



The role of emotions reported in the emergency department in four-month chronic pain development: Effects of sadness and anger

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ARTICLE INFO

Article history:

Received 5 July 2024

Received in revised form 3 February 2025

Accepted 24 February 2025

Available online xxxx

Keywords:

Anger
Biopsychosocial model
Chronic pain
Emergency department
Emotions
Sadness

ABSTRACT

Objective: This study aims to assess whether the emotions experienced during an urgent health problem represent risk factors for developing chronic pain.

Method: A pain study was carried out as part of a randomized multicentre study on the prevention of post-concussion syndrome and post-traumatic stress syndrome (SOFTER) following emergency hospitalisation. Nine hundred and fourteen patients not suffering from chronic pain at admission provided information on the presence and intensity of eight emotions (anger, fear, regret, sadness, relief, contentment, joy, and interest) during their stay at the emergency department. Four months later, they were called to assess if chronic pain had developed. The predisposition to experience these emotions prior to the emergency room was questioned at this occasion.

Results: Four months after their admission to the emergency department (ED), 30 % of the patients described experiencing chronic pain. Adjusted for patient's perception of own health, intensity of acute pain, reason for visit and level of education at the time of admission, sadness (OR = 1.5 95 % CI = [1.1–2.2]) and anger (OR = 1.6 95 % CI = [1.1–2.5]) declared in the ED were predictive of pain status at four months. By taking into account patient pre-disposition to feel each of these two emotions, we observed a significantly higher risk of chronic pain at four months among patients pre-disposed to anger who declared a relatively strong anger during their time spent in the ED (OR = 2.90, IC = 1.12–7.52).

Conclusion: This study shows that the emotional state of patients admitted to the ED must be taken into consideration in order to detect people likely to experience chronic pain and therefore offer personalised preventive treatment. Further studies will be necessary to better comprehend the role played by emotions in the development of chronic pain.

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1. Introduction

A medical emergency or sudden injury represent a risk of developing chronic pain (CP) [1], defined in the ICD-11 as “pain that persists or recurs for longer than 3 months.” [2]. An emergency, whether medical or traumatic, represents a biological stress for the organism which can trigger mechanisms of CP development. Interactions within the central nervous system, followed by top-down effects on the peripheral autonomic, immune and endocrine systems in conjunction with genetic

predisposition, in turn reinforce central processes [3]. One Canadian study demonstrates that 20 % of patients accessing emergency medical services report chronic pain at three months [4]. In light of the recurrent nature and potential long duration of CP [5], it is crucial we obtain a better understanding of the contributing factors at play.

Following the biopsychosocial model proposed by Engel in 1977, which suggests a theoretical and practical approach that, in addition to the biological dimension, considers psychological and social factors in pathologies [6], taking the subjective perceptions of individuals into consideration in chronic pain research has entered more significantly into common practice [3]. Among the psycho-affective risk factors, anxiety [7] and depression [8] have been widely studied, whereas emotions, defined by Scherer as “an episode of interrelated, synchronised changes in the states of all or most of the five

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organismic subsystems in response to the evaluation of an external or internal stimulus event as relevant to major concerns of the organism" [9] only feature in a handful of studies. Chronic pain patients, however, may suffer from emotional disorders such as emotional inhibition or very intense negative emotions [10].

This raises questions of the direction of the relation and the ability to detect patients likely to develop CP from first admission. Only two studies seem to explore emotional factors prior to CP development. Negative emotional states linked to a road traffic accident, such as depression, anxiety, fear and frustration, as early as 6 weeks after the accident, are predictive of the presence of pain 4 months and 1 year after suffering whiplash [11]. Another study shows that the suppression of emotions, which refers to inhibiting the expression of emotion, as a self-regulating mechanisms is a predictive factor for CP at 6 months among people who suffered an injury [12]. However, as the timeline for assessing this scale was not mentioned in the study, there is no way of knowing if this emotional regulation maps onto normal behaviour prior to the trauma or if it occurred as a result.

In fact, to the best of our knowledge, no study has yet been carried out on the link between emotional state during an acute health problem such as admission to the emergency department (ED) and the development of CP three months after the event. Yet, emotions can be detected and collected in the ED using a self-assessment system [9].

Our objective was to study the role of emotional state and the various emotions experienced during time spent in the ED on the development of chronic pain at four months.

2. Material and methods

2.1. Design, implementation and recruitment

The study population was selected from a longitudinal follow-up of a randomized cluster crossover trial on the prevention of post-concussion syndrome and post-traumatic stress disorder (ref: NCT04916678).

