Review

The prevalence and moderators of clinical pain in people with schizophrenia: A systematic review and large scale meta-analysis

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ABSTRACT

Background: People with schizophrenia frequently have physical comorbidities that can cause pain. Experimental studies report reduced pain sensitivity among schizophrenia patients, but it remains unclear if clinically relevant pain is less prevalent in schizophrenia.
Method: We systematically searched major electronic databases from inception till 03/2014. Articles were included that reported the prevalence of clinical pain in people with schizophrenia. Two independent authors conducted searches, completed methodological quality assessment and extracted data. A random effects relative risks (RR) meta-analysis was conducted to determine the prevalence of all-cause and specific pain in schizophrenia, and the relative prevalence compared to the general population, and to assess moderators.
Results: Altogether, 14 studies were included encompassing 242,703 individuals with schizophrenia (30.2–55.8 years) and 4,259,221 controls. Different types of pain were considered. The overall pooled prevalence of clinical pain in people with schizophrenia was 34.7% (95% CI = 23.6–46.6). In the comparative analysis involving 7 studies with controls, the RR was 0.99 (95% CI = 0.83–1.19). The pooled prevalence of headache among 94,043 individuals with schizophrenia was 29.9% (95% CI = 3–69%) and the RR compared to 4,248,284 controls was 1.32 (95% CI = 0.85–2.07). In moderator analyses, neither age, sex, study quality or pain assessment method influenced pain prevalence.
Conclusion: Clinical pain affects a third of people with schizophrenia and levels are similar with age- and sex-comparable controls. Future research is needed to determine if similar clinical pain prevalences in schizophrenia occur despite having more painful conditions, resulting from under-reporting, higher pain thresholds or lower help seeking behaviours.

1. Introduction

Pain has a deleterious impact upon an individual's health and quality of life. Chronic painful conditions, such as low back pain (LBP) are a leading cause of global burden accounting for a substantial amount of years lived with disability (Murray et al., 2013). A considerable amount of research established that pain is strongly associated with depressive symptoms (Katon et al., 2007; Means-Christensen et al., 2008), yet research considering the association with severe mental illness (SMI)

is less clear. Recently, a meta-analysis involving over 12 million people found that people with bipolar disorder are more likely to experience pain than those without bipolar disorder in the general population (relative risk 2.14; 95% CI = 1.67–2.75, Stubbs et. al, in press). However, to date little attention has been given to clinical pain among people with schizophrenia. This requires consideration, as people with schizophrenia are at an increased risk of experiencing multiple physical comorbidities that can cause pain (Leucht et al., 2007; Mitchell et al., 2009; De Hert et al., 2011a, 2011b). Clinical pain is naturally occurring and is not elicited experimentally or through a medical procedure (e.g., lumbar puncture) and is important because it often drives people to seek medical help and may underlie a potential serious medical ailment (Scherder et al., 2003; Engels et al., 2014). Previous research has demonstrated that people with schizophrenia are less likely to be aware of co-occurring physical comorbidities and are less likely to

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receive subsequent medical treatment (Lord et al., 2010). It remains unclear if this observation extends to clinical pain.

For many years, there have been reports that under experimental conditions, people with schizophrenia have reduced pain sensitivity compared to the general population (Bleuler, 1951; Potvin and Marchand, 2008). However, studies measuring clinical pain have yielded conflicting results. For instance, in a study involving over 2400 people, Strassnig et al. (2003) found that individuals with schizophrenia reported a higher severity of bodily pain than members of the general population. In addition, previous research has demonstrated that most people with schizophrenia who are in pain do not report it (Kuritzsky et al., 1999) and the majority do not get the necessary treatment for their pain (Watson et al., 1981; De Almedia et al., 2013). Recently, Engels et al. (2014) conducted a narrative systematic review and report that people with schizophrenia only appear to have a reduced pain prevalence compared to healthy controls when studies are considered in which pain is stimulated by a medical procedure (e.g., lumbar puncture). While this review is helpful, the authors did not conduct a meta-analysis and they mixed together results from studies of clinically occurring pain and those that stimulated pain via medical procedures (e.g., lumbar acupuncture). Therefore, the overall prevalence of clinical pain in schizophrenia is not known. In addition, it is still unclear if people with schizophrenia have lower levels of clinical pain than members of the general population reported under the same conditions. A formal meta-analysis is required to answer these questions. Further, it remains unclear which factors may influence the prevalence of clinical pain in schizophrenia. For instance, increasing age and female sex have been implicated in the general pain literature (AGS, 2009), but it remains unclear if this extends to people with schizophrenia. In addition, study quality can influence the prevalence of pain, and a moderator analysis is required to investigate the impact of these factors on the prevalence of clinical pain in schizophrenia.

In recognition of the potential for pain to be problematic and potentially under recognised in people with schizophrenia, the study had the following three aims: 1) to establish the pooled prevalence of all-cause and specific-cause clinical pain in people with schizophrenia, 2) to compare the prevalence of clinical pain in people with schizophrenia with that in age- and sex-matched general population comparison groups, and 3) to identify potential moderators of clinical pain in people with schizophrenia.

