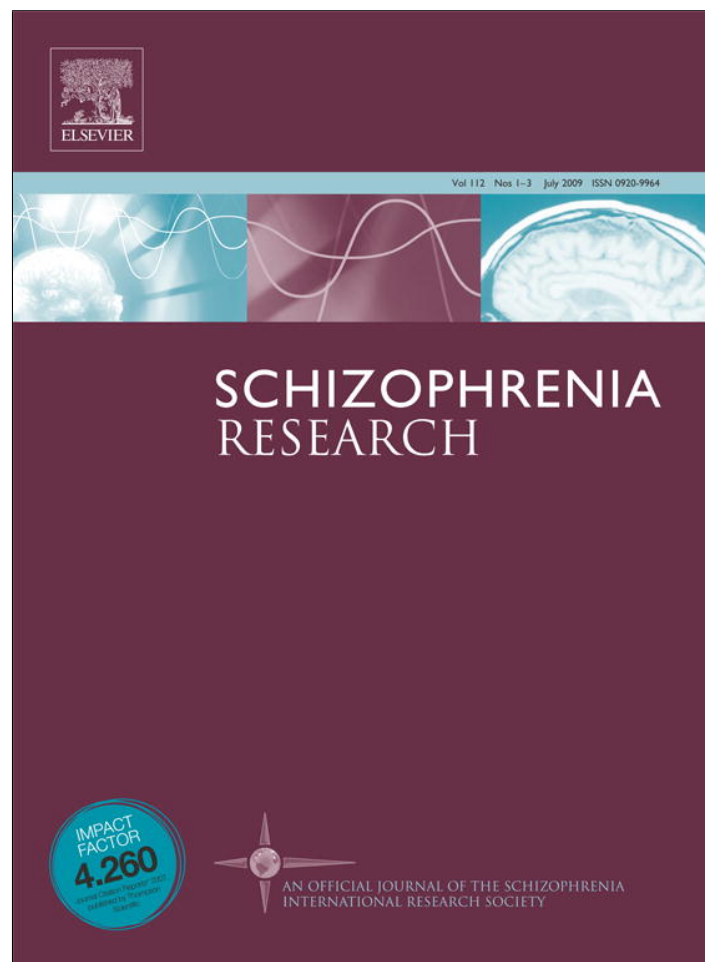


Provided for non-commercial research and education use.
Not for reproduction, distribution or commercial use.



This article appeared in a journal published by Elsevier. The attached copy is furnished to the author for internal non-commercial research and education use, including for instruction at the authors institution and sharing with colleagues.

Other uses, including reproduction and distribution, or selling or licensing copies, or posting to personal, institutional or third party websites are prohibited.

In most cases authors are permitted to post their version of the article (e.g. in Word or Tex form) to their personal website or institutional repository. Authors requiring further information regarding Elsevier's archiving and manuscript policies are encouraged to visit:

<http://www.elsevier.com/copyright>

Contents lists available at [ScienceDirect](http://www.sciencedirect.com)

Schizophrenia Research

journal homepage: www.elsevier.com/locate/schres

Dream content in chronically-treated persons with schizophrenia[☆]

Félix-Antoine Lusignan^{a,c}, Antonio Zadra^c, Marie-Josée Dubuc^{a,c}, Anne-Marie Daoust^a, Jean-Pierre Mottard^d, Roger Godbout^{a,b,*}

^a Centre de Recherche Fernand-Seguin, Neurodevelopmental Disorders Program, Hôpital Rivière-des-Prairies, 7070, boulevard Perras, H1E 1A4, Montréal (Québec), Canada

^b Department of Psychiatry, Université de Montréal, Montréal (Québec), Canada

^c Department of Psychology, Université de Montréal, Montréal (Québec), Canada

^d Department of Psychiatry, Hôpital du Sacré-Cœur de Montréal, Montréal (Québec), Canada

ARTICLE INFO

Article history:

Received 11 December 2008

Received in revised form 23 March 2009

Accepted 26 March 2009

Available online 5 May 2009

Keywords:

Schizophrenia

Dreaming

Dream content

REM sleep

Nightmares

Atypical antipsychotics

Polysomnography

ABSTRACT

Many clinical, laboratory and non-laboratory studies have examined dream content reported by patients with schizophrenia but findings have been variable and inconsistent. Using both questionnaire-based measures and laboratory REM sleep awakenings, we investigated dream content in 14 patients with schizophrenia (mean age = 25.5 ± 3.2 years) under atypical antipsychotic medication and 15 healthy controls (mean age = 22.3 ± 4.2 years). The relationship between eye movement density during REM sleep and dream content was also explored. Questionnaire data revealed that when compared to controls, patients with schizophrenia report experiencing a greater number of nightmares but no significant differences were found on other measures including overall dream recall, presence of recurrent dreams, and frequency of specific emotions. 39 dream reports were collected from each group following awakenings from REM sleep. Laboratory dream narratives from the patients were shorter and, after controlling for report length, most significant differences in dream content between the two groups disappeared with the exception of a greater proportion of unknown characters in the participant group. Patients with schizophrenia spontaneously rated their dream reports as being less bizarre than did controls, despite a similar density of bizarre elements as scored by external judges. Finally, both groups had a comparable density of rapid eye movements during REM sleep but a significant positive correlation between eye-movement density and dream content variables was only found in controls. Taken together, the findings suggest that dream content characteristics in schizophrenia may reflect neurocognitive processes, including emotional processing, specific to this disorder.

© 2009 Published by Elsevier B.V.

1. Introduction

Similarities between dreams and mental disorders, most particularly psychosis, have long been emphasized by clinicians and researchers alike. Speculations regarding the relationship between these two phenomena inspired numerous studies aiming to gain insights into the processes underlying psychotic states. Much of this research focused

on differences in the manifest dream content of schizophrenic and nonschizophrenic individuals, with the goal of identifying dream particularities that would be pathognomonic of schizophrenia. While some earlier studies found distinctive trends in the manifest dreams of patients with schizophrenia (Cappon, 1959; Chang, 1964; Lings, 1966; Lanter, 1954; Noble, 1951), none of them were suggestive of a unique dream experience that specifically characterized schizophrenia.

1.1. Non-laboratory results

Most non-laboratory studies of dream content in patients with schizophrenia were conducted using clinical interviews

[☆] This study was performed at Hôpital Rivière-des-Prairies, 7070, boulevard Perras, H1E 1A4, Montréal (Québec), Canada.

* Corresponding author. Sleep Laboratory and Clinic, Hôpital Rivière-des-Prairies, 7070, Boulevard Perras, Montréal (Québec), Canada H1E 1A4. Tel.: +1 514 323 7260x2657; fax: +1 514 328 3533.

E-mail address: roger.godbout@umontreal.ca (R. Godbout).

or therapy sessions in which patients were asked to recall their most recent dreams. These retrospective methods can be affected by recall bias (Schredl and Wittmann, 2005) and dreams reported during an interview after a therapy can be influenced by elements related to the context of the clinical interview such as the therapist's attitude toward the patient or one's theoretical approach (Lanter, 1954). That said, non-laboratory studies found that when compared to dream reports from controls, those from patients with schizophrenia were less frequent (Schnetzler and Carbonnel, 1976), simpler and less elaborate (Biddle, 1963; Hall, 1966; Noble, 1951; Schnetzler and Carbonnel, 1976), and contained less self-involvement and emotional expression (Hadjez et al., 2003). Moreover, illness chronicity can negatively impact dream content as suggested by shorter, simpler and more fragmented dream reports in chronic schizophrenia as compared to patients in the acute phase of the illness (Chang, 1964). Dream reports from patients with schizophrenia have also been described as being more negative, destructive and containing more themes of death and painful sexuality, fewer themes of friendly actions initiated by other dream characters (Schnetzler and Carbonnel, 1976), and a higher frequency of morbid and brutal mutilation imagery when compared to control dream reports (Carrington, 1972). Moreover, patients with schizophrenia are more likely than controls to experience dreams in which they are victims of aggression (Carrington, 1972; Langs, 1966; Noble, 1951; Stompe et al., 2003) and to react more passively to external aggressions (Schnetzler and Carbonnel, 1976). Finally, while some early studies suggested greater levels of dream bizarreness in schizophrenia (Cappon, 1959; Carrington, 1972; Richardson and Moore, 1963), this was not found by other researchers (Hall, 1966; Scarone et al., 2008).

