associated with anxiety and affective symptoms, and with a higher prevalence of psychiatric comorbidities [3]. Transdiagnostic approaches suggest that common mechanisms underpin symptoms across different psychiatric diagnoses. Thus, emotional dysregulation has been associated with both disordered eating and NSSI [4], and high levels of emotional dysregulation could be involved in the relationship between disordered eating behaviours and later NSSI. The co-occurrence of NSSI and disordered eating has been associated with greater severity of suicide attempts than for NSSI or disordered eating alone. In addition, individuals who shift from one ED symptom to another have been reported to be more prone to engaging in deliberate self-harm and to mention higher levels of symptoms indicative of mental illness.

Yet, inconsistencies and gaps in the existing literature suggest there is still a need to further investigate the triggering context and factors associated with NSSI among people with AN and determine whether they could be transdiagnostic markers for certain psychological difficulties. The aim of this study was to describe the overall prevalence of NSSI, the means involved, the triggering context and associated factors of NSSI in a large sample of women hospitalised for AN.

Methods

Population

This study was part of a large French longitudinal multicentre observational study (EVHAN: evaluation of hospitalisation for AN, EudraCT number: 2007-A01110-53, registered in Clinical trials: NCT00910169). It included 303 individuals with AN consecutively hospitalized in 11 ED treatment facilities (see Fig. 1). Enrolment occurred from April 2009 to May 2011.

The EVHAN inclusion criteria were: being hospitalised for AN, admission Body Mass Index (BMI) < 15 and/or sudden and rapid weight loss, agreement to participate in the study, and being affiliated to the French social security health coverage system. The exclusion criteria were: insufficient command of the French language, existence of a potentially confounding medical condition (e.g., diabetes, Crohn's disease, or other metabolic disorders). For the present study on NSSI, we also excluded males, individuals younger than 13 years, and missing/incomplete evaluation of NSSI. Thus, a total of 202 women with full-syndrome or subthreshold DSM-IV-TR defined AN were included in the present analysis. Using DSM-5 criteria, all participants endorsed a diagnosis of full-syndrome AN (see also [5]).

Ethics statement

The study protocol was approved by the Ile-de-France III Ethics Committee and the French Data Protection Authority (*Commission Nationale de l'Informatique et des Libertés, CNIL*). In accordance with the Helsinki declaration, written informed consent was obtained before inclusion from each participant, and from their parents for those who were under 18 years.

Measures

The research evaluation was performed within the first 2 weeks after the admission in the inpatient ED unit and before discharge. Since the Ottawa self-injury inventory was completed at discharge, we used the discharge scores for the other self-questionnaires as well.

Sociodemographic data and medical histories were collected, including age, age at AN onset, illness duration, number of previous hospitalisations for an ED, minimum BMI, BMI at admission and at discharge and duration of hospitalisation.

At enrolment, the diagnosis of AN was based on the DSM-IV-TR criteria (current classification at the time of inclusion). These criteria were assessed using the Eating Disorder Examination Questionnaire (EDE-Q) and the Composite International Diagnostic Interview (CIDI). The EDE-Q is a 28-item self-report questionnaire, which focuses on the person's report of ED symptom occurrence over the past 28 days and includes four subscales: "restraint concerns", "eating concerns", "weight concerns", and "shape concerns". The higher the score, the greater the level of symptoms. The CIDI-short-form was used to diagnose major depressive disorder (MDD), obsessive–compulsive disorder (OCD), generalized anxiety disorder (GAD), post-traumatic stress disorder (PTSD), social phobia, agoraphobia and panic disorder.

NSSI was evaluated at discharge in 14 questions taken from the Ottawa self-injury inventory (OSI inventory), a 32-item self-report questionnaire enabling the simultaneous assessment of both motivations and addictive features of NSSI. It assesses the occurrence, frequency of NSSI and reasons for engaging in it) in the past 6 months.

Worries about weight and body shape were evaluated using the Body Shape Questionnaire (BSQ), a 34-item