2. Method

This systematic review was conducted in accordance with the MOOSE guidelines (Stroup et al., 2000) and in line with the PRISMA statement (Moher et al., 2009) following a predetermined protocol.

2.1. Inclusion and exclusion criteria

Studies were eligible that fulfilled the following criteria: 1) Included participants with schizophrenia, diagnosed according to diagnostic criteria (e.g., DSM IV, APA, 2000 or ICD 10, WHO, 1993) either prospectively or retrospectively through medical record review. If we encountered studies in mixed samples with schizoaffective disorder or psychosis, we attempted to extrapolate the variables of interest for people with schizophrenia. If this was not possible, we contacted the research groups to ascertain this information and if we did not receive a response, we included the study only if >80% had a diagnosis of schizophrenia. 2) Reported the prevalence of clinical pain (of any type or location) with or without a healthy comparison group that did not have a mental illness, referred to as the comparison group. We categorised the type of clinical pain where possible according to body location and duration (current pain was that for which the duration was not stated and chronic pain was lasting >3 months).

We excluded studies that reported the prevalence of non-clinical pain, i.e., stimulated by a medical procedure (e.g., lumbar puncture) or

under experimental conditions. We also excluded studies that reported pain as an adverse event of a drug trial (e.g., headache) or reported the prevalence of schizophrenia in a biased sample of patients who all had pain. When we encountered studies that assessed pain in a sample with a continuous measure (e.g., SF 36 bodily pain scale), but did not provide a cutoff to determine the prevalence of pain, we contacted the authors up to two times to obtain this categorical information. If we were not able to ascertain the prevalence of pain, the study was excluded. We did not place any language restrictions upon our searches. When we encountered studies reporting data from the same sample at different time points, we used the most recent data and/or the largest data set.

2.2. Information sources and searches

Two independent reviewers searched Academic Search Premier, MEDLINE, Psychology and Behavioral Sciences Collection, PsycINFO, SPORTDiscus, CINAHL Plus and Pubmed from inception until March 2014. We used the key words 'schizophrenia' or 'schiz*' or 'psychosis' and 'pain*'. A third reviewer conducted additional searches to ensure completeness. In addition, the reference lists of all eligible articles and recent systematic reviews of pain in schizophrenia were screened to assess eligibility of additional studies. Primary/corresponding authors of research groups were contacted where necessary.

2.3. Data extraction

Two authors extracted data using a predetermined form. The data collected from each article included: study design, geographical location, details of schizophrenia participants (mean age, % males), diagnosis method, details of medications and chronicity of illness, and comparison group participant characteristics (mean age, % males). We extracted the prevalence of pain in people with schizophrenia and comparison groups where available. In addition we recorded details of the pain assessment including the method, site, duration, severity and interference of pain with daily activities.

2.4. Methodological quality assessment

Two authors completed methodological quality assessment of included articles using the Newcastle Ottawa Scale (NOS; Wells et al., 2010). Due to the paucity of data, we included studies without a comparison group and considered these as cross-sectional case control studies for methodological assessment in line with a recent review (Stubbs et. al, in press). Studies were given a NOS score ranging from 0 to 9, with a score of 5 or greater being indicative of satisfactory methodological quality. We anticipated that studies without a comparison group would score below this threshold and present their results with due consideration. In addition, in order to examine the influence of methodological quality upon the prevalence rates, we conducted a regression analysis coding results as satisfactory (NOS score >5) and not satisfactory (NOS 0–4).

2.5. Meta-analysis

First, we pooled all-cause and specific-cause prevalence results meta-analytically (Aim 1). Due to the anticipated heterogeneity we pooled individual study data using DerSimonian–Laird proportion meta-analysis (DerSimonian and Laird, 1986) with StatsDirect. Second, we calculated the relative risk to investigate the differences in pain between individuals with schizophrenia and members of the general population (Aim 2). Whenever possible, we conducted subgroup analysis to investigate the prevalence of pain according to the sub-groups of pain classification. In order to assess for heterogeneity we calculated Cochran's Q statistic for each analysis (Higgins et al., 2003). Third, we investigated the influence of moderators on the observed

results (Aim 3). To this end, we conducted meta-regression analyses of continuous variables using a mixed random effects model, examining whether the observed variance was significantly explained by continuous variables, such as mean age of the study sample or the percentage of male participants. In addition, we conducted a logistic meta-regression analysis with categorical data (NOS scores satisfactory vs unsatisfactory, high vs low prevalence of pain based upon the median (i.e., $\geq$40.0% vs. <40.0%)) to examine the effect of these variables on the existing heterogeneity. We also investigated the influence of pain assessment method (self-report vs. clinician recorded/medical records) on the observed result. Finally, we assessed risk of bias with a visual inspection of funnel plots and the Begg–Mazumdar Kendall's tau (Begg and Mazumdar, 1994) and Harbord bias test (Harbord et al., 2006).

3. Results

3.1. Study selection, study and participant characteristics

The initial search yielded 1783 hits. After removal of duplicates, 421 abstracts and titles were screened (Fig. 1). At the full text review stage, 34 articles were considered and 20 were subsequently excluded with reasons, leaving 14 articles that were included in the review. Details regarding the search strategy including reasons for exclusion of articles are summarised in Fig. 1.

