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Epileptic psychoses are underrecognized by French neurologists and psychiatrists☆,☆☆

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ABSTRACT

This study evaluates the knowledge about psychotic disorders associated with epilepsy among medical practitioners in France. A self-report questionnaire was sent, and responses of 486 participants were collected. Results showed the rate of correct responses being higher among neurologists compared to psychiatrists, respectively 70.6% and 58.3% ($p < 10^{-11}$). The highest rate of correct responses was found for the participants trained in epileptology (71%), and a regression analysis confirmed that epilepsy-training was the most influential variable. However, we found that knowledge about epileptic psychosis was imprecise among all participants: current classification was not known to most participants (77%), there were false beliefs concerning postictal confusion and psychosis (41%), and both prevalence and duration of postictal psychosis were not well-known. There is the first survey to highlight such gaps of knowledge, and hopefully lead to measures to remedy this, especially specialists such as psychiatrists, neurologists, and epileptologists who may be called upon to treat such patients.

1. Introduction

Psychotic disorders are defined by abnormalities in one or more of the following five domains: delusions, hallucinations, disorganized thinking, grossly disorganized or abnormal motor behavior, and negative symptoms (Diagnostic and Statistical Manual of Mental Disorders (DSM-5)) [1]. Consciousness is usually preserved during a psychotic episode. Psychoses in epilepsy can be grouped in relation to seizures in two main categories: interictal psychosis (IIP) and postictal psychosis (PIP) [2–4]. Interictal psychosis refers to any psychosis in clear consciousness that occurs in someone who has previously been diagnosed with epilepsy, and the psychosis is not exclusively during or immediately following a seizure. Some clinical features of IIP resemble to schizophrenia, with subtle clinical differences such as more frequent visual hallucinations, acute onset, fewer negative symptoms, and relatively preserved emotional responses in epileptic psychosis [5]. Postictal psychosis is a specific syndrome in relation to seizure activity: a clear temporal relationship exists between the psychotic state of sudden onset and a precipitating bout of complex partial or generalized seizures. The presence of a lucid interval between the last seizure and the beginning of psychotic symptoms rules out a simple postictal delirium. The outcome is characterized by remission of the psychotic symptoms over several days (mean: 1 week), with or without treatment [4].

A recent meta-analysis [6] reported that the prevalence of psychoses was high (5.6%) in epilepsy – the highest prevalence reached 7% in temporal lobe epilepsy. Prevalence rates of interictal and PIP were found to be respectively 5.2% and 2%. At the present time, there is no internationally-validated classification and no clear diagnostic criteria. For example, DSM-5 classification does not include a specific category

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Table 1
Mean age for practitioners by category.

Profession	Mean age (years old)
Neurologist group	45.9
Residents in neurology	27.5
Neurologists	46.1
Neurosurgeon (n = 1)	57.0
Neuropediatrics	47.7
General practitioners	50.7
Psychiatrist group	42.8
Residents in psychiatry	28.7
Psychiatrists	44.2
Neuropsychiatrists	60.3
Child psychiatrists	49.6
Trained in epileptology	46.6

for these disorders. This lack of consensus probably has consequences on diagnostic and therapeutic decisions.

In this study, we assessed the knowledge of medical professionals in France by submitting a self-report questionnaire on the psychoses of epilepsy.

2. Methods

A 13-item questionnaire was sent to neurologists, psychiatrists, neuropsychiatrists, neurosurgeons, neuropediatricians, child psychiatrists, general practitioners (GPs), and internists (residents and practitioners), from October 2017 to January 2018.

2.1. Questionnaire - epileptic psychosis

This survey is anonymous and will take approximately ten minutes. Thank you for your participation.