The emergency departments of seven hospitals in France participated. These hospitals receive all non psychiatric cases, while psychiatric emergencies are dealt with in specialized mental health emergency departments.

The randomized trial took place over two weeks in each center: an intervention period with the presence of psychologists in addition to the usual team, and a control period with only the usual emergency team, the general medicine team. The weeks were randomly ordered, and a wash-out period was performed in between. The intervention consisted in the presence of psychologists in the usual emergency teams. During the week of intervention, the psychologists first attended the patients identified by the care teams as being most in need of psychological intervention, and then attended to as many patients as possible. The trial compared the 4-month incidence of post-concussion syndrome and posttraumatic stress disorder based on the week of intervention.

Patients had to be over 18 years of age, fully conscious, able to give their consent, able to receive a telephone call and agree to a telephone consultation 4 months after hospitalisation. Any patient presenting to the emergency department, and who was eventually discharged from the emergency department or hospital, were considered. A specific section on chronic pain risk was added in the study. The presence of prevalent CP was assessed at baseline. Patients from the trial already diagnosed with chronic pain upon inclusion were excluded from this study. Except for this criterion, all patients in the trial were retained.

Patients fulfilling the inclusion criteria were assessed, when possible, at two points during their time spent in emergency care via a self-assessment questionnaire, assisted by one of the researchers

involved in the study when necessary. The first assessment was carried out when they were admitted to the emergency ward after nurse triage, before their first medical consultation. The second assessment, when completed, was carried out before discharge from the ward, after receiving medical attention. Between these two intervals, depending on the week of trial randomisation, they could have been visited by a psychologist in the ward (during intervention period).

All patients were contacted again 4 months after admission by a call centre. The enrolment period for the study commenced on October 18, 2021, concluded on June 17, 2022, and the follow-up phase was completed on November 17, 2022.

2.2. Methodology

2.2.1. Outcome: CP at four months

The main assessment criterion was the existence of chronic pain measured four months after admission to the ED according to the ICD-11 [2]. This was measured during the telephone interview at 4 months by asking the following question: "Have you been experiencing persistent or recurring pain for more than three months?" The patients who answered "yes" to this question were considered as chronic pain sufferers.

2.3. Risk factors analysed

2.3.1. Affective variables

The affective variables were identified at two assessment stages: firstly, in the ED, during the post-admission questionnaire, in which patients were asked about the emotions they felt at the time of the ED visit (emotional state), and secondly, during data collection at the four-month mark, when patients were questioned on the frequency of these emotions before coming to the ED (emotional characteristics, corresponding to an affect disposition).

Patients were specifically questioned on eight emotions according to the Geneva Emotion Wheel [13]. As the questionnaire was self-administered in most cases, patients were asked on the questionnaire to answer for all the emotions questioned, even if they seemed inappropriate. They were asked whether or not they felt the emotion in question, and if so, its intensity. Out of these eight emotions, four are negative: anger, fear, regret, and sadness, while four are positive: relief, contentment, joy, and interest. The intensity of the emotion stated is graded on a scale of one ("not very intense") to five ("very intense"). Each of these emotions was dichotomised according to its intensity and only studied when its rating was equal to or higher than three. Patients could also report "no emotion" or another emotion not listed on the wheel but in these cases intensity was not assessed.

An emotional state variable expressing the pleasantness or unpleasantness of the event that triggered the emotion, called valency, was created based on the wheel of emotions, taking into account the overall palette of emotions experienced. In this way, people can feel no emotion at all, only emotions of negative valency, only emotions of positive valency, or emotions of mixed valency: positive and negative, when the emotional state reported included at least two emotions of opposite valency. The valency variable therefore has four forms: no emotion, mixed valency, negative valency, positive valency, without assessment of intensity.

At four months, the affect dispositions defined by Scherer as "the tendency of a person to experience certain moods more frequently or to be prone to react with certain types of emotions, even upon slight provocation" [9] were examined. This assessed the frequency of these emotions prior to patient admission to the ED, on a three-point scale of "never" to "often". For the "often" frequency, each of these emotional dispositions was also dichotomised and studied.

2.3.2. Control variables

Sociodemographic variables were assessed: sex, age, level of education (less than 12 years of studies, or more than 12 beyond high school diploma), and whether the patient lives alone or with others. Other factors taken into account were a health self-assessment on a five-point Likert scale (excellent to mediocre), which was then dichotomised into perception of health as good (good to excellent) or poor (mediocre or poor), the reason for their visit to the ED assessed in 15 categories plus an option for “other”, in which the patient was asked to specify. Reasons for admission were also grouped into two categories (trauma-related or medical) and the randomisation group of the original study (period of intervention by a psychologist, or period without a psychologist) were also recorded. Pain intensity experienced during emergency care was collected on a numerical rating scale of zero to ten then dichotomised for analysis with a cut-off of three: no pain or light pain [0–3] and moderate or severe pain [4–10] according to French recommendations for pain management in the ED with pain relief as a priority from a pain level of 4/10 [14].