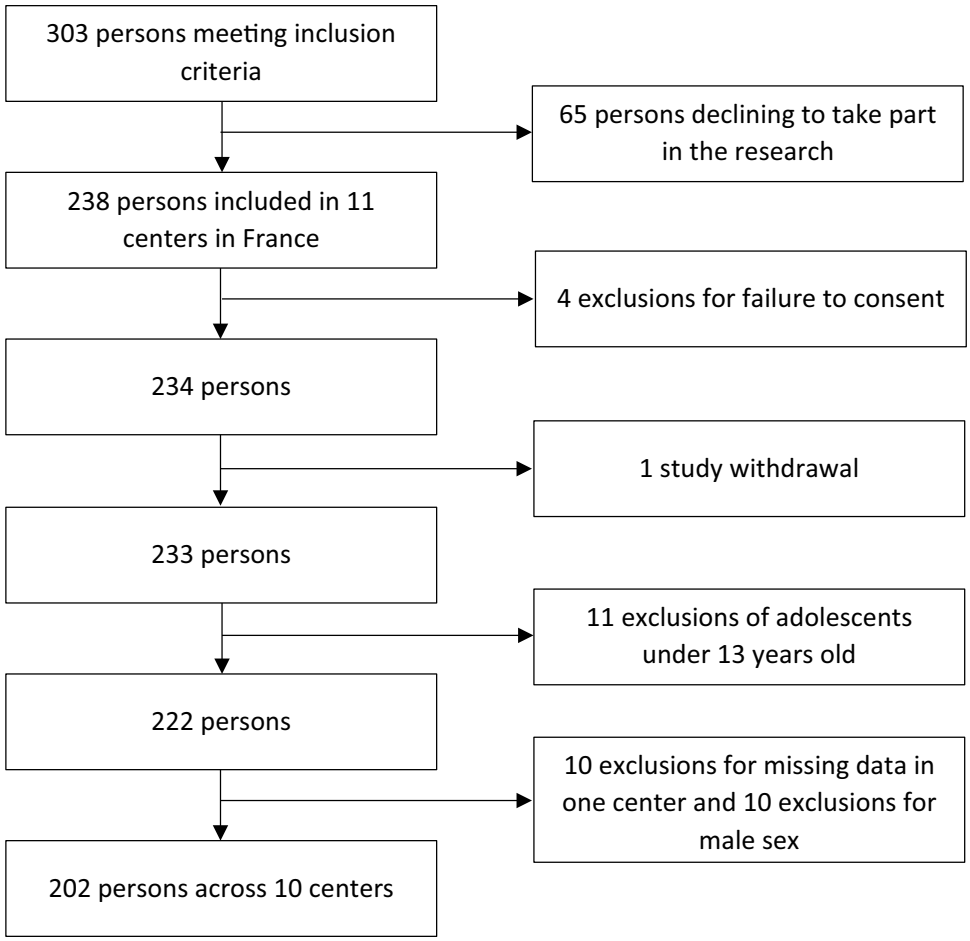

Fig. 1 Flow chart

self-administered questionnaire. The Figure Rating Scale (FRS) was used to assess the difference in the participants' evaluation of their own body shape and their ideal body shape at the time of the evaluation. The five dimensions of the alexithymia construct (emotionalizing, fantasizing, identifying, analysing, and verbalizing) were evaluated using the Bermond–Vorst Alexithymia Questionnaire Form B (BVAQ), a 20-item self-administered questionnaire. The degree to which individuals appraise situations in their lives as stressful was measured using the Perceived Stress Scale short-form (PSS), a self-report questionnaire with 4 items. Family functioning was assessed using the general functioning subscale (12 items) from the self-report McMaster Family Assessment Device (FAD).

Statistical analyses

Analyses were conducted using R studio software (version 1.2.5033). Participants were dichotomized using the 14 items of the OSI inventory (NSSI + versus NSSI-). The descriptive statistics of the overall sample and by NSSI category were conducted first. The characteristics of these two groups were then compared using Chi-squared tests or Fisher exact tests for categorical variables and Student's *t* tests for dimensional variables with their associated effect sizes. Between-group differences were considered significant at $p < 0.05$, and variables with a $p < 0.1$ in bivariate analyses were retained for the second level of analysis.

Logistic regression analysis with a Stepwise procedure was then used to identify the association of NSSI with: lifetime MDD and GAD, history of suicide attempt, AN subtype, duration of AN, BMI at admission, four subscale scores on the EDE-Q at discharge, and PSS score at discharge. Lifetime PTSD was not included in this model because of the limited number of cases (N = 10).