1. You are: a student of neurology, neurologist, student of psychiatry, psychiatrist, student of neurosurgery, neurosurgeon, neuropsychiatrist, neuropediatrician, child psychiatrist, GP, specialist in internal medicine, other
2. In your country, a patient with epilepsy is first referred to: a neurologist, a psychiatrist, a neurosurgeon, it depends on the cases
3. Do you have specific training in epilepsy?
4. Do you: use DSM on a daily basis to assist with diagnosis of psychiatric conditions; not use DSM
5. Have you observed psychosis associated with epilepsy i.e. episodes that only occur during the course of epileptic disorder, but not in the absence of epileptic disorder.
6. Do you have a specific classification system for psychosis in epilepsy?
7. The symptoms of epileptic psychosis do not differ fundamentally from those in other neurological conditions such as (stroke, multiple sclerosis or Parkinson's disease…). True; False
8. The occurrence of a psychotic episode after an epileptic fit, or a cluster of seizures, corresponds to postictal psychosis. Yes; No
9. Postictal psychosis includes the confused delirium often observed after generalized tonic–clonic seizures. Yes; No
10. Which type of epileptic psychosis is similar to schizophrenia? Postictal psychosis, Interictal psychosis
11. Is it helpful to have an Electroencephalogram (EEG) during psychotic episodes. Yes No
12. Epileptic psychosis occurs in less than 5%; between 5 and 10%; more than 10% of persons with epilepsy.
13. The duration of PIP is: less than a week; less than a month, much longer

The questionnaire was developed by four of us (BdT, PS, KK, CH) to assess some basic knowledge on the topic: classification (Q4: there is no specific classification of epileptic psychoses in the DSM; Q6: it is mandatory to distinguish between PIP and IIP according to the chronology); specificity (Q5 and 7); definition of PIP (Q8) not to be confused with delirium (Q9); specific semiology of PIP (Q10); usefulness of the EEG for the diagnosis of ictal psychosis (spikes) and delirium (slow waves) (the EEG during the course of PIP is identical to the prepsychotic EEG); epidemiology (Q12), and short duration of PIP (Q13). In addition, we wanted to check if training in epileptology improved the rate of correct answers, and if there was a difference between neurologists and psychiatrists (Q1, 2 &3).

Emailing was carried out directly (2429 emails through personal professional messaging) or indirectly (213 emails sent to hospital psychiatry department secretaries, residents or mental health professional associations), to enable wide distribution. An email was also sent through a psychiatry healthcare professionals' website (http://www.encephale.com) and was included in the newsletter of a scientific French language journal (Encéphale). An email reminder was sent using the same method one month after the initial request.

2.2. Statistical analysis

All statistical analyses were implemented by Excel and R 3.6.0.softwares (R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL: http://www.R-project.org). The questionnaire score was described using rate of correct answers and compared using the Wilcoxon-Mann–Whitney test. All tests were two-tailed, and $P < 0.05$

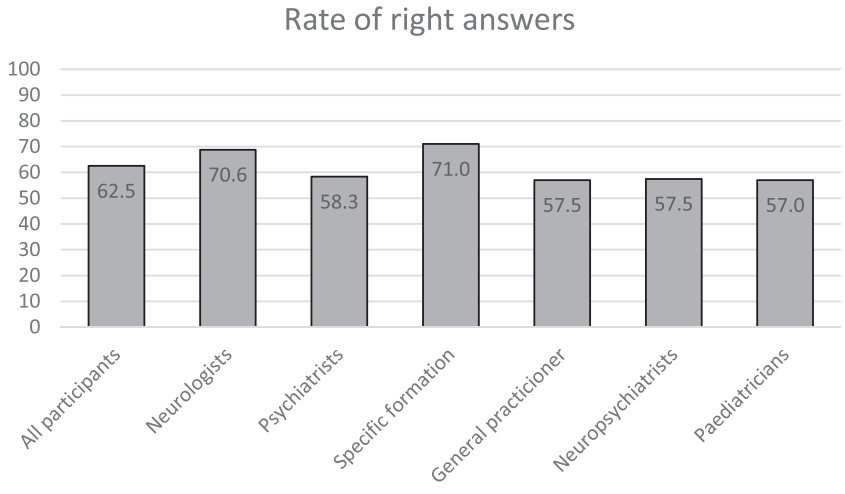

Fig. 1. Percentage of correct answers in each group of practitioners.