2.4. Analysis

Firstly, those responding in the four-month assessment were compared with those lost to follow-up using Chi-squared tests for qualitative variables and variance tests for the quantitative variables mentioned above.

The numbers and percentages of each factor studied for chronic pain sufferers at 4 months (4-month-CP) and in non-chronic pain sufferers at 4 months (no-4-month-CP) were then compiled in a descriptive table. Descriptions of the intensity of acute pain on admission have also been presented for both groups in a figure. For each of the variables described, the crude odd ratio and its 95 % confidence interval and *p*-value are provided. The interactions between univariate significant emotions were tested, as well as those between emotions and affect dispositions to experience the same feeling often. Regarding relationships established between emotions and intense pain, particularly in the context of emotional modulation of pain [15], interaction and mediation analyses were conducted on the relationship between intense pain on admission and CP at four months. We used Baron & Kenny's concept of mediation to research the effects of mediation [16]. According to them, the mediator describes a process through which the independent variable is likely to influence the dependent variable. This results in a total effect that combines the effects of a direct relationship between the dependent variable and the independent variable, and an indirect relationship between these two variables via the mediator.

Non-emotional factors showing a significant correlation with CP in the univariate model were added to an initial multivariate model to create the adjustment model. Each emotion significantly associated with CP in the univariate model was then studied separately in the previous adjustment model.

To identify the effects of emotion and affect disposition, each emotion significantly associated with CP in the multivariate model was studied alongside its affect disposition, with, where necessary, an interaction term. A final multivariate model assesses these emotions and affect disposition of patients to feel these emotions often.

Mediation analyses were carried out using the R Cran “mediation” package, version 3 [17]. All other analyses were performed using SAS 9.4.

2.5. Ethics and consent

The study was approved by the *Comité de protection des personnes* (21042–71,449). All patients provided signed informed consent before inclusion. The study protocol has been registered and is available on [ClinicalTrials.gov](https://clinicaltrials.gov) (Identifier: NCT 04916678). The reporting of this study followed the Consolidated Standards of Reporting Trials (CONSORT) statement extended to cluster randomized trials [18].

3. Results

3.1. Study population and comparison with non-respondents

In total, 2965 patients were included in the study at the time of their admission to the ED. Nine hundred and fifty-seven patients were excluded from this study for already presenting CP at time of admission. Of the 2008 patients with no CP upon admission, 914 responded to the pain questionnaire at four months. These patients made up the study population (Fig. 1).

As described in Table 1, respondents at four months were less likely to live alone than non-respondents. They were less likely to describe their own state of health as poor and the visit to the ED was more likely to be their first for the reason listed, which did not differ between respondents and non-respondents. Feelings of pain, stress and emotional valency did not differ significantly between the two groups.

Most patients came for somatic reasons (around 60 %), with abdominal, neurological, cardiac, respiratory, general medical and headache reasons in order of frequency. For traumatic reasons, the most frequently reported causes were falls, road, work or sports accidents for the most frequently reported. Few had psychiatric or psychological reasons: 5 people came for a suicide attempt and 4 for anxiety or depression (Appendix 1).

3.2. Chronic versus non-chronic pain sufferers

Two hundred and seventy-five patients, slightly less than a third (30.1 %) of patients without CP at admission to the ED, reported CP 4 months later.

The two distributions of pain experienced on admission, in patients with and patients without CP at four months, point to greater pain intensity in the former (Fig. 2). A pain level of 4/10 represents a threshold above which CP sufferers at four months are more represented for each pain level, with 68 % of CP sufferers above this threshold compared with 54 % of non-CP sufferers.

Distributions of the factors studied in the 4-month-CP group and no-4-month-CP group, as well as the crude odd ratios associated with the 4-month-CP group, are reported in Table 2. In terms of socio-demographic and health factors, a level of education lower than a high school, admission for trauma and a poor self-assessment of one's own health represented risk factors for developing CP four months after ED admission. In terms of physical feelings, moderate and severe acute pain increased the risk of CP risk at four months. As for emotions, negative emotions were primarily associated with CP at four months: anger, regret and sadness of an intensity equal to or higher than three out of five during emergency hospitalisation. Only one emotion felt during time spent in the ED appeared to have a less detrimental effect: relief.