1.2. Laboratory-based results

Relatively few studies have used laboratory awakenings to collect dream reports from schizophrenic patients. These data indicate that when compared to controls, patients have a lower frequency of dream recall following experimental awakenings from REM sleep (Dement, 1955; Kramer et al., 1970; Okuma et al., 1970), show a greater time delay before providing a verbal report (Debieve et al., 1977; Okuma et al., 1970), and require a greater number of questions from the experimenter to elicit a report (Okuma et al., 1970). When dream reports are obtained, the narratives are less elaborate, shorter in length (Cartwright, 1972; Debieve et al., 1977; Okuma et al., 1970), and typically characterized by an emptiness of content (Dement, 1955; Gold and Robertson, 1975; Okuma et al., 1970). Patients' dream reports are also characterized by a paucity of peer interactions (Gold and Robertson, 1975), a greater proportion of characters being strangers (Kramer and Roth, 1973), a higher frequency of unpleasant feelings (Okuma et al., 1970) and aggressive social interactions (Kramer and Roth, 1973). Finally, in terms of their bizarreness, patients' dream reports do not have greater incoherence or implausibility (Cartwright, 1972; Debieve et al., 1977; Okuma et al., 1970) but rather lower levels of bizarre elements than dream reports from controls (Cartwright, 1972; Okuma et al., 1970).

1.3. Nightmares and schizophrenia

Nightmares are both unusually frequent and prevalent in psychiatric populations (Levin and Nielsen, 2007), including in individuals suffering from schizophrenia spectrum disorders (Claridge et al., 1997; Hartmann and Russ, 1979; Kales et al., 1980; Levin and Daly, 1998). For instance, Herz and Melville (1980) found that bad dreams were among the most common symptoms of relapse in two large independent cohorts of schizophrenic patients. Taken together, data from these studies indicate that the prodromal phase of schizophrenia can be accompanied by nightmares and that the occurrence of frequent nightmares is closely related to clinical indices of schizophrenia. However, since frequent nightmares are associated with a wide range of psychiatric conditions, personality dimensions and cognitive styles, nightmares are not specific to schizophrenia and likely represent a general clinical phenomenon mediated by psycho-affective factors (Levin and Nielsen, 2007).

1.4. Effects of antipsychotic medications on dream content in schizophrenia

Due to ethical and clinical considerations, information on the dream content of neuroleptic-naïve patients with diagnosed schizophrenia is sparse. Preliminary data from our sleep laboratory (Lusignan et al., 2005) suggest that when compared to controls, the laboratory dream reports of drug-naïve patients with schizophrenia are shorter and contain fewer reportable items on the following scales: activities performed by the dreamer, known characters, female characters, objects, settings and descriptive elements. Some questionnaire studies report subjective improvements in patients' dream recall following treatment with typical neuroleptics (Giordano and Spoto, 1977; Scarone et al., 1976), but laboratory studies revealed that these patients' level of dream recall remains unchanged after the administration of neuroleptics (Jus et al., 1973a; Kramer et al., 1970). Laboratory studies with healthy controls (Gaillard and Moneme, 1977) and patients with schizophrenia (Kramer et al., 1970; Ornstein et al., 1969) suggest that typical neuroleptics have a dampening effect on dream content by reducing dream length as measured by number of words (Gaillard and Moneme, 1977; Kramer et al., 1970), as well as aggressiveness (Gaillard and Moneme, 1977; Kramer et al., 1970), sexuality (Gaillard and Moneme, 1977) and affectivity (Ornstein et al., 1969). In addition, typical neuroleptics appear to improve the coherence and conciseness of patients' laboratory dream reports (Kramer et al., 1970; Ornstein et al., 1969). To our knowledge, little if no data is available regarding the effects of atypical antipsychotics on dream content in schizophrenia. Given that typical and atypical antipsychotics have different pharmacological actions on dopaminergic and serotonergic receptors and that they may affect distinct brain structures (Dazzan et al., 2005), it is possible that novel atypical antipsychotics and classical antipsychotics have differential effects on dream content.

1.5. REM sleep phasic events and dream correlates in schizophrenia

Several electrophysiological variables correlate with dream characteristics in healthy subjects. For example, density of rapid eye movements during REM sleep is

positively associated with visual dream imagery (Berger and Oswald, 1962; Hobson et al., 1965; Hong et al., 1997; but see Pivik, 1991). However, to our knowledge, no comparable data exist in patients with schizophrenia. Polysomnographic abnormalities (e.g., increased sleep latency, decreased slow wave sleep duration) have been noted in schizophrenia, but findings have been inconsistent, probably due to methodological factors (Chouinard et al., 2004). One of the most consistent findings regarding REM sleep abnormalities in schizophrenia is that contrary to healthy controls, patients' recovery sleep following partial and selective REM sleep deprivation does not show the habitual rebound in REM sleep (Gillin et al., 1974; Zarcone et al., 1975). Moreover, quantified REM sleep EEG activity is altered in patients with schizophrenia suggesting faulty REM sleep control mechanisms (Poulin et al., 2003). However, other REM sleep parameters such as REM sleep latency, total REM sleep percentage (Chouinard et al., 2004) and rapid eye movement density (Benson and Zarcone, 1993) are not significantly different in schizophrenia. Given the variability and inconsistency of these results, several aspects of sleep disturbances associated with schizophrenia, including REM sleep abnormalities, remain to be elucidated.

1.6. Aims and hypotheses

The main goal of the present study was to investigate dream content in patients with schizophrenia using both questionnaire-based measures and laboratory REM sleep awakenings. The relationship between eye movement density during REM sleep and dream content was also explored.

Based on the clinical and scientific literature, we predicted that when compared to controls' responses to questionnaire items, patients with schizophrenia would report 1) a lower frequency of dream recall, as well as more "white dreams" (impression of having dreamt without explicit recall); 2) a higher frequency of bad dreams and nightmares; and 3) a higher frequency of negative dream emotions. In addition, we predicted that when compared to controls, the content of laboratory dream reports from our patients would show: 4) a lower frequency of dream recall and more white dreams; 5) a lower word count per dream narrative and fewer reportable items; 6) a higher rate of aggression; 7) more negative affect; and 8) no differences in bizarreness. Finally, for both groups we expected 9) the density of rapid eye movements during REM sleep to be positively correlated with the density of visual imagery, dream length and dream activities.

2. Methods

2.1. Participants

The experimental group was comprised of 14 patients with schizophrenia (13 M, 1 F; mean age = 25.5 years, S.D. = 3.2, range: 20–30; highest level of education obtained = 11.7 ± 0.4) who met DSM-IV-TR (American Psychiatric Association, 2000) diagnostic criteria for schizophrenia. All patients were under atypical antipsychotic medication (olanzapine, clozapine, quetiapine, risperidone) with one participant taking adjuvant medication (procyclidine). Exclusion criteria were comprised of suspected drug abuse, the presence of neurological or sleep

disorders, or with any other psychiatric diagnosis as determined by a psychiatric interview.

The comparison group, which was matched as closely as possible for age and education level, included 15 healthy controls (12 M 3 F; mean = 22.3 years, S.D. = 4.2, range: 18–31; highest level of education obtained = 12.9 ± 0.4) recruited through advertisements in the community. They completed a questionnaire on previous health disorders, medical and psychiatric diagnoses, treatments and hospitalization. Exclusion criteria were a personal history of psychiatric, neurological or sleep disorders, a chronic or current illness, a recent history of shift work, evidence of drug abuse, or current use of CNS-active drugs. Groups differed by 3.2 years for mean age ($p = 0.03$) and by 1.2 years for education level ($p = 0.049$).