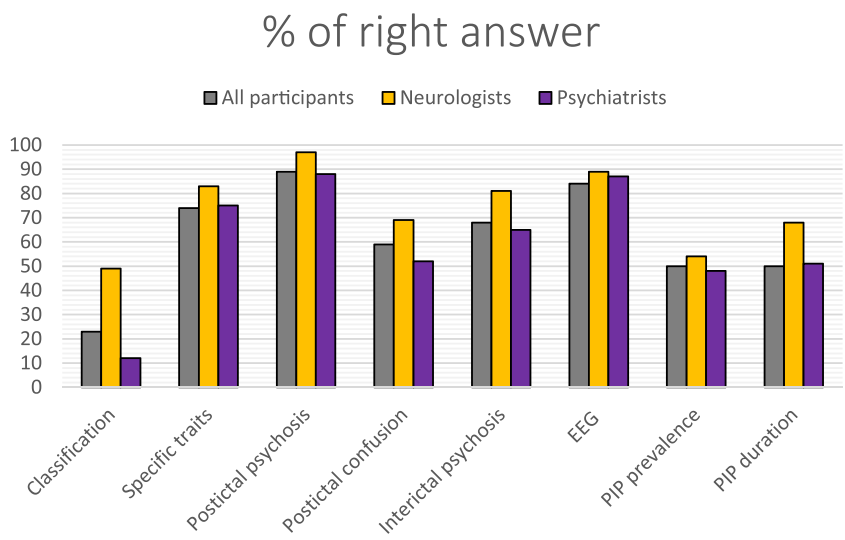

Fig. 2. Percentage of correct answers concerning theoretical knowledge of epileptic psychoses.

was considered statistically significant. To explore the determinants of the questionnaire's score, we used a multilevel linear regression model, considering the assumption of normality to be reasonably robust on overall data (n = 461). Variance inflation factor (VIF) analysis was then used to evaluate colinearity and correlation between the chosen variables in the model.

3. Results

3.1. Study sample (Q1)

We obtained responses from 486 participants practicing in France. The neurologists' group (n = 162, 33%) included neurologists (n = 119), neurosurgeons (n = 1), neuropediatricians, (n = 31) and residents in neurology (n = 11). The psychiatrists' group (n = 299, 61%) included psychiatrists (n = 206), neuropsychiatrists (n = 5), child psychiatrists (n = 39), and residents in psychiatry (n = 49). The third group comprised GPs (n = 7) and undetermined (n = 18). The mean age of practitioners by category is displayed in Table 1.

Regarding the geographical distribution, we noted that 16% (n = 76) are practicing in the Parisian region, 10% (n = 50) are in the department of Meurthe-et-Moselle, and the rest of the sample was widely distributed throughout France.

3.2. General considerations and participants profile (Q2–4)

The pathway for access to epileptic care is neurological (91%) in France. One-third of all participants received a specific training in epilepsy (without additional information about the training). Nearly one-half of the sample (46%) used the DSM-5 in daily practice to evaluate mental disorders, and 84% of those persons belonged to the psychiatrists' group. A majority (62%) had previously treated patients with psychosis associated with epilepsy, equally distributed among psychiatrists and neurologists.

3.3. Responses on knowledge (Q5–13)

Responses are displayed in Fig. 1.The great majority of answers (77%) reflected lack of knowledge of any classification of epileptic psychoses. Among the 114 persons familiar with a specific classification, 79 used it routinely and the majority of them were neurologists (75%). Roughly three-quarters knew that there are some specific features of psychoses in epileptic syndromes compared to other neurological diseases. The concept of PIP was known to 89% of the participants, but 41% thought that it was associated with postictal mental confusion. One-half of the responders (50%) gave the correct response concerning the prevalence or the duration of PIP, but only 29% knew both. A majority of responders was familiar with IIP (68%), while 84% considered that EEG was useful during a psychotic episode in a patient with epilepsy.

Focusing only on the items concerning theoretical knowledge (Fig. 2), we found that the rate of correct answers was high (62.5%), and also that very few (3.9%, n = 19, 14 neurologists and 5 psychiatrists) had all the answers correct, among whom the majority (79%, n = 15) had specific training in epileptology. Those with such training were significantly more aware of epileptic psychoses than the other participants.