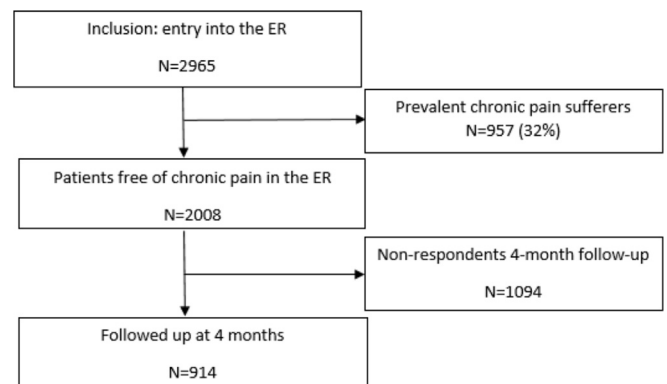


Fig. 1. Study population flow-chart. ER = emergency room.

Table 1
Comparison between 4 month-respondents and 4 month-non-respondents.

	4 month-respondents (N = 914)		4 month-non-respondents (N = 1094)		CI 95 % of the difference	p-value
	n	%	n	%		
Women	431	47.2	486	44.4	[−1.6–7.1]	0.2
Age, mean (sd)	43.8	(19.4)	41.8	(20.6)	[0.3–3.8]	0.06
Living alone*	394	43.1	534	48.8	[−10.1 – −1.3]	0.02
Education < high school diploma	280	30.6	378	34.6	[−9.0–0.0]	0.3
In employment	640	70.0	764	69.8	[−4.5–5.0]	0.3
Perceives own health as poor	98	10.7	168	15.4	[−16.3 – −3.8]	0.007
Admission was trauma-related	363	39.7	455	41.6	[−6.4–2.5]	0.7
1st visit for this reason*	663	72.5	732	66.9	[1.9–11.3]	0.04
Pain, mean (sd*)	4.2	(2.9)	4.4	(2.9)	[0.0–0.5]	0.5
Stress, mean (sd*)	3.1	(2.9)	3.2	(3.1)	[−0.1–0.4]	0.2
Valency, no emotion	139	15.2	179	16.4	[−8.1–3.8]	0.2
Valency, negative emotions only	254	27.8	342	31.3	[−8.9–0.6]	
Valency, mixed emotion	266	29.1	324	29.6	[−5.4–4.2]	
Valency, positive emotions only	255	27.9	249	22.8	[1.7–11.8]	

(sd) Standard deviation, CI=Confidence Interval.

For affect dispositions, those associated with CP at four months were also found to be equally significantly associated with CP at 4 months, except for one emotion of positive valency (relief). Therefore, dispositions of anger, regret and sadness were associated with CP at four months.

Regarding the interaction between emotions and affect disposition, only that concerning anger proved to be significantly associated with CP at four months.

Finally, emotions and intense pain did not show any mediation relationship or interaction with risk of CP at four months.

3.3. Multivariate risk factors for 4-month-CP and the specific role of emotions in chronic pain development

Adjusted CP risks are presented in Table 3. Pain, a negative perception of one's own health, admission to the ED for trauma and a level of education lower than a high school diploma remained significantly and independently associated with CP at four months.

Anger and sadness were found to increase CP risk by a factor of 1.6 for anger and 1.5 for sadness. When these two emotions and their affect disposition are introduced jointly into the model, as two separate

variables for sadness and a cross-variable for anger, only anger experienced during emergency hospitalisation by patients with a pre-disposition for anger remains significantly associated with the development of CP at four months, drastically multiplying its risk by 4. Whereas for sadness, it is the pre-disposition for sadness that remains associated with CP at four months. The sadness pre-disposition increases risk of CP by 1.45, a level almost equivalent to that measured for the sadness emotion in the previous model.

When these two emotions and these two affect dispositions are introduced together, only the feeling of anger in people pre-disposed to anger persists, with a risk of CP at four months multiplied by almost 3.

4. Discussion

Our study demonstrates that 30 % of patients not suffering from CP upon admission suffer CP four months later. Despite taking into account factors such as acute pain, one's own health perception, admission reason and education level, sadness or anger, equal to or higher than 3 out of 5, were twice as likely to lead to CP at four months. The effects of anger are more pronounced among those pre-disposed to anger.