2.2. Dream questionnaire

Participants completed an 11-item self-report questionnaire that assessed dream-related experiences over the past month including recall of dream content, frequency and number of recalled dreams, easiness and quality of recall, vividness of dreams, and number of nightmares and bad dreams experienced. Nightmares were defined as an "unpleasant dream (frightening or causing anxiety) containing images and/or emotions that are so disagreeable that it wakes you up, remembering the content". Bad dreams were defined as an "unpleasant dream (frightening or causing anxiety), but that does not wake you up". Participants also provided "yes" or "no" responses to questions regarding the presence of recurrent dreams, lucid dreaming and ability to control one's dreams, as well as past experiences of physical sensations during dreams. Participants also used a five-point scale ranging from 0 (never) to 4 (always) to report on the overall frequency of the following emotions in their everyday dreams: joy, fear, sadness, relaxation, confusion, satisfaction, anger, frustration, sexual arousal, apprehension and embarrassment.

2.3. Laboratory sleep measures

Participants were recorded in the sleep laboratory for three consecutive nights. They were permitted to go to bed and rise at their preferred time based on a sleep agenda completed over a two-week period prior to coming to the laboratory. During this period, participants were instructed to maintain their typical sleep-wake schedule and not to deprive themselves of sleep. Night one served as an adaptation night and was used to rule out the presence of sleep disorders including sleep apneas (defined as 10 apneas per hour of sleep). On nights two and three, dream reports were collected following awakenings from REM sleep (see details below).

Sleep was recorded with a Grass Neurodata Model 15 Acquisition System assisted by Harmonie software (Stellate, Montréal, Canada). A 22-electrodes montage was used (Fp1, Fp2, F3, F4, F7, F8, Fz, C3, C4, Cp5, Cp6, T3, T4, Tp7, Tp8, P3, P4, P7, P8, Pz, O1, and O2) according to the American Electroencephalographic Society (1994). EEG electrodes were referenced to linked earlobes (A1 + A2), and each reference electrode had a serial 10-k Ω resistor for impedance equilibrium purposes (Pivik et al., 1993). Sleep stages were scored

blind relative to group membership according to standard criteria (Rechtschaffen and Kales, 1968) using 20-second epochs. REM density was computed by dividing the total number of two-second REM sleep epochs containing at least part of a rapid eye movement by the total time (in hours) spent in REM sleep (Poulin et al., 2003). Oronasal airflow, thoracic and abdominal respiratory effort, oximetry and anterior tibialis EMG were monitored during nights one and two. All subjects received a financial compensation for their participation. The study was approved by the ethics committee of the Rivière-des-Prairies hospital and has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki). Written informed consent was obtained from each participant.

2.4. Laboratory dream collection

Since polysomnographic data from night two was collected as part of a project on sleep architecture, participants were only awakened during the last sleep cycle to minimize sleep interruptions. Specifically, participants were awakened during REM sleep and questioned for sleep mentation after the following criteria were met: at least 420 min had elapsed since sleep onset and the subject had at least 15 min of REM sleep prior to the awakening. On night three, each participant was awakened during REM sleep (starting from the second sleep cycle) and interviewed for dream content after at least 10 min of REM sleep (second and third sleep cycle) or 15 min in any subsequent sleep cycle. This schedule of awakenings is consistent with dream collection protocols with depressed (e.g., Cartwright and Wood, 1993) and schizophrenia patients (e.g., Okuma et al., 1970). Awakenings were induced within 10 s following the observation of a burst of rapid eye movements. Participants were allowed to return to sleep after the dream reporting was completed.

A male experimenter conducted the laboratory recordings and collected all dream reports. Participants were informed that they would be awakened by a knock on the bedroom door during the night and then questioned about what had been going through their mind (e.g., images, thoughts, or feelings) just prior to their awakening. The word “dream” was not used unless a participant specifically did so. Participants were instructed to confirm that they were awake by a simple verbal response, to remain lying down with their eyes closed, and to start describing any material recalled with no particular attempt to be logical, sequential, or interpretative. When a participant did not spontaneously start reporting within 10–15 s, the experimenter asked whether they had been seeing, hearing, or thinking about something just prior to being awakened; upon a negative reply, the participant was asked whether they thought something had been going through their mind but could not be remembered (white dream) or if it was a total absence of sleep mentation. Whenever a pause of 10–15 s occurred during the verbal report, the experimenter inquired if there was additional material. At the end of a report, the experimenter asked a few short questions to ensure that the material recounted had been correctly understood. Questions typically concerned actions, locations, characters and feelings or thoughts associated with the dream. All verbal reports were tape-recorded and subsequently transcribed.

2.5. Scoring of dream content

Dream content was coded and analyzed independently by two extensively trained judges according to the objective coding system of Hall and Van de Castle (1966). All dream reports were independently scored by two experienced raters and inter-rater agreement ranged from 76% to 91% across all of the content categories. The following nine basic categories were used: 1) *Characters*, consisting of people, animal or mythical figures, classified under each of the following four headings: number, gender, identity and age; 2) *Social interactions*, consisting of relations between individual characters or groups that can be scored under three subscales: aggression, friendliness and sexuality; 3) *Activities*, i.e., actions performed by dream characters, classified under eight categories: physical, movement, location change, verbal, expressive communication, visual, auditory and thinking; 4) *Emotions*, representing affective states of characters divided into positive, negative and neutral emotions; 5) *Achievement outcome*, including success and failure, i.e., a successful handling of some difficulty encountered by a character or an incapacity of the character to achieve his or her desired goal because of personal limitations and inadequacies; 6) *Environmental press*, i.e., good fortune and misfortune; 7) *Settings*, i.e., the environment where the dream takes place, in accordance with location and familiarity; 8) *Objects*, i.e., items that are contained in the physical surroundings, classified under 12 categories: architecture, household, food, implements, travel, streets, regions, nature, body parts, clothing, communication and money; 9) *Descriptive elements*, describing attributes and qualities of objects, people, actions and emotional states such as color, size, age, density, thermal, velocity, linearity, intensity and evaluation.

The following scales were also included to investigate particular features of dream content in schizophrenia: 1) *Physical sensations*, including tactile, pain and visceral sensations, as well as smell and taste sensations; 2) *Involvement*, i.e., the degree of dreamer's behavioral participation in the dream (i.e., observer or participant); 3) *Subjective feeling of bizarreness* (i.e., spontaneous reported feeling of bizarreness). The degree of bizarreness in dream reports was also scored by two independent judges using the Bizarreness Scale of Williams et al. (1992). This scale includes three levels of bizarreness: discontinuities, incongruities and uncertainties. Each of these three levels can be detailed according to four different categories: 1) characters/actions/places/objects/time; 2) thoughts of dreamer or dream characters; 3) emotions, feelings and physical sensations; 4) Ad hoc explanations (i.e., explanations that refer to a previously noted bizarreness and that offer some sort of explanation to this bizarreness).

Two scales were used to further investigate the degree of rationality of the dream narratives (Rationality scale) and the degree to which the dream approximates that of everyday life (Everydayness scale) (Cann and Donderi, 1986). The *Rationality* scale refers to the likelihood of occurrence of the dream content and the degree of his adherence to natural laws. The scale is comprised of six levels: 1) irrational; 2) non-rational but comprehensible; 3) borderline or uncertain; 4) rational but very unlikely; 5) rational but uncommon; 6) rational and not unlikely. The *Everydayness* scale examines the degree to

which the dream content approximates that of everyday life. It includes six levels which are described as follows: 1) very remote from everyday life, 2) very unlikely in everyday life, 3) with an impossible twist to everyday life, 4) unlikely variations from everyday life, 5) slight variations from everyday life, and 6) just like everyday life.

Dream report length was determined by tabulating the number of words for each dream report. The number of words not specifically related to the dream content was also computed. Individual differences in report length were controlled for by dividing the total number of mentions of a dream content element by the total number of words in the report and multiplying the result by 100. Dream content data from each report were then pooled within each group to form two distinct data sets.

2.6. Statistical analysis

Between group statistical comparisons were performed using nonparametric Mann–Whitney *U*-tests since the variance of many variables was found to be different between the two groups. Outlier data, defined as any value more than three standard deviations below or above the mean were excluded from analyses. Categorical data were analyzed using Chi-square tests. We also computed the presence (score ≥ 1) or the absence (score = 0) of each emotion presented in the dream questionnaire to compare the number of participants never reporting versus reporting a given emotion at least once. The hypothesis that density of rapid eye movements during REM sleep and dream content were related was tested by computing Spearman's rank-order correlation rho coefficients between REM density and dream content variables. A criterion for significance was set at .05 for all analyses.