3.4. Neurologists compared to psychiatrists (Fig. 2)

The neurologist group was composed of 73% neurologists, 19% neuropediatricians, 6.7% residents, and 0.3% neurosurgeons. The majority (90%) had completed training in epileptology, and a minority (20%) had never been in charge of patients with epileptic psychoses, which included 40% of neuropediatricians. The psychiatrist group was composed of psychiatrists (69%), psychiatry residents (16%), child psychiatrists (13%), and neuropsychiatrists (2%). Only a few (5.7%) had completed training in epileptology, a large proportion (45%) had never been in charge of epileptic psychoses, while the majority (65%) declared using the DSM regularly in their practice.

The percentages of correct answers for neurologists were significantly higher than for psychiatrists, being 70.6% and 58.3%, respectively (Wilcoxon test: W = 35,489, $p < 10^{-11}$) (Fig. 2). Regarding each item, 39% of neurologists knew and used specific classification of those syndromes, while 12% of psychiatrists were aware of a specific classification and only 5.3% used this classification; 83% of neurologists and 75% of psychiatrists were aware of the specific features of epilepsy-associated mental disorders compared to other neurological diseases. Postictal psychosis was known to most participants (97% neurologists and 88%

Table 2
Rate of correct answers of each group in comparison to the others participants.

	Number	Rate of right answers (%)	Wilcoxon test	p
Neurologists/others	162/324	70.6/58.3	W = 36,315	10^{-11}
Psychiatrists/others	299/187	58.3/70.1	W = 17,360	10^{-11}
Specific formation/others	170/316	71.0/57.5	W = 38,241	10^{-13}
Pediatrics/others	70/416	57.0/63.7	W = 12,655	0.007

Table 3
Rate of correct answers of each group in comparison to those with training in epileptology (71.0% of correct answers).

	Number	Rate of right answers (%)	Wilcoxon test	*p*
Neurologists not trained	24	61.4	W = 2584.5	0.01
Psychiatrists not trained	288	57.9	W = 34,096	10^{-12}
Pediatrics not trained	42	53.9	W = 5231.5	10^{-6}

psychiatrists), but both groups (31%) thought that mental confusion was part of this syndrome (respectively 31% and 48%); 37% of neurologists, but only 6% of psychiatrists, were aware of both prevalence and duration of PIP. Concerning the definition of IIP, respectively 81% and 65% of neurologists and psychiatrists knew it, and both considered that EEG was useful (89% and 87%).

3.5. Participants trained in epileptology compared with other participants

This group was composed mostly of neurologists (91%, 107 neurologists, 29 neuro pediatricians, 5 residents, 1 neurosurgeon), with only 9% of psychiatrists (8 psychiatrists, 2 child psychiatrists, 3 neuropsychiatrists) and 1 GP. Around 20% had never been in charge of patients with epileptic psychoses.

This group had 71.0% of correct answers (Fig. 1 and Tables 2, 3), significantly higher than those who are not trained ($p < 10^{-13}$) (Fig. 3). Regarding each item, 39% of them knew and used specific classifications of those syndromes, while only 9.8% of not-trained clinicians were aware of a specific classification and only 5.8% used it; 80% of trained and 72% of not-trained doctors were aware of the specific features of epilepsy-associated mental disorders compared to other neurological diseases. Postictal psychosis was known to most participants (92% trained and 89% not-trained), but 31% of those with epileptology training still believed that mental confusion was part of this syndrome (versus 51% of those not trained); 36% of those trained were aware of both the prevalence and duration of PIP, but only 2.6% of the other group. About the definition of IIP, respectively 79% and 63% of trained versus not-trained clinicians knew it, and both considered EEG to be useful (84% and 86%).