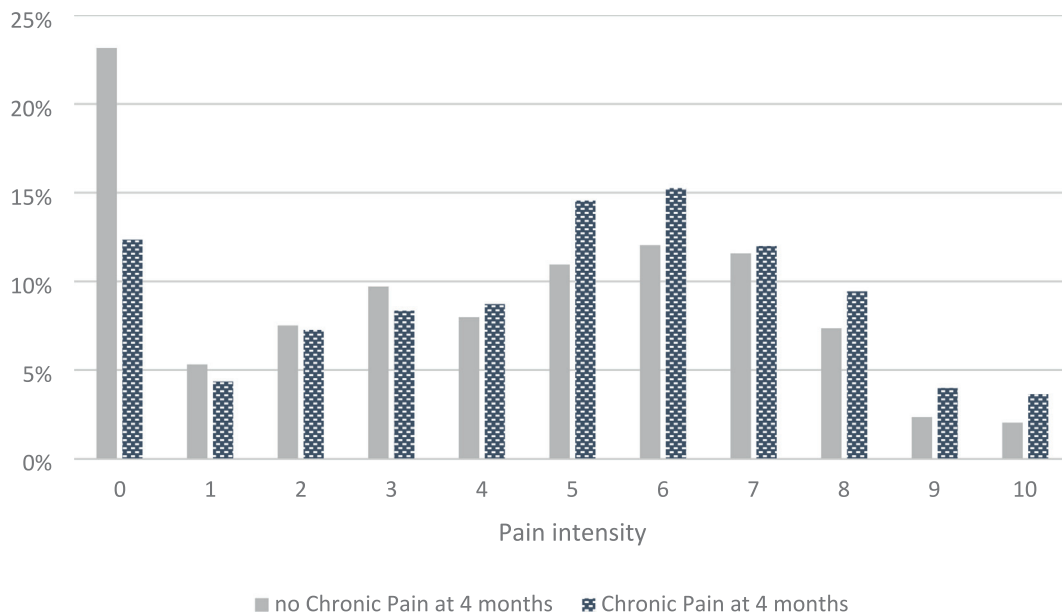


Fig. 2. Distribution of pain intensity at admission in patients with 4-month-CP and in patients without 4-month-CP.

Table 2

Comparison between 4-month-CP sufferers and no-4 month-CP-sufferers, N = 914.

	4-month-CP sufferers (N = 275) n (%)	No-4-month-CP sufferers (N = 639) n (%)	95 % CI of the difference	Crude OR	4-month-CP [OR 95 % CI]	p-value
Sociodemographic factors						
Female	139 (50.5)	292 (45.7)	[−1.9–10.1]	1.22	[0.92–1.61]	0.2
Age, mean (sd)	44.7 (19.5)	43.4 (19.4)	[−4.0–1.5]	1.00	[0.99–1.01]	0.4
Lives alone	126 (45.8)	268 (41.9)	[−2.7–9.4]	1.17	[0.88–1.56]	0.3
Education < high school diploma	103 (37.5)	177 (27.7)	[3.0–16.3]	1.56	[1.16–2.11]	0.004
Health factors						
Perceives own health as poor	40 (14.5)	58 (9.1)	[1.8–22.2]	1.71	[1.11–2.62]	0.02
Use of anxiolytics/antidepressants in the last 12 months	40 (14.5)	77 (12.1)	[−4.5–13.9]	1.24	[0.82–1.87]	0.3
Trauma-related reason	140 (62.2)	223 (34.9)	[7.9–20.2]	1.94	[1.45–2.58]	<0.0001
Psychologist present	151 (54.9)	339 (53.1)	[−4.4–7.5]	1.08	[0.81–1.43]	0.6
Acute pain above 3	186 (67.6)	347 (54.3)	[5.7–17.4]	1.76	[1.31–2.37]	0.0002
Acute pain, mean (sd)	4.8 (2.8)	3.9 (3.0)	[−1.3 – −0.5]	1.11	[1.05–1.16]	<0.0001
Acute stress above 3	119 (43.3)	267 (41.8)	[−4.8–7.3]	1.06	[0.80–1.41]	0.7
Acute stress, mean (sd)	3.1 (2.9)	3.0 (2.9)	[−0.5–0.3]	1.01	[0.96–1.06]	0.6
Emotions^a						
anger	47 (17.1)	61 (9.6)	[5.4–25.1]	1.95	[1.30–2.94]	0.001
fear	58 (21.1)	122 (19.1)	[−4.9–10.2]	1.13	[0.80–1.61]	0.5
regret	55 (20.0)	87 (13.6)	[1.6–18.9]	1.59	[1.09–2.30]	0.02
sadness	65 (23.6)	102 (16.0)	[2.7–18.9]	1.63	[1.15–2.31]	0.006
relief	64 (23.3)	198 (31.0)	[−14.3 – −1.6]	0.68	[0.49–0.94]	0.02
contentment	37 (13.5)	97 (15.2)	[−11.1–5.3]	0.87	[0.58–1.31]	0.5
joy	18 (6.5)	49 (7.7)	[−14.5–7.6]	0.84	[0.48–1.48]	0.6
interest	74 (26.9)	194 (30.4)	[−9.9–2.9]	0.84	[0.62–1.16]	0.3
no emotion	43 (15.6)	96 (15.0)	[−7.3–9.3]	1.05	[0.71–1.55]	0.8
Affect disposition to feel these emotions often						
anger	28 (10.2)	42 (6.6)	[−1.2–22.6]	1.76	[1.05–2.95]	0.03
fear	30 (10.9)	59 (9.2)	[−6.3–14.3]	1.17	[0.72–1.89]	0.5
regret	29 (10.5)	40 (6.3)	[0.9–25.0]	1.97	[1.2–3.3]	0.01
sadness	47 (17.1)	68 (10.6)	[2.8–21.9]	2.17	[1.41–3.34]	0.001
relief	77 (28.0)	181 (28.3)	[−6.9–6.3]	1.01	[0.69–1.48]	0.9
contentment	103 (37.5)	218 (34.1)	[−3.2–9.4]	1.23	[0.84–1.80]	0.3
joy	126 (45.8)	270 (42.3)	[−2.9–9.1]	1.15	[0.79–1.68]	0.5
interest	135 (49.0)	304 (47.6)	[−4.7–7.2]	1.24	[0.82–1.86]	0.3
no emotion	48 (17.5)	122 (19.1)	[−9.8–5.3]	0.90	[0.62–1.30]	0.6