3. Results

3.1. Dream questionnaire

Table 1 presents responses obtained from both groups to the self-report questionnaire on general dream experiences. When compared to controls, patients with schizophrenia reported experiencing nightmares more frequently and more

Table 1
Results from the dream questionnaire (mean ± S.E.M.) for control participants vs. participants with schizophrenia.

Variables	Controls	Schizophrenia	<i>p</i> -level
Regularity of dream recall (Yes or No) ^b	1.5 ± 0.1	1.3 ± 0.1	ns
Easiness of dream recall (1 to 4 scale) ^a	2.7 ± 0.3	2.9 ± 0.2	ns
Dreams recalled per night (number) ^a	1.6 ± 0.3	1.7 ± 0.3	ns
Bad dream frequency (0 to 7 scales) ^a	3.5 ± 0.7	4.1 ± 0.6	ns
Bad dreams (number per year) ^a	14.5 ± 4.8	90.9 ± 40.4	ns
Nightmare frequency (0 to 7 scale) ^a	2.1 ± 0.5	4.1 ± 0.5	0.006*
Nightmares (number per year) ^a	3.5 ± 1.8	22.8 ± 10.7	0.003*
Presence of recurrent dreams (Yes or No) ^b	0.5 ± 0.2	0.7 ± 0.2	ns
Dream realism (1 to 5 scale) ^a	0.8 ± 0.1	0.5 ± 0.1	ns
Dream control (Yes or No) ^b	0.5 ± 0.1	0.3 ± 0.1	ns
Dream vividness (1 to 5 scale) ^a	2.4 ± 0.3	2.8 ± 0.3	ns
Pain sensation (Yes or No) ^b	0.5 ± 0.1	0.4 ± 0.1	ns

^a Mann–Whitney *U* test.
^b Chi-square tests; ns: not significant.

Table 2
Frequency of emotions (mean ± s.e.m) in dream questionnaires of control participants and participants with schizophrenia.

Emotions	Number of participants reporting "never" ^b			Absolute frequency (0 to 4) ^a		
	CTL	SCZ	<i>p</i>	CTL	SCZ	<i>p</i>
Joy	0	0	ns	3.1 ± 0.2	3.5 ± 0.3	ns
Fear	2	1	ns	2.6 ± 0.3	2.9 ± 0.3	ns
Sadness	4	2	ns	2.1 ± 0.2	2.5 ± 0.3	ns
Relaxation	2	2	ns	2.9 ± 0.3	2.7 ± 0.3	ns
Confusion	2	2	ns	2.7 ± 0.3	2.7 ± 0.3	ns
Satisfaction	2	0	ns	3.1 ± 0.3	2.8 ± 0.3	ns
Anger	4	5	ns	2.0 ± 0.2	2.0 ± 0.3	ns
Frustration	5	5	ns	1.9 ± 0.2	2.0 ± 0.3	ns
Sexual arousal	0	1	ns	2.6 ± 0.2	2.2 ± 0.2	ns
Apprehension	2	2	ns	2.6 ± 0.3	2.5 ± 0.3	ns
Shyness	4	4	ns	2.1 ± 0.3	1.9 ± 0.2	ns

CTL: control group; SCZ: schizophrenia group.
^a Mann–Whitney *U*-tests.
^b Chi-square; ns: not significant.

nightmares per year. However, no significant differences were found on items related to the frequency and number of bad dreams, even after eliminating outlying data. There were no significant differences on any of the general measures of dream recall or on the presence of recurrent dreams, lucid dreaming, control of dreaming or physical sensations during dreams. The frequency of emotions reported by both groups on the self-report dream questionnaire is presented in Table 2. There were no significant differences on any of the classes of emotions.

3.2. Laboratory sleep measures

Table 3 presents key polysomnographic and laboratory variables for patients with schizophrenia and controls. There were no significant differences between the two groups in sleep latency or in REM sleep characteristics.

3.3. Laboratory dream content

There were a total of 92 awakenings from REM sleep, which resulted in 78 dream reports (SCZ = 45 vs. CTL = 47). There were no significant differences between the two groups in the number of dream reports with reportable content (SCZ = 39 vs. CTL = 39) nor in the number of white dreams (SCZ = 4 vs. CTL = 3). Each group contributed a total of 39

Table 3
Laboratory sleep measures (mean ± S.E.M.) in control participants vs. participants with schizophrenia.

Sleep parameters	Controls	Schizophrenia	<i>p</i>
Sleep latency (min) ^a	11.8 ± 1.8	42.8 ± 16.9	ns
REM sleep latency (min) ^a	82.3 ± 9.8	116.0 ± 21.9	ns
REM sleep efficiency (%) ^a	84.1 ± 2.1	83.6 ± 2.3	ns
Rapid eye movement density during REM sleep ^a	454.5 ± 18.5	480.1 ± 12.3	ns
Number of rapid eye movements during REM sleep ^a	703.7 ± 51.9	714.9 ± 62.9	ns

*PSG values listed above were calculated from night two only.
^a Mann–Whitney *U*-tests; ns: not significant.

dream reports, with individual subjects reporting between one to four dreams each. One participant in each group reported a single dream and three patients and one control reported as many as four dreams. As shown in Table 4, patients' dream reports contained fewer words despite an equivalent number of verbal interventions from the experimenter (EVI). Both groups of participants reported an equivalent number of words not specifically related to dream content in their reports. Patients reported significantly fewer known (familiar) characters, more strangers, and fewer neutral emotions. Also, there was a trend towards significance for setting familiarity with the schizophrenia group reporting fewer familiar settings ($p=0.06$). Table 4 also shows that while both groups did not differ in the objective scores on the bizarreness scales, participants with schizophrenia spontaneously reported a lower subjective feeling of bizarreness.

Supplemental analyses were performed on significantly different variables (i.e., known characters, strangers, neutral emotions) following two strategies. First, frequency scores obtained for each of these variables were divided by the

Table 4

Number of dream elements in laboratory REM sleep reports (mean \pm S.E.M.) in control participants vs. participants with schizophrenia.

Dream reports parameters	CTL ($n=39$)	SCZ ($n=39$)	p
Number of words ^a	290.39 \pm 55.2	124.33 \pm 24.7	0.001 *
Additional words ^a (not related to dream content)	42.18 \pm 10.5	21 \pm 4.6	ns
Number of reportable items ^a	25.8 \pm 4.5	15 \pm 2.2	ns
Experimenter's verbal intervention (EVI) ^a	9.54 \pm 0.9	11.00 \pm 1.1	ns
Characters ^a	3.74 \pm 0.6	2.51 \pm 0.3	ns
Known (Familiar) ^a	2.28 \pm 0.4	0.87 \pm 0.2	0.02 *
Strangers ^a	0.64 \pm 0.2	1.03 \pm 0.2	0.03 *
Settings ^a	1.74 \pm 0.3	1.13 \pm 0.1	ns
Familiar ^a	0.87 \pm 0.2	0.44 \pm 0.1	ns
Unfamiliar ^a	0.85 \pm 0.2	0.69 \pm 0.1	ns
Objects ^a	7.15 \pm 1.3	4.00 \pm 0.8	ns
Descriptive elements ^a	3.32 \pm 0.6	1.54 \pm 0.4	ns
Social interactions ^a	0.8 \pm 0.2	0.5 \pm 0.2	ns
Friendliness ^a	0.23 \pm 0.1	0.13 \pm 0.1	ns
Aggression ^a	0.51 \pm 0.2	0.36 \pm 0.1	ns
Sexuality ^a	0.03 \pm 0.02	0.03 \pm 0.03	ns
Activities ^a	7.26 \pm 1.7	4.31 \pm 0.8	ns
Dreamer's activities ^a	3.33 \pm 0.8	1.97 \pm 0.4	ns
Character's activities ^a	3.95 \pm 1.0	2.33 \pm 0.4	ns
Total emotions ^a	1.26 \pm 0.2	0.82 \pm 0.1	ns
Positive emotions ^a	0.36 \pm 0.1	0.44 \pm 0.1	ns
Negative emotions ^a	0.54 \pm 0.2	0.31 \pm 0.1	ns
Neutral emotions ^a	0.36 \pm 0.1	0.08 \pm 0.1	0.02 *
Physical sensations ^a	0.08 \pm 0.1	0.0 \pm 0.0	ns
Success ^a	0.08 \pm 0.1	0.0 \pm 0.0	ns
Failure ^a	0.18 \pm 0.1	0.13 \pm 0.1	ns
Good fortune ^a	0.0 \pm 0.0	0.0 \pm 0.0	ns
Misfortune ^a	0.31 \pm 0.1	0.08 \pm 0.04	ns
Subjective feeling of bizarreness ^a	0.8 \pm 0.2	0.1 \pm 0.5	0.03 *
Bizarreness density ^a (bizarre elements/reportable items ratio)	0.07 \pm 0.02	0.10 \pm 0.03	ns
Rationality ^a	4.8 \pm 0.2	5.0 \pm 0.2	ns
Everydayness ^a	4.8 \pm 0.2	4.9 \pm 0.2	ns
Involvement ^b (% of active participation in the dream)	82.05%	69.23%	ns