Results

Participant characteristics

The sample included 202 women and girls (see Table 1). Half presented restrictive AN, the other half the binge-eating/purging subtype. Mean age was 20.8 years (± 6.6). Mean BMI at admission and discharge were, respectively, 14.3 (± 1.5) and 17.1 (2.1) after 125.4 days of hospitalisation

Table 1 Characteristics of the total sample, NSSI- and NSSI + groups

	Total sample N = 202	NSSI- N = 129	NSSI + N = 73	p	Effect size [95%CI]
Age at admission (years)	20.8 (6.6)	20.6 (6.7)	21.2 (6.4)	0.555	− 0.09 [− 0.37;0.20]
Age at onset (years)	16.4 (4.3)	16.4 (4.3)	16.3 (4.2)	0.957	0.008 [− 0.27;0.30]
Duration of illness (years)	4.0 (4.2)	3.5 (3.8)	5.0 (4.6)	**0.018**	− 0.36 [− 0.66;-0.06]
Number of previous hospitalisations	2.7 (4.3)	2.1 (2.7)	3.8 (6.0)	**0.035**	− 0.36 [− 0.69;-0.02]
Minimum BMI	13.1 (1.6)	13.0 (1.5)	13.3 (1.8)	0.374	− 0.13 [− 0.43;0.16]
BMI at admission	14.3 (1.5)	14.1 (1.4)	14.6 (1.6)	0.056	− 0.29 [− 0.58;-0.01]
BMI at discharge	17.1 (2.1)	17.2 (2.1)	17.0 (2.0)	0.652	0.07 [-0.22;0.35]
Length of stay (days)	125.4 (103.2)	127.1 (105.4)	122.2 (99.8)	0.743	0.05 [− 0.24;0.33]
AN subtype					
- Binge eating/purging	101 (50.0%)	58 (45.0%)	43 (58.9%)	0.079	0.13 [0.00;1.00]
- Restrictive	101 (50.0%)	71 (55.0%)	30 (41.1%)		
Psychiatric comorbidities					
- MDD	92 (56.1%)	42 (44.2%)	50 (72.5%)	**0.001**	0.28 [0.15;1.00]
- GAD	53 (32.3%)	22 (23.2%)	31 (44.9%)	**0.006**	0.23 [0.10;1.00]
- Panic disorder	4 (40.0%)	3 (50.0%)	1 (25.0%)	0.571	0.25 [0.00;1.00]
- Agoraphobia	37 (90.2%)	20 (95.2%)	17 (85.0%)	0.343	0.17 [0.00,1.00]
- Social phobia	50 (30.5%)	26 (27.4%)	24 (34.8%)	0.397	0.08 [0.00;1.00]
- OCD	42 (25.6%)	22 (23.2%)	20 (29.0%)	0.507	0.07 [0.00;1.00]
- PTSD	10 (6.1%)	1 (1.1%)	9 (13.0%)	**0.002**	0.25 [0.12;1.00]
- Suicide attempt	42 (24.0%)	14 (13.7%)	28 (38.4%)	**< 0.001**	0.28 [0.16;1.00]
EDE-Q—restraint concerns	1.3 (1.4)	1.0 (1.3)	1.6 (1.4)	**0.003**	− 0.36 [− 0.69;-0.02]
EDE-Q—eating concerns	1.7 (1.4)	1.3 (1.2)	2.2 (1.5)	**< 0.001**	− 0.66 [− 0.99;-0.33]
EDE-Q—shape concerns	2.8 (1.7)	2.4 (1.6)	3.4 (1.6)	**< 0.001**	− 0.66 [− 0.99;-0.33]
EDE-Q—weight concerns	2.3 (1.6)	1.9 (1.4)	2.9 (1.6)	**< 0.001**	− 0.62 [− 0.95;-0.29]
BSQ	91.4 (40.4)	78.3 (35.8)	109.8 (39.6)	**< 0.001**	− 0.84 [− 1.17;-0.51]
Figure Rating Scale	− 0.6 (1.5)	− 0.3 (1.4)	− 1.0(1.6)	**0.016**	0.40 [0.08;0.73]
BVAQ	53.0 (9.8)	52.9 (9.9)	53.2 (9.7)	0.875	− 0.03 [− 0.34;0.29]
PSS	6.9 (3.8)	6.3 (3.6)	7.8 (4.0)	**0.018**	− 0.40 [− 0.72;-0.07]
FAD					
- Good family functioning	21 (14.7%)	15 (17.7%)	6 (10.3%)	0.332	0.10 [0.00;1.00]

In bold: $p < 0.05$. NSSI: non-suicidal self-injury. EDE Q: Eating Disorder Examination Questionnaire. MDD: major depressive disorder. OCD: obsessive–compulsive disorder. GAD: generalized anxiety disorder, PTSD: post-traumatic stress disorder. BSQ: Body Shape Questionnaire. BVAQ: Bermond–Vorst Alexithymia Questionnaire Form B. PSS: Perceived Stress Scale short form. FAD: McMaster family assessment device

(± 103.2). The average duration of illness was 4.0 years (± 4.2) and there was an average of 2.7 (± 4.3) previous hospitalisations for an ED.