CP = Chronic Pain, OR = Odd Ratio; CI=Confidence Interval.

^a Emotions measured after 1st nurse consultation, of an intensity equal to or higher than 3 out of 5.

4.1. CP development rate

Our study offers new information on the CP development rate for all admission reasons. Existing studies on the development of CP following ED admission single out pathologies or severe acute pain [19–21]. Similarly to in our study, most CP development rates for trauma-related reasons are higher than for medical reasons [22]. All reasons combined, one study selecting patients who had received an oral opioid found a 27 % rate at 6 months [20], near our results but probably slightly lower due to the longer time period.

Attrition bias linked to the difference between those followed up and those lost to follow-up may have produced a lower CP development rate. Indeed, respondents at four months differed from non-respondents by their perception of their own health. Other differences (living alone or not, and first time going to the ED for the reason listed) have no influence on CP outcome in our study. Our main study focus, the feelings, does not differ between these two populations. It should be noted that we do not know the reasons for non-participation in the 4-month follow-up.

4.2. CP risk based on emotions declaration during emergency department stay

This prospective study highlights emotions experienced in the ED as a risk factor associated with CP development. To our knowledge, no clinical study has previously explored, emotional state in the ED [11,12].

Our results are in support of the hypothesis put forward in Koechlin's review of the link between relatively intense negative emotions and the risk of CP [10]. In our study, the risk factors of sadness

and anger seem to be explained by vulnerability during a health emergency represented by these affect dispositions. The CP risk factor of sadness is mainly explained by the patient's pre-disposition to experience this emotion. In contrast, the CP risk associated with anger is tied to both the emotion felt in the ED and the affect disposition. The same goes for Carroll's study [11] in which risk-associated emotions are linked to these feelings pre-accident frequency, anger having the strongest effect.

The prominent effect of anger state is confirmed by a review of the anger meaning and scope in CP cases [23]. Several studies report that CP sufferers express more anger, despite they have similar predisposition as healthy controls. Although causality wasn't shown, pain expression could be a somatisation mechanism associated with anger repression. Furthermore, a study established a link between hostility (anger-related tendencies and behaviour) and health that may point towards another mechanism leading to CP. People who demonstrated hostility developed a "what's the point" attitude that may endanger their health. Additionally, hostility undermines the therapeutic alliance and care or rehabilitation suffers, leading to treatment failure.

It is interesting to note that, in the sadness model, pre-disposition to sadness was more influential than sadness felt in the ED. The same studies as those previously mentioned also find a link between sadness and CP [10,11,24]. However, no study to our knowledge has established a link between sadness pre-disposition and CP risk. In a study on emotional responses to the SARS pandemic in Hong Kong and coping strategies, sadness expression was linked to the use of passive coping strategies [25], known to be risk factors for developing CP after trauma [26,27].

Table 3

Role of emotions and affective disposition to feel these emotions in chronic pain at 4 months, multivariate analysis.