CTL: control group; SCZ: schizophrenia group.

ns = not significant.

^a Mann–Whitney *U*-tests.

^b Chi-square tests.

* significant.

Table 5

Significant correlation (Spearman's rho rank-order correlation coefficient) between the density of rapid eye movements during REM sleep and dream content in control participants.

	Spearman's rho ^a	P
Control group		
Total emotions	0.6	0.009
Positives emotions	0.6	0.03
Neutral emotions	0.5	0.05
Settings	0.6	0.02
Descriptive elements	0.7	0.006
Failure	0.6	0.02

No significant correlation was found in the schizophrenia group.

^a Spearman rank-order correlation rho coefficient.

values obtained for the general category to which they belonged (e.g., known characters/all human characters; neutral emotions/all emotions). This allows one to evaluate the proportion of a general category that is reflected in each of its subscales. Second, in order to control for report length, each of the above mentioned variables was divided by the total number of words in the report and the result multiplied by 100. This allows one to determine that, for an equivalent report length, a given dream content element is more, less or equally frequently reported by one group of participants in comparison to the other. Following the first strategy, patients with schizophrenia reported a lower proportion of known characters (SCZ = 37.9% \pm 6.7 vs. CTL = 57.0% \pm 6.5; $p=0.04$), a greater proportion of strangers (SCZ = 49.8% \pm 7.2 vs. CTL = 19.4% \pm 5.3; $p=0.003$) and a lower proportion of neutral emotions (SCZ = 8.3% \pm 5.8 vs. CTL = 38.2% \pm 8.3; $p=0.02$). However, when controlling for report length, most of the significant dream content differences between the two groups disappeared (i.e., known characters (SCZ = 2.0% \pm 0.5 vs. CTL = 1.4% \pm 0.2; $p=0.8$), neutral emotions (SCZ = 1.2% \pm 0.2 vs. CTL = 0.7% \pm 0.2; $p=0.1$), with the exception of strangers which remained proportionally and significantly more reported by participants with schizophrenia (SCZ = 1.8% \pm 0.3 vs. CTL = 0.7% \pm 0.2; $p=0.01$).

3.4. Relationships between dream content and REM sleep rapid eye movements

Table 5 presents the results of the correlational analyses performed to assess the relationship between dream content variables and REM sleep eye movement density. Overall, significant correlations between dream content variables and eye-movement density were in the predicted direction for the control participants. Positive correlations were found for total number of emotions, positives emotions, neutral emotions, settings, descriptive elements and failure. No significant correlations, however, were obtained in the schizophrenia group. Finally, no significant correlations were obtained in either group between REM sleep eye movement density and dream activities.

4. Discussion

4.1. Summary of the results

The self-report questionnaire data reveal that patients with schizophrenia report experiencing nightmares more

frequently than do controls. Laboratory-based dream narratives from our patients appeared to be quantitatively different from those of controls, with fewer reportable items on several scales. The narratives of the schizophrenia group were shorter and, after controlling for report length, most content scale differences between the two groups were not significant with the exception of a greater proportion of unknown characters in participants with schizophrenia. After reporting dream content, patients with schizophrenia spontaneously rated their dream narratives as being less bizarre than did controls, despite a similar density of bizarre elements as scored by external judges. Finally, a significant positive correlation between dream content variables and eye-movement density during REM sleep was found in the control group.

4.2. Questionnaire findings

Contrary to our first prediction, no significant group differences were found on variables related to self-reported quality and quantity of dream recall. This contrasts with laboratory findings showing decreased dream recall frequency in individuals with schizophrenia (Dement, 1955; Kramer et al., 1970; Okuma et al., 1970). This discrepancy may be due to inherent methodological differences between self-report retrospective data and controlled experimental laboratory awakenings from REM sleep. In fact, when compared to prospectively obtained data, retrospective measures of dream recall frequency can reflect an estimation bias and may be vulnerable to memory distortions (e.g., Beaulieu-Prevost and Zadra, 2007). Ideally, non-laboratory investigations of dream content in schizophrenia should use prospective dream logs which are generally considered as more direct and valid measures of dream recall frequency than retrospective instruments (Beaulieu-Prevost and Zadra, 2007; Levin and Nielsen, 2007). Consistent with previous findings on nightmares and schizophrenia spectrum disorders (Claridge et al., 1997; Hartmann and Russ, 1979; Kales et al., 1980; Levin and Daly, 1998), patients with schizophrenia reported experiencing a higher frequency of nightmares than did controls. However, no differences were found for bad dream frequency. Given that nightmares are more emotionally intense than bad dreams (Zadra et al., 2006), and that nightmares by definition awaken the sleeper, we suggest that nightmares' high saliency facilitates their recollection and that this effect is particularly augmented in schizophrenic patients.

Since nightmares are comorbid with several psychiatric conditions (e.g., post-traumatic stress disorder, anxiety disorders, and schizophrenia spectrum disorders) Levin and Nielsen (2007) suggest that rather than predicting specific psychopathology subtypes, nightmares are more generally associated with poor psychological well-being. Poor psychological well-being, although not directly measured in the present study, may account for the higher nightmare frequency observed in our patient group. However, the relation between nightmares and psychological well-being in schizophrenia remains unclear and may be mediated by other factors such as nightmare distress (i.e., the extent to which nightmares negatively impact people's waking state). Nightmare distress has been shown to be a better predictor of psychological disturbance than nightmare frequency (Belicki, 1992; Blagrove et al., 2004) and the investigation of night-

mare distress in psychiatric populations is suggested to better understand the significance of elevated nightmare frequency.

4.3. Laboratory findings

The comparable questionnaire-based dream recall frequencies reported by our two groups was replicated in the laboratory-based awakenings from REM sleep. The percentage of experimental awakenings accompanied by dream recall in our study (SCZ = 87% vs. CTL = 83%) is consistent with what is generally observed in studies of REM sleep mentation in healthy adults (82% ± 9) (Nielsen, 2000). The fact that our sample of schizophrenic patients showed a higher frequency of dream recall compared to previous laboratory investigations (range of 28% to 74%) (Dement, 1955; Jus et al., 1973b; Kramer et al., 1970; Okuma et al., 1970) might be attributable to variations in experimental protocols including method of awakening (e.g., sounding a buzzer, calling out the sleeper's name, knocking on the chamber's door), duration of REM sleep prior to planned awakenings, inclusion or not of an adaptation night, and number of nights investigated. Discrepancies in dream recall may also reflect varying patient characteristics and treatment modalities. For instance, Dement's (1955) study included patients who had undergone prefrontal lobotomy, a condition highly susceptible of affecting dream recall (Solms, 2000). Our patient group was also comparatively younger than in past studies (age range between 20–30 years vs. 21–63 years in previous studies) and consequently illness duration was presumably shorter in our sample. In addition, whereas our patients continued to receive antipsychotic treatment during their assessments in the sleep laboratory, patients in Okuma et al.'s (1970) study were withdrawn from their neuroleptic medication for at least 10 days prior to the polysomnographic recordings. This may have impaired sleep patterns as well as dream recall although prolonged treatment with older neuroleptics may have contributed to lower dream recall in earlier studies. However, Kramer et al. (1970) found no significant differences in schizophrenic patients' dream recall between pre-treatment (74%) and post-treatment (68%) conditions involving classical neuroleptics.