3.6. Linear regression analysis

We defined the rate of right answers about epileptic psychosis as objective variable. Linear regression analysis was applied to identify the affecting variables among professional status, epilepsy-training and DSM-use. A first linear regression was performed using the following explanatory variables: profession (psychiatry vs neurology), epilepsy-training, and DSM-use. Significant association was shown between epilepsy-training and rate of correct answers (coefficient = 8.14, p = 0.022) (Table 4). A second regression used each profession categorizations (psychiatry resident, neurologists, neurosurgeons, neuropediatricians, neuropsychiatrists, psychiatrists, and child psychiatrists), epilepsy-training, and DSM-use as explanatory variables. The results showed that being a neurologist and having an epilepsy-training were both significantly associated with the rate of right answers, respectively (coefficient = 13.7, p = 0.023 and coefficient = 7.6, p = 0.038) (Table 5). We can assume that epilepsy-training and neurologists are not independent factors, as well as DSM-use and being psychiatrists. It could explain the separation of two couples: training/neurologists as influential variables and DSM/psychiatrists as not influential. Variance inflation factor analysis was then applied to each models; correlation was shown between both profession status and epilepsy-formation without compromising interpretation of both models (VIF score < 5).

Table 4
Linear regression analysis comparing profession, epilepsy-training and DSM-use.

	Determination coefficient	*p*
Profession	6.82	0.0598
Epilepsy-training	8.14	0.0215*
DSM-use	1.51	0.4368

* $p < 0.05$.

3.7. The pediatrician group

We included neuropediatricians (44%) and child psychiatrists (56%) in the survey. About one-half had completed training in epileptology, with most (82%) being neuropediatricians, but 43% had never been in charge of epileptic psychoses. In this group, the rate of correct answers was high (57%). Only 10% knew and used specific classification of those syndromes. A majority (74%) was aware of the specific features of epilepsy-associated mental disorders compared to other neurological diseases. Postictal psychosis was known to 91%, but 46% thought that mental confusion was part of this syndrome. A minority (24%) was aware of both prevalence and duration of PIP, 61% knew the definition of IIP, and 94% considered that EEG was useful.

4. Discussion

The questionnaire was elaborated for assessing basic knowledge on the topic. The first step for making a diagnosis is to be aware of any

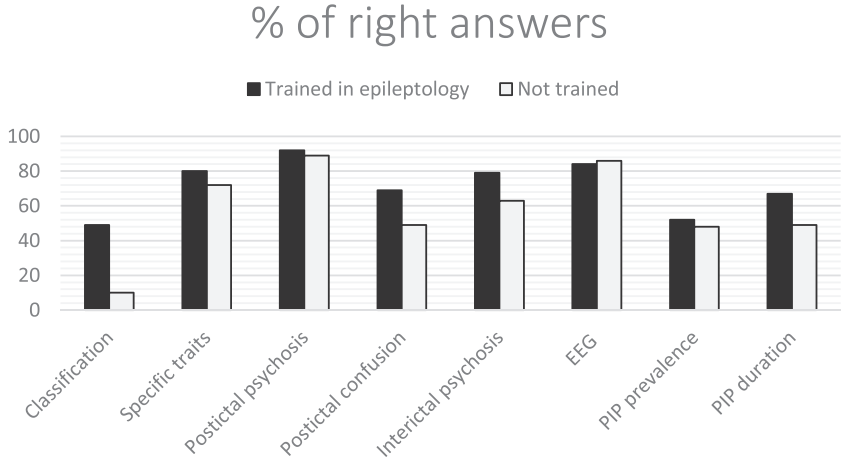

Fig. 3. Percentage of correct answers concerning theoretical knowledge of epileptic psychoses comparing participants trained in epileptology to those who were not.

Table 5
Linear regression analysis comparing each profession, epilepsy-training and DSM-use; neurologist residents were selected as reference for professional status.