	4-month-CP		
	ORadj	[95 % CI]	P-value
Adjustment model			
Pain higher than 3	1.65	[1.21–2.23]	0.001
Perceives own health as poor	1.91	[1.22–2.98]	0.005
Trauma-related reason	1.97	[1.46–2.65]	<0.0001
Education lower than high school diploma	1.54	[1.13–2.09]	0.006
Four separated models for each emotion^{a,b}			
Anger	1.61	[1.05–2.46]	0.03
Regret	1.32	[0.90–1.95]	0.2
Sadness	1.53	[1.06–2.20]	0.02
Relief	0.76	[0.54–1.07]	0.1
Two models for each emotion with its affect disposition^{a,b}			
Sadness	1.45	[0.99–2.1]	0.05
Disposition to sadness	1.53	[1.01–2.34]	0.049
Anger in a person with a disposition to anger	4.08	[1.65–10.1]	0.002
Anger in a person with no disposition to anger	1.24	[0.76–2.01]	0.4
No anger in a person with disposition to anger	0.89	[0.45–1.76]	0.7
No anger in a person with no disposition to anger	ref	–	–
Final model with emotions and affect disposition to said emotions^{a,b}			
Sadness	1.32	[0.89–1.96]	0.2
Disposition to sadness	1.45	[0.92–2.29]	0.1
Anger in a person with a disposition to anger	2.90	[1.12–7.52]	0.03
Anger in a person with no disposition to anger	1.13	[0.68–1.88]	0.6
No anger in a person with disposition to anger	0.74	[0.36–1.51]	0.4
No anger in a person with no disposition to anger	ref	–	–

CP = Chronic Pain, ORadj = Odd Ratio adjusted; CI=Confidence Interval.

^a Emotions measured after 1st treatment by nurse, of an intensity equal to or higher than 3 out of 5.

^b Adjusted on the 4 variables of the adjustment model.

It is also interesting to note that the vast majority of non-CP patients in our study came to the emergency department for problems other than psychiatric ones (>99 %). With regard to their medical history, patients were asked whether they had taken anxiolytics or antidepressants in the previous 12 months, and this was not associated with the risk of CP. This leads us to think that the risk of CP associated with emotions may exist in a population with no psychiatric history.

Our results differ from the literature regarding the lack of an effect found in fear and emotion inhibition. Two studies mentioned the fear effect [24]. Carroll's study on the presence of pain four months after suffering whiplash highlights a risk effect of fear reported six weeks after [11]. In our study, fear may have been felt during the event that caused the emergency but ceased due to the medical care. It would then no longer affect the patient's ED experience. In any case, it does not seem that the emotion of fear specifically included in the questionnaire was poorly chosen compared to other similar affects labels that could have been surveyed. Less than 1 % of patients reported emotions close to fear without having reported fear.

In contrast to the reviews by Koechlin [10] and Trevino [12] in which emotional suppression as an emotional regulation mechanism is linked to CP, our study does not show a risk effect of a lack of emotions in the ED. This result could be explained by two reasons: either the patients who did not describe feeling any emotion in the ED represent a population combining those who use suppression as a mode of regulation and those whose ED visit did not trigger any emotion, or the link between a pre-disposition for emotional suppression and the emotions actually

felt in emergency is not sufficient. Another study would be required to shed further light on this result.

This study adjusted the results on emotions to the presence of moderate acute pain. The effect of emotions seems to be independent of the initial acute pain, which is itself a risk factor. Thus, the CP under consideration may be both a secondary CP to the urgent health problem [28–31], and in particular trauma, but also a primary CP [2] whose link with the health problem is unexplained. Studies on either of these CP would enrich the results on the risk associated with the emotions of anger and sadness.

4.3. Can we reduce the risk of CP thanks to emotions in the emergency department?

Our study, despite the fact that emotions were reported prior to any chronicisation process, cannot establish a causal relationship. The mechanism between emotions and CP is still to be investigated. However, the effect of anger and especially sadness would indicate an emotional vulnerability to the CP development and the need for emotional resources to cope with a health emergency. This would exist prior to the emergency department and could not be resolved during the emergency visit. However, our results on affect dispositions should be treated with caution as they were collected during the four-month telephone interview and could be biased by a change in perception after the health emergency or by a memory bias. We preferred to interview emotions frequencies a posteriori, rather than during the emergency stay, to avoid the influence of the emotional state response on the disposition one.

The psychologist's presence during the weeks covered by the intervention period was not found to reduce the CP risk. Modifying punctually the emotions experienced in the ED already present is therefore not enough to influence CP development. Further research is needed to determine what type of specific emotional support would prevent the development of CP.