Our patients' higher dream recall frequency may also be due to improved sleep with atypical antipsychotic treatment. Whereas significant reductions in dream recall are associated with increased sleep disturbances (e.g., insomnia, reduced sleep efficiency) (Pagel and Shocknesse, 2007), atypical antipsychotics appear to improve sleep disturbances in patients with schizophrenia in comparison to conventional antipsychotic drugs (Yamashita et al., 2004). Conventional antipsychotic drugs are also considered to be more sedating than atypical antipsychotic drugs (Miller, 2004; Wirz-Justice et al., 1997, 2001). For example, quetiapine and ziprasidone are relatively less likely than the other antipsychotic agents to result in daytime sleepiness and represent the greatest potential in enhancing nighttime sleep without leading to daytime somnolence (Krystal et al., 2008). Thus, it is conceivable that the reduced sedative effect of atypical antipsychotic agents improve dream recall via increased daytime alertness.

There were no significant differences between our two groups in the number of aggressive interactions reported in

their dream narratives or in the direction of the acts (e.g., towards the dreamer versus other dream characters). It has been suggested that classical antipsychotics reduce the number of aggressive dreams in patients with schizophrenia (Kramer et al., 1970) as well as in healthy individuals (Gaillard and Moneme, 1977). However, to our knowledge, no data exist on such relationships with regards to atypical antipsychotics but beneficial effects of atypical antipsychotics on hostility and aggression in schizophrenia have been noted and some atypical antipsychotics may be superior to classical antipsychotics in the treatment of aggression in schizophrenia (Citrome et al., 2001). Additional studies are needed to explore the extent to which the purported “antiaggressive” effects of different classes of antipsychotic medications influence the expression of aggression in patients' dream reports.

Based on the literature, a higher frequency of negative emotions was expected in the dream reports from our patients. The only significant difference between our two groups, however, was that patients with schizophrenia reported fewer neutral emotions. These results do not support those of Hadjez et al. (2003) who found less emotional expression in the dream reports of adolescent patients with schizophrenia, which was interpreted as being the result of the overall emotional and cognitive constriction characterizing schizophrenia. The emotions described in our patients' dream reports were more polarized as compared to those from controls, supporting the Okuma et al.'s (1970) idea that dreams are more affectively laden in schizophrenia. Psychophysiological studies have shown that basic emotional processing is not impaired in schizophrenia (Curtis et al., 1999), suggesting that schizophrenic patients' blunted or flat affect might misrepresent their underlying emotional experience. We thus suggest that the emotional dream experience in schizophrenia may be dissociated from the waking expression of emotions and propose that the manifest content of dreams represent an interesting venue to better understand emotional processing in schizophrenia.

It was also predicted that our groups' dream reports would not differ in terms of bizarreness as assessed by external raters. While this prediction was confirmed, patients were less likely than controls to subjectively view their dream content as being bizarre. At least two possibilities may explain this finding. Control participants may simply have a greater capacity for insight and critical thinking and thus better perceive the strangeness of their dreams experiences. Alternatively, patients with schizophrenia may be accustomed to a higher degree of strangeness in their thoughts and consequently potentially bizarre elements are not as salient or unusual for them.

The quantitative analysis of the dream reports also showed that patients with schizophrenia reported significantly fewer known characters, a greater number of strangers, and a trend towards significance for fewer familiar settings. Moreover, strangers were reported more frequently in the dreams of patients compared to controls regardless of report length. Similar findings were reported by Kramer et al. (1970) who suggested that these dream content patterns reflect the social withdrawal that characterizes patients with schizophrenia. We suggest that these findings may also reflect decreased activity of the “social brain” in schizophrenia

(Burns, 2006). Potential structural and functional abnormalities within the cortical networks of the social brain might play a role in the social behavioral problems in schizophrenia; difficulties that might also be reflected in the dream content of individuals with schizophrenia. This possibility could be tested by evaluating the correlations between these dream content variables and EEG activity during REM sleep (Poulin et al., 2008).

4.3.1. Correction for dream report length

The dream reports of patients with schizophrenia contained fewer words than did those from controls despite an equal number of EVIs, thereby supporting past results (Cartwright, 1972; Chang, 1964; Debieve et al., 1977; Hall, 1966; Okuma et al., 1970). Several psychological factors have been suggested to account for these findings. Chang (1964) proposed that patients with schizophrenia experience difficulties in translating the visual images of a dream into a concept and then into a communicable sentence. More recently, Scarone et al. (2008) identified lack of motivation as a psychological aspect of schizophrenia that may partially account for the restricted length of dream reports. These hypotheses could be investigated by using laboratory dream collection protocols based on forced-choices or semi-structured interviews rather than on open-ended questions.

It is noteworthy, however, that even though our patient group used fewer words than controls to describe their dream experiences, they used the same number of words to describe elements not directly related to the dream content. Thus, the constriction of the dream narratives appears to be limited to the dream as opposed to overall speech productivity. Controlling for group differences in the length of the dream narratives negated most of our previously significant findings. While Chang (1964) proposed that neurophysiological dysfunctions might be responsible for simpler and more fragmented dream reports in schizophrenia, our findings suggest that the dream content of participants with schizophrenia is not that different from controls and that discriminatory features in their dream content may be partially attributable to patients' reduced ability in reporting dream content as opposed to an actual impoverishment of the dream experience itself. Hence, the capacity to organize verbal accounts of recalled dream materials may represent a key variable. Neuropsychological dysfunctions in schizophrenia such as speech disturbance (DeLisi, 2001) and memory impairment (Boyer et al., 2007) might contribute to this phenomenon but processes underlying such difficulties remain to be elucidated. In keeping with Okuma et al. (1970), we propose that an estimation of overall language production (using free speech samples) would be useful to rule unspecific language anomalies in schizophrenia that may contribute to the shortness of their dream reports.

4.4. Correlations between eye movements and dream content

As expected, control participants showed a significant positive correlation between eye movement density during REM sleep and dream content. Patients with schizophrenia, however, did not show this relationship even though both groups had a comparable density of rapid eye movements during REM sleep (Table 5). The absence of a positive

correlation in our patient group may be related to their difficulties in reporting dream content or to altered/atypical brain connectivity involving REM neural control within the limbic system (Ioannides et al., 2004; Liu et al., 2008). The absence of a significant correlation between eye movement density during REM sleep and dream activities in both groups of participants contrasts with results from previous papers (Berger and Oswald, 1962; Dement and Wolpert, 1958). This discrepancy might be due to methodological differences. For instance, in these previous studies, eye movements during REM sleep were categorized as an active or passive dichotomy based on EOG potentials and dream reports were classified as active or passive based on the dreamer's degree of involvement in the action of the dream while we used continuous numerical measures. Thus, dreams containing profusion of activities, but for which the dreamer was not actively implicated, were included in our analyses.

4.5. Methodological limitations

Some limitations of the present study include the relatively small sample sizes and the overrepresentation of male subjects. Larger and more diversified populations are required to investigate potential gender effects as well as the dream content of patient groups with a predominance of either negative or positive symptomatology or those in the acute phase of the illness versus patients with chronic histories. The fact that schizophrenia patients were all medicated may be considered as a limiting factor, preventing a purer assessment of the dream experience. In the present study, awakenings were made by a knock on the chamber's door and dream reports were collected on tape from the bedside. When compared to the use of an intercom, this procedure may be perceived as being more intrusive, especially by some patients. Finally, although the numerous statistical comparisons may increase the probability of making Type I errors, the differences observed were highly significant.

4.6. Conclusion

Taken together with previous findings, the present results suggest that dream content characteristics in schizophrenia may reflect neurocognitive processes specific to this condition and that quantitative study of patients' dream reports may represent a valuable and alternative venue to better understand psychological and emotional processing associated with the disorder.