	Determination coefficient	*p*
Psychiatry resident	2.92	0.65
Neurologists	13.68	0.023*
Neurosurgeons	−11.82	0.54
Neuropediatrics	−0.91	0.89
Neuropsychiatrists	−5.69	0.59
Psychiatrists	3.54	0.55
Child psychiatrists	−2.57	0.69
Epilepsy-training	7.62	0.038*
DSM-use	1.61	0.40

* $p < 0.05$.

patient with epilepsy can develop a psychotic disorder. This situation is not infrequent since the prevalence is 5.6% (up to 7% in temporal lobe epilepsy) [6]. To properly handle a patient, a practitioner should be able to distinguish between two main categories according to chronology: PIP and IIP [7,8]. Any psychotic episode that occurs within 1 week after a seizure, or usually a cluster of seizures, corresponds to a PIP [9]. The presence of a lucid interval between the last seizure and start of changes in mental state guarantees a qualitative difference between postictal and simple postictal confusion [10]. Several functional neuroimaging studies have shown hyperperfusion in various cerebral regions during PIP, suggesting an excessive activation of particular structures of the brain rather than a postictal depression of cerebral activity [3]. The outcome is characterized by remission of the psychotic symptoms over several days (mean: 1 week), with or without treatment [4]. The short duration probably explains why the disorder is under diagnosed. Interictal psychosis was defined as occurrence of psychosis, in clear consciousness, without a decisive anteceding seizure or cluster of antecedent seizures, and with the first psychotic episode having occurred after the development of epilepsy. The chronic psychosis resembles schizophrenia phenomenologically [7,11].

Concerning participants' profiles, we note that those having training in epileptology were mostly neurologists and neuropediatricians. Concerning mean age, each group is comprised between 44 and 49 years old. There are 3 exceptions. Residents are under 30 years old that is inherent to their grade, and they are distributed in neurologist and in psychiatrist groups. Neuropsychiatrist group is over 60 years old because the common cursus between neurology and psychiatry ended in 1968, but the size is very small ($n = 5$). Then both groups might be equally experienced. Additional information about years of expertise, the kind of practice (hospital, ambulatory) was not asked. That could constitute a limitation to the assessment of the practitioner experience.

Concerning medical knowledge, although all participants recognized specificities of epileptic psychoses, we note that their classification was not known to most participants. Basic definitions of interictal and postictal psychoses were generally known, but the false belief concerning postictal confusion and psychosis was common. Prevalence of PPI was not well-known, nor its duration. Within each subgroup, we generally found the same profile of responses. It appears that neurologists were more informed than psychiatrists about epileptic psychoses. It seems that being a neurologist and having an epilepsy-training were the two factors associated with a better rate of correct answers. However, the lack of appropriate knowledge was present even in the group with training in epileptology, although it reached the highest rate of correct answers. Indeed, we found that around 20% were not aware of the particularities of epileptic psychoses and had never been in charge of it, and one-third did not distinguish between mental confusion and PIP. We therefore conclude that knowledge about epilepsy and psychotic disorders in French neurologists and psychiatrists is imprecise and not necessarily corrected by training in epileptology. We must add that in France residencies of psychiatry and neurology are totally separated, with no common university course or common internship.

To our knowledge, this is the first study evaluating specialist medical knowledge of epileptic psychoses. Given these results, we recommend that the first year of psychiatric and neurologic residencies in France should be common (which is the case for internal medicine and infectious diseases) to improve the clinical and scientific training in the neuropsychiatric field.

Concerning the limitations of this study, we note that many questions were not precise enough to evaluate the knowledge on epileptic psychoses in detail, for example, we did ask about the full spectrum of symptoms, of about distinctions between brief and chronic interictal psychoses. This was a self-report questionnaire, and this method is prone to reporting bias and quantification can be difficult. However, its strength is that a reasonably large sample of 486 participants was obtained, with broad representation of the relevant specialties.

5. Conclusion

Epileptic psychoses are under recognized by psychiatrists and neurologists in France. It would be useful to have an international consensual classification of epileptic psychoses to facilitate teaching, because this lack of knowledge does not appear to be improved by specific training in epileptology. We also suggest the development of common theoretical training for residents in neurology and psychiatry to improve their knowledge of neuropsychiatric syndromes like epileptic psychoses. Finally, it would be interesting to conduct a similar survey in other countries to develop a global picture of the state of this knowledge.

Declaration of competing interest

None.

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