Prevalence and characteristics of NSSI

At discharge, 73 participants (36.1%) had self-harmed in the past 6 months. The average age of onset of NSSI was 16.1 years (± 4.88). The means used for NSSI were numerous: cutting objects (63%), bites or scratches (30.1%), pointed objects (17.8%), hitting oneself (17.8%), hitting a wall (11.0%), burning oneself (6.9%), and others (2.7%). The injured body parts were: the upper limbs (90.4%), the lower limbs (28.8% of which 47.6% concerned the thighs or hips), the trunk (11.0%, of which 75.0% concerned the abdomen), and the head (19.2%).

Twenty-six participants (36.6%) reported that they never felt pain when they deliberately injured themselves. The factors that were reported as triggering NSSI were a feeling of physical or psychological unease (N = 33; 45.2%), feelings of anger (N = 18; 24.7%), a need to relieve discomfort (N = 14; 19.2%), low self-esteem (N = 12; 16.4%), a desire to get attention (N = 4; 5.5%), self-punishment (N = 5; 6.9%), imitation of others (N = 3; 4.1%) or eating-related difficulties (N = 2; 2.7%). Nine participants (12.3%) could not explain why they self-harmed. The majority explained that they had found no useful treatment to reduce NSSI (N = 50; 70.4%).

Associations between NSSI and clinical characteristics

In bivariate analyses, compared to the NSSI-, the NSSI + women had similar age and BMI at admission and discharge ($p > 0.05$), but a longer illness duration of ED ($p = 0.018$), significantly more psychiatric comorbidities (PTSD, $p = 0.002$; MDD, $p = 0.001$; GAD, $p = 0.006$), suicidal thoughts ($p < 0.001$) and suicide attempts ($p < 0.001$). There was no effect of AN subtype ($p = 0.079$). NSSI + also perceived a greater difference between their ideal and perceived body shapes (FRS, $p = 0.016$), and endorsed higher BSQ ($p < 0.001$), PSS ($p = 0.018$) and EDE-Q scores (restraint concerns: $p = 0.003$; eating, weight, and shape concerns: $p < 0.001$).

The results of the logistic regression are displayed in Table 2. EDE-Q eating concerns at discharge, lifetime MDD and suicide attempts were significantly associated with NSSI in the past 6 months.

Discussion

The aim of this study was to describe the characteristics of subjects who self-harm and the factors associated with NSSI among people who had been hospitalized for AN. In our sample of women and girls who had received inpatient care for AN, over one-third reported NSSI in the past 6 months, most often using cutting or pointed objects, bites, or scratches. The injured body parts were mainly the upper limbs. The clinical factors most strongly independently associated with NSSI were a lifetime diagnosis of MDD, a history of suicide attempt and high levels of eating concerns at discharge.

The association of NSSI and binge-eating/purging behaviours, which has often been reported in the literature [3, 6, 7], was not replicated in the present sample. While the NSSI group included a majority of the binge-purging AN subtype (58.9%), the absence of significant difference could be due to a too small number of subjects in this study. Moreover, although NSSI is more frequent in bulimia nervosa than in AN, this difference was not found between the restrictive and binge eating/purging AN subtypes in the meta-analysis by Cucchi et al. [1]. In addition, a study conducted in a non-clinical sample of undergraduate students found that restrictive eating was associated with NSSI above and beyond the influence of binge eating/purging behaviours [8]. Nonetheless, in a recent study [9], NSSI were more frequent in binge-purging than restrictive AN, but it included a younger (adolescents) and less severe (average BMI more than one point higher than in our sample) population. Thus, the association between NSSI and AN severity or subtypes still requires further investigation to draw firm conclusions.

Table 2 Variables retained in the model to explain NSSI

	Estimated parameter	Standard deviation	Odds ratio [95% CI]	*p* value
EDE-Q at discharge, eating subscale score	0.42	0.14	1.52 [1.17;2.01]	0.003
Lifetime MDD Yes (versus No)	0.89	0.38	2.44 [1.17;5.22]	0.019
Suicide attempts Yes (versus No)	0.88	0.45	2.42 [1.02;5.96]	0.048

While the different domains of ED symptoms were linked to NSSI, only the level of eating concerns appeared to be an independent predictor of NSSI. These findings are in line with previous studies [6, 7]. As in the study by Ahn et al., the factor the most robustly associated with NSSI was psychiatric comorbidity [6]. In their sample of outpatients seeking treatment for an ED, the severity of ED symptoms was related to NSSI, but the variable the most robustly associated was comorbid MDD [6]. This observation was also found among young people hospitalised for restrictive AN [3]. Muehlenkamp et al. also reported higher levels of depressive symptoms among people presenting both NSSI and disordered eating than in the groups presenting a single behaviour [4]. Nevertheless, this study highlights the importance of a history of MDD for people with AN, and of the persistence of this association even when the history of suicide attempt is considered.