Role of the funding source

Part of this work was supported by an operating grant from the Canadian Institute of Health Research (CIHR) to RG (MOP49564) and a studentship to FAL also from the CIHR. The sponsor of the study had no role in study design; in the collection, analysis and interpretation of data; in the writing of the report; and in the decision to submit the paper for publication.

Contributors

The authors RG and AZ designed the study and wrote the protocol. Authors JPM, FAL and MJD were involved in the development of recruitment methods and the actual recruitment of the participants. Author FAL was responsible for the literature search and analyses, and authors FAL and MJD carried out data collection. Authors FAL and AMD undertook the statistical analysis, and author FAL wrote the first draft of the manuscript. All authors contributed to and have approved the final manuscript.

Conflict of interest

All authors declare that they have no conflicts of interest.

Acknowledgments

The authors gratefully acknowledge the skilful technological assistance of Élyse Chevrier (polysomnographic recordings and scoring, laboratory coordination). We also thank Claude Berthiaume for his help in the statistical analyses.

References

- American Electroencephalographic Society, 1994. Guideline thirteen: guidelines for standard electrode position nomenclature. *J. Clin. Neurophysiol.* 11, 111–113.
- American Psychiatric Association, 2000. *Diagnostic and Statistical Manual of Mental Disorders*. Author: American Psychiatric Association, Washington, DC. (Revised 4th ed.).
- Beaulieu-Prevost, D., Zadra, A., 2007. Absorption, psychological boundaries and attitude towards dreams as correlates of dream recall: two decades of research seen through a meta-analysis. *J. Sleep Res.* 16 (1), 51–59.
- Belicki, K., 1992. Nightmare frequency versus nightmare distress: relations to psychopathology and cognitive style. *J. Abnorm. Psychol.* 101 (3), 592–597.
- Benson, K.L., Zarccone Jr., V.P., 1993. Rapid eye movement sleep eye movements in schizophrenia and depression. *Arch. Gen. Psychiatry* 50 (6), 474–482.
- Berger, R.J., Oswald, I., 1962. Eye movements during active and passive dreams. *Science* 137, 601.
- Biddle, W.E., 1963. Images: the Objects Psychiatrists Treat. *Arch. Gen. Psychiatry* 9, 464–470.
- Blagrove, M., Farmer, L., Williams, E., 2004. The relationship of nightmare frequency and nightmare distress to well-being. *J. Sleep Res.* 13 (2), 129–136.
- Boyer, P., Phillips, J.L., Rousseau, F.L., Ilivitsky, S., 2007. Hippocampal abnormalities and memory deficits: new evidence of a strong pathophysiological link in schizophrenia. *Brain Res. Rev.* 54 (1), 92–112.
- Burns, J., 2006. The social brain hypothesis of schizophrenia. *Psychiatr. Danub.* 18 (3–4), 225–229.
- Cann, D.R., Donderi, D.C., 1986. Jungian personality typology and the recall of everyday and archetypal dreams. *J. Pers. Soc. Psychol.* 50 (5), 1021–1030.
- Cappon, D., 1959. Morphology and other parameters of phantasy in the schizophrenias. *Arch. Gen. Psychiatry* 1, 17–34.
- Carrington, P., 1972. Dreams and schizophrenia. *Arch. Gen. Psychiatry* 26 (4), 343–350.
- Cartwright, R.D., 1972. Sleep fantasy in normal and schizophrenic persons. *J. Abnorm. Psychol.* 80 (3), 275–279.
- Cartwright, R.D., Wood, E., 1993. The contribution of dream masochism to the sex ratio difference in major depression. *Psychiatry Res.* 46 (2), 165–173.
- Chang, S.C., 1964. Dream-recall and themes of hospitalized schizophrenics. *Arch. Gen. Psychiatry* 10, 119–122.
- Chouinard, S., Poulin, J., Stip, E., Godbout, R., 2004. Sleep in untreated patients with schizophrenia: a meta-analysis. *Schizophr. Bull.* 30 (4), 957–967.
- Citrome, L., Volavka, J., Czobor, P., Sheitman, B., Lindenmayer, J.P., McEvoy, J., et al., 2001. Effects of clozapine, olanzapine, risperidone, and haloperidol on hostility among patients with schizophrenia. *Psychiatr. Serv.* 52 (11), 1510–1514.
- Claridge, G., Clark, K., Davis, C., 1997. Nightmares, dreams, and schizotypy. *Br. J. Clin. Psychol.* 36 (Pt 3), 377–386.
- Curtis, C.E., Lebow, B., Lake, D.S., Katsanis, J., Iacono, W.G., 1999. Acoustic startle reflex in schizophrenia patients and their first-degree relatives: evidence of normal emotional modulation. *Psychophysiology* 36 (4), 469–475.
- Dazzan, P., Morgan, K.D., Orr, K., Hutchinson, G., Chitnis, X., Suckling, J., et al., 2005. Different effects of typical and atypical antipsychotics on grey matter in first episode psychosis: the AESOP study. *Neuropsychopharmacology* 30 (4), 765–774.
- Debieve, J., Bedoret, J.M., Meaux, J.P., Fontan, M., 1977. [The onset of dreams in schizophrenics by awakening during polygraphic registering of sleep]. *Lille Med* 22 (3), 132–139, 193.
- DeLisi, L.E., 2001. Speech disorder in schizophrenia: review of the literature and exploration of its relation to the uniquely human capacity for language. *Schizophr. Bull.* 27 (3), 481–496.
- Dement, W., 1955. Dream recall and eye movements during sleep in schizophrenics and normals. *J. Nerv. Ment. Dis.* 122 (3), 263–269.
- Dement, W., Wolpert, E.A., 1958. The relation of eye movements, body motility, and external stimuli to dream content. *J. Exp. Psychol.* 55 (6), 543–553.