Questioning patients about their emotions is a simple and practical tool. Its implementation may be quicker and more intuitive than multi-item scales. Patients at a higher risk of developing CP can be detected using the Geneva Emotion Wheel or by specifically questioning patients on feelings of sadness and anger during emergency hospitalisation. This detection can be refined by questioning the frequency of these feelings prior to the medical or trauma-related emergency. In all cases, emergency departments have a key role to play in the early detection of patients at risk of CP. They could then refer sad and angry patients for follow-up after discharge from the ED before the development of CP. Some studies have pointed to the potential for preventing the development of CP through early interdisciplinary interventions involving the fields of psychology, physical therapy, occupational therapy and case management [32,33].

The risk of CP associated with the state of anger suggests that it may be possible to mitigate CP risk by avoiding the emergence of anger emotions in the emergency department. Improved reception and care conditions on arrival might prevent the emergence of care-related anger. Emotions themselves are little studied, so the possibility of modifying them through organizational changes needs to be investigated. For example, it might be interesting to evaluate the effect on anger of better information on treatment protocols and the corresponding delays. Nevertheless, further work is needed to better understand the origins of anger in emergency patients. Anger may also precede arrival at the emergency department.

5. Conclusion

Our study demonstrates that negative declared emotions in the ED, particularly sadness and anger, contribute to CP development four months later. The patient's affect disposition to experience these feelings often partially explained this effect. This study is the first to collect data on emotions experienced by a clinical population in ED. Also it the first to document in a general clinical population the emotional state at the time of the health issue and prior to chronicisation in the risk of CP study.

Our findings highlight the importance of taking patients' emotions into consideration, both in the context of research and patient care. It represents the potential for new interventions as it points to emotions as new indicators to monitor to identify patients at risk of developing CP. This would provide personalised care to those most at risk upon ED discharge in order to prevent CP.

Further research, with a broader assessment of the variables present prior to and at the time of emergency hospitalisation, is required to better understand the role of emotions in CP development.

Funding

This study was supported by the French Ministry of Health under grant PHRCN-18-0787; the French Délégation à la Sécurité Routière and from the Apicil Foundation.

CRedit authorship contribution statement

Claire Pilet: Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Cédric Gil-Jardiné:** Writing – review & editing, Project administration, Funding acquisition, Conceptualization. **Juliane Tortes Saint Jammes:** Writing – review & editing, Methodology, Conceptualization. **Emmanuel Lagarde:** Writing – review & editing, Supervision, Funding acquisition, Conceptualization. **Sylviane Lafont:** Writing – review & editing, Supervision, Methodology, Funding acquisition, Conceptualization. **Michel Galinski:** Writing – review & editing, Validation, Supervision, Methodology, Conceptualization.

Declaration of competing interest

The authors declare they have no current or potential competing interests.

Acknowledgments

The authors would like to thank all the professionals at the seven health centres contributing to our data collection, without whom this study would not have been possible: Bordeaux University Hospital; Centre Hospitalier de Libourne; Hôpital Edouard Herriot, Hospices Civils de Lyon; Toulouse University Hospital; Hôpital de Beaujon; Teaching Hospital Louis Mourrier, AP-HP; Hôpital Lariboisière, AP-HP. They would like to thanks also the SOFTER IV group collaborators for their valuable contribution to this study: Samantha Al Joboory, Juliane Bosc, Anthony Chauvin, Xavier Dubucs, Nicolas Javaud, Olivier Sorel, Karim Tazarourte and Prabakar Vaittinada Ayar.

Appendix A. Appendix

Appendix 1

Reasons for emergency department visits.*

	N (%)
For trauma patients (% all)	363 (39.7)
Fall (% trauma)	60 (16.5)
Road crash	79 (21.8)
Work accident	59 (16.3)
Home accident	43 (11.8)
Sports accident	66 (18.2)
Leisure accident	25 (6.9)
interpersonal violence	9 (2.5)
suicide attempt	5 (1.4)
School accident	2 (0.5)
others	15 (4.1)
For medical patients (% all)	553 (60.5)
abdominal problem (% medical)	109 (19.7)
neurological problem	91 (16.5)
Heart problem	50 (9.0)
respiratory problem	34 (6.1)
general medical problem	34 (6.1)
headache	33 (6.0)
digestive problem	31 (5.6)
infection	31 (5.6)
rheumatological problem	23 (4.2)
ENT problem*	12 (2.2)
acute pain	8 (1.4)
dermatological problem	8 (1.4)
psychological or psychiatric problem	4 (0.7)
toxicological problem	4 (0.7)
others	81 (14.6)

* ENT = ear, nose and throat.

Data availability

Data could be available on reasonable request.

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