In line with the literature, we showed a significant link between NSSI and a history of suicide attempt. This relationship, as well as that with a history of suicidal ideation, is often observed in ED [1, 3, 6]. One meta-analysis showed a significant rise in NSSI among people who had attempted suicide: the likelihood of NSSI increased by 24% for every 10% increase in the percentage of subjects with histories of suicide attempt [1]. Studies in clinical and general populations have shown that people who engage in NSSI and present ED behaviours often do so when they have suicidal thoughts [10]. These studies reported higher levels of suicidal thoughts or death-related intention during NSSI and during episodes of restrictive eating compared to binge-eating or compensatory behaviours [10]. In another study including various types of ED, binge eating was found to be a predictor of depression, which in turn was found to be related to NSSI frequency, suicide attempts and suicide ideations [11]. These studies suggest that self-harming, ED and suicidal behaviours could be viewed as forming a continuum.

The OSI inventory itself does not enable assessment of suicidal ideation, because the question probing for intentionality excludes suicidal ideation ("Why do you think you started and if you have continued, why do you

still self-injure (without meaning to kill yourself)?"). Nevertheless, the vast majority of our study population described NSSI as a way of dealing with unpleasant feelings. This is in line with common underlying transdiagnostic mechanisms linking emotional dysregulation to NSSI and ED. Indeed, people with NSSI and ED are more likely to engage in impulsive behaviour when they experience negative affects [7]. In ED, self-injury behaviours play a strong role in regulating negative emotions [12]. In a non-clinical sample, individuals with co-occurring NSSI and restrictive eating also seemed to rely on numerous forms of problematic behaviours to attempt to regulate their emotions [8].

Neurobiological studies suggest that both NSSI and AN behaviours are initially a way to regulate negative affects, and are then repeated because of their reinforcing effect on the reward system [13]. NSSI, binge-eating, food restriction and excessive exercising could be ways to gain an endorphin rush and provide short-term reward relief from negative emotions in AN [13]. The reinforcement could be enhanced in AN as a result of the effects of starvation, as beta-endorphin levels are reduced as a consequence of malnutrition. The self-harming behaviours could thus be a way to self-stimulate and mobilize the last reserves of the endogenous opioid system [13].

Strengths and limits

Limitations of this study include its cross-sectional design, as well as the relatively small sample size of people engaging in NSSI. Moreover, only women and girls, all inpatients, were included, which impede the generalizability of the results. In addition, the evaluation did not include an assessment of impulsivity, emotional regulation strategies or suicidal ideation in association with NSSI. If the evaluation was conducted on inpatients recruited between 2009 and 2011—when the diagnostic criteria for AN were different—which could have limited the comparison of our results with the findings of studies on samples diagnosed using the updated DSM criteria, all the participants in the present study actually fulfilled the DSM-5 diagnostic criteria for AN. Moreover, this study was part of a large longitudinal multicentre observational study which enabled us to obtain a homogeneous sample of both adolescents and adults with severe AN.

What is already known on this subject?

NSSI is frequent among women hospitalised for AN. It is associated with the severity of the ED symptoms and its prevention and treatment are complex.

What your study adds?

NSSI appears to be related to elements of the clinical psychiatric presentation as a whole (major depressive disorder history, suicide attempts, and higher levels of ED symptoms). Hypotheses of common mechanisms between NSSI and those elements suggest that we should evaluate interventions to improve coping with negative emotions that could provide an overall improvement in symptoms.

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Author contributions SB, NG, LG, CB and the EVHAN group have given substantial contributions to the conception of the study and to the acquisition of the data. NG, CB, SG, FH and AA to the design of the study. AA, FH, SB and NG to analysis and interpretation of the

data. FH, AA and NG have participated to drafting the manuscript. All authors revised it critically and approved the final version of the manuscript.

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Data availability Data can be available on request and in compliance with the French law on the protection of medical data.

Declarations

Ethics approval and consent to participate The study protocol was approved by the Ile-de-France III Ethics Committee and the French Data Protection Authority (*Commission Nationale de l'Informatique et des Libertés, CNIL*). EudraCT number: 2007-A01110-53, Clinical trials number: NCT00910169. In accordance with the Helsinki declaration, written informed consent was obtained before inclusion from each participant, as well from their parents for those who were under 18 years.

Competing interests The authors declare no competing interests.

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