- Gaillard, J.M., Moneme, A., 1977. Modification of dream content after preferential blockade of mesolimbic and mesocortical dopaminergic systems. *J. Psychiatr. Res.* 13 (4), 247–256.
- Gillin, J.C., Buchsbaum, M.S., Jacobs, L.S., Fram, D.H., Williams, R.B., Vaughan Jr., T.B., et al., 1974. Partial REM sleep deprivation, schizophrenia and field articulation. *Arch. Gen. Psychiatry* 30 (5), 653–662.
- Giordano, P.L., Spoto, G., 1977. Patients' reports of their own sleep and dream experience in psychopharmacological sleep research and treatment. *Act. Nerv. Super (Praha)* 19 Suppl 2, 370.
- Gold, M.S., Robertson, M.F., 1975. The night/day imagery paradox of selected psychotic children. *J. Am. Acad. Child Psychiatry*. 14 (1), 132–141.
- Hadjez, J., Stein, D., Gabbay, U., Bruckner, J., Meged, S., Barak, Y., et al., 2003. Dream content of schizophrenic, nonschizophrenic mentally ill, and community control adolescents. *Adolescence* 38 (150), 331–342.
- Hall, C.S., 1966. A comparison of the dreams of four groups of hospitalized mental patients with each other and with a normal population. *J. Nerv. Ment. Dis.* 143 (2), 135–139.
- Hall, C.S., Van de Castle, R.L., 1966. *The Content Analysis of Dreams*. Appleton, New-York.
- Hartmann, E., Russ, D., 1979. Frequent nightmares and the vulnerability to schizophrenia: the personality of the nightmare sufferer. *Psychopharmacol. Bull* 15 (1), 10–12.
- Herz, M.I., Melville, C., 1980. Relapse in schizophrenia. *Am. J. Psychiatry* 137 (7), 801–805.
- Hobson, J.A., Goldfrank, F., Snyder, F., 1965. Respiration and mental activity in sleep. *J. Psychiatr. Res.* 3 (2), 79–90.
- Hong, C.C., Potkin, S.G., Antrobus, J.S., Dow, B.M., Callaghan, G.M., Gillin, J.C., 1997. REM sleep eye movement counts correlate with visual imagery in dreaming: a pilot study. *Psychophysiology* 34 (3), 377–381.
- Ioannides, A.A., Corsi-Cabrera, M., Fenwick, P.B., del Rio Portilla, Y., Laskaris, N.A., Khurshudyan, A., et al., 2004. MEG tomography of human cortex and brainstem activity in waking and REM sleep saccades. *Cereb. Cortex* 14 (1), 56–72.
- Jus, A., Jus, K., Gautier, J., Villeneuve, A., Pires, P., Lachance, R., et al., 1973a. [The recall of dreams after administration of reserpine in chronic schizophrenics treated with prefrontal lobotomy]. *Vie Med Can Fr* 2 (9), 843–848.
- Jus, A., Jus, K., Villeneuve, A., Pires, A., Lachance, R., Fortier, J., et al., 1973b. Studies on dream recall in chronic schizophrenic patients after prefrontal lobotomy. *Biol. Psychiatry* 6 (3), 275–293.
- Kales, A., Soldatos, C.R., Caldwell, A.B., Charney, D.S., Kales, J.D., Markel, D., et al., 1980. Nightmares: clinical characteristics and personality patterns. *Am. J. Psychiatry* 137 (10), 1197–1201.
- Kramer, M., Roth, T., 1973. A comparison of dream content in laboratory dream reports of schizophrenic and depressive patient groups. *Compr. Psychiatry* 14 (4), 325–329.
- Kramer, M., Whitman, R.M., Baldrige, B.J., Ornstein, P.H., 1970. Dream content in male schizophrenic patients. *Dis. Nerv. Syst.* 31 (Suppl), 51–58.
- Krystal, A.D., Goforth, H.W., Roth, T., 2008. Effects of antipsychotic medications on sleep in schizophrenia. *Int. Clin. Psychopharmacol.* 23 (3), 150–160.
- Langs, R.J., 1966. Manifest dreams from three clinical groups. *Arch. Gen. Psychiatry* 14 (6), 634–643.
- Lanter, R., 1954. [The role of the dream in mental disorders.]. *Evol. Psychiatr. (Paris)* 4, 685–720.
- Levin, R., Daly, R.S., 1998. Nightmares and psychotic decompensation: a case study. *Psychiatry* 61 (3), 217–222.
- Levin, R., Nielsen, T.A., 2007. Disturbed dreaming, posttraumatic stress disorder, and affect distress: a review and neurocognitive model. *Psychol. Bull.* 133 (3), 482–528.
- Liu, Y., Liang, M., Zhou, Y., He, Y., Hao, Y., Song, M., et al., 2008. Disrupted small-world networks in schizophrenia. *Brain* 131 (Pt 4), 945–961.
- Lusignan, F.A., Daoust, A.M., Stip, E., & Godbout, R. (2005). Dream content in drug-naïve schizophrenia: a laboratory investigation. Paper presented at the 19th Annual Meeting of the Association of Professional Sleep Societies, Denver, CO.
- Nielsen, T.A., 2000. A review of mentation in REM and NREM sleep: "covert" REM sleep as a possible reconciliation of two opposing models. *Behav. Brain Sci.* 23 (6), 851–866 discussion 904–1121.
- Miller, D.D., 2004. Atypical antipsychotics: sleep, sedation, and efficacy. *Prim Care Companion J Clin Psychiatry* 6 (Suppl 2), 3–7.
- Noble, D., 1951. A study of dreams in schizophrenia and allied states. *Am. J. Psychiatry* 107 (8), 612–616.
- Okuma, T., Sunami, Y., Fukuma, E., Takeo, S., Motoike, M., 1970. Dream content study in chronic schizophrenics and normals by REMP-awakening technique. *Folia Psychiatr. Neurol. Jpn.* 24 (3), 151–162.
- Ornstein, P.H., Whitman, R.M., Kramer, M., Baldrige, B.J., 1969. Drugs and dreams. IV. Tranquilizers and their effects upon dreams and dreaming in schizophrenic patients. *Exp. Med. Surg.* 27 (1–2), 145–156.
- Pagel, J.F., Shocknesse, S., 2007. Dreaming and insomnia: polysomnographic correlates of reported dream recall frequency. *Dreaming* 17 (3), 140–151.
- Pivik, R.T., 1991. Tonic states and phasic events in relation to sleep mentation. In S. J. Ellman & J. S. Antrobus (Eds.), *The Mind in Sleep: Psychology and Physiology* (2nd ed., pp. 214–247). New-York: J. Wiley.
- Pivik, R.T., Broughton, R.J., Coppola, R., Davidson, R.J., Fox, N., Nuwer, M.R., 1993. Guidelines for the recording and quantitative analysis of electroencephalographic activity in research contexts. *Psychophysiology* 30 (6), 547–558.
- Poulin, J., Daoust, A.M., Forest, G., Stip, E., Godbout, R., 2003. Sleep architecture and its clinical correlates in first episode and neuroleptic-naïve patients with schizophrenia. *Schizophr. Res.* 62 (1–2), 147–153.
- Poulin, J., Stip, E., Godbout, R., 2008. REM sleep EEG spectral analysis in patients with first-episode schizophrenia. *J. Psychiatr. Res.* 42 (13), 1086–1093.
- Richardson, G.A., Moore, R.A., 1963. On the manifest dream in schizophrenia. *J. Am. Psychoanal. Assoc.* 11, 281–302.
- Rechtschaffen, A., Kales, A., 1968. *A Manual of Standardized Terminology, Techniques and Scoring Systems for Sleep Stages of Human Subjects*. UCLA Brain Research Institute, Los Angeles.
- Scarone, S., Manzone, M.L., Gambini, O., Kantzas, I., Limosani, I., D'Agostino, A., et al., 2008. The dream as a model for psychosis: an experimental approach using bizarreness as a cognitive marker. *Schizophr. Bull* 34 (3), 515–522.
- Scarone, S., Spoto, G., Penati, G., Canger, R., Moja, E.A., 1976. A study of the EEG sleep patterns and the sleep and dream experience of a group of schizophrenic patients treated with sulpiride. *Arzneimittelforschung* 26 (8), 1626–1628.
- Schnetzler, J.P., Carbonnel, B., 1976. [Thematic study of the narration of dreams of normal, and of schizophrenic and other psychotic subjects]. *Ann. Med. Psychol. (Paris)* 1 (3), 367–380.
- Schredl, M., Wittmann, L., 2005. Dreaming: a psychological view. *Schweiz. Arch. Neurol. Psychiatr.* 156 (8), 484–492.
- Solms, M., 2000. Dreaming and REM sleep are controlled by different brain mechanisms. *Behav. Brain Sci.* 23 (6), 843–850 discussion 904–1121.
- Stompe, T., Ritter, K., Ortwein-Swoboda, G., Schmid-Siegel, B., Zitterl, W., Strobl, R., et al., 2003. Anxiety and hostility in the manifest dreams of schizophrenic patients. *J. Nerv. Ment. Dis.* 191 (12), 806–812.
- Williams, J., Merritt, J., Rittenhouse, C., Hobson, J.A., 1992. Bizarreness in dreams and fantasies: implications for the activation-synthesis hypothesis. *Conscious Cogn.* 1 (2), 172–185.
- Wirz-Justice, A., Cajochen, C., Nussbaum, P., 1997. A schizophrenic patient with an arrhythmic circadian rest-activity cycle. *Psychiatry Res* 73 (1–2), 83–90.
- Wirz-Justice, A., Haug, H.J., Cajochen, C., 2001. Disturbed circadian rest-activity cycles in schizophrenia patients: an effect of drugs? *Schizophr. Bull* 27 (3), 497–502.
- Yamashita, H., Mori, K., Nagao, M., Okamoto, Y., Morinobu, S., Yamawaki, S., 2004. Effects of changing from typical to atypical antipsychotic drugs on subjective sleep quality in patients with schizophrenia in a Japanese population. *J. Clin. Psychiatry* 65 (11), 1525–1530.
- Zadra, A., Pilon, M., Donderi, D.C., 2006. Variety and intensity of emotions in nightmares and bad dreams. *J. Nerv. Ment. Dis.* 194 (4), 249–254.
- Zarcone, V., Azumi, K., Dement, W., Gulevich, G., Kraemer, H., Pivik, T., 1975. REM phase deprivation and schizophrenia II. *Arch. Gen. Psychiatry* 32 (11), 1431–1436.