Within the final sample, 7 were comparative studies including a control group (Coppen, 1965; Kuritzky et al., 1999; Konig et al., 2007; Gurbuz et al., 2009; Vancampfort et al., 2011a; Birgenheir et al., 2013; Foldemo et al., 2014) and 7 were non-comparative studies (Delaplaine et al., 1978; Watson et al., 1981; Chaturvedi, 1987; Luo et al., 2006; Rajender et al., 2009; Walid and Zaytseva, 2009; de Almeida et al., 2013). The total data set involved 242,703 individuals with schizophrenia and 4,259,221 sex- and age-comparable controls (details in Supplementary Table 1). The mean age of people with schizophrenia ranged from 30.2 years (Watson et al., 1981) to 55.8 (Gurbuz et al., 2009).

3.2. Methodological quality

All seven studies that had a comparison group were satisfactory methodological quality (mean NOS score = 6.8 $\pm$ 0.89). The 7 studies that did not have a comparison group all scored lower than 5 on the NOS, which was attributable to the absence of a comparison group.

3.3. Pain ascertainment and details

Out of different types of pain, the most commonly assessed pain was current clinical pain (6 studies), without specified pain duration (Delaplaine et al., 1978; Watson et al., 1981; Konig et al., 2007; Rajender et al., 2009; Walid and Zaytseva, 2009; Foldemo et al., 2014), followed by chronic pain (lasting >3 months, four studies: Birgenheir et al., 2013; Vancampfort et al., 2011a; Chaturvedi, 1987; de Almeida et al., 2013). A wide range of methods were used to assess pain (Supplementary Table 1). All 14 studies reported on all-cause/non-site specific pain, while 3 studies reported also on the prevalence of headaches (Coppen, 1965; Kuritzky et al., 1999; Birgenheir et al., 2013), each also containing a control group.

3.4. Prevalence of all-cause/site non-specific clinical pain in schizophrenia

The pooled prevalence of clinical pain among 242,703 people with schizophrenia from 14 studies was 34.7% (95%CI = 23.6–46.6; Cochrane Q = 24622, p < 0.0001) (Fig. 2a). The funnel plot was asymmetrical (Fig. 2b), but both the Begg–Mazumdar Kendall's tau (=0.1648, P = 0.450) and Harbord: bias tests (=4.13761, P = 0.768) did not demonstrate any evidence of publication bias.

After removing three studies that measured site-specific pain, the prevalence of clinical pain was 34.4% (95% CI = 22.1–47.9%, N = 11 studies, n = 242,195 individuals). Neither the Begg–Mazumdar: Kendall's tau (= −0.0181, P = 0.87) or Harbord: bias tests (=5.364, P = 0.774) suggested any publication bias.

3.5. Comparing the prevalence of all-cause/site non-specific clinical pain in people with schizophrenia to the comparison group

Comparing the pooled prevalence of clinical pain among 95,511 unique individuals with schizophrenia and 4,259,221 age- and sex-matched controls (7 studies), the pooled RR was 0.99 (95% CI = 0.83–1.19) (Fig. 3). The funnel plot was symmetrical and both the Begg–Mazumdar Kendall's tau (= −0.047619, P = 0.7726) and Harbord-bias tests (= −2.389045, P = 0.290) were non-significant (Supplementary Fig. 1).

3.6. Moderators of all-cause/site non-specific clinical pain in schizophrenia

The prevalence of clinical pain among people with schizophrenia was not related to the mean age (df = 11, t = −1.255, p = 0.2352), percentage of males (df = 9, t = −0.4847, p = 0.639) or the study quality (df = 2, Chi squared = 2.875, p = 0.23). Logistic regression analysis demonstrated that studies reporting high ($\geq$40%) or low (<40%) pain frequencies were not significantly related to the prevalence of clinical pain (overall df = 7, Chi squared = 11.456, p = 0.12). Finally, the type of pain assessment (self-report vs clinician record/medical record) was not significantly related to the prevalence of clinical pain (df = 10, chi squared = 14.47, p = 0.14).

3.7. The prevalence of site-specific clinical pain among people with schizophrenia: headaches

Only 3 studies (Coppen, 1965; Kuritzky et al., 1999; Birgenheir et al., 2013) reported data on headaches among people with schizophrenia. Pooling data from 94,043 individuals with schizophrenia, the pooled prevalence of headaches was 29.9% (95% CI = 3–69%, Q = 175.0, P < 0.0001). There was no evidence of publication bias (Harbord test = 15.948, P = 0.121).

3.8. Comparing the prevalence site-specific clinical pain among people with schizophrenia and the comparison group: headaches

Pooling data from 94,043 people with schizophrenia and 4,248,284 controls yielded a non-significant RR of 1.32 (95% CI = 0.85–2.07), without signs of publication bias (Harbord test = −5.69, P = 0.0674).

4. Discussion

Within this large scale meta-analysis involving 4,501,924 people, we found that a third of people with schizophrenia (34.7%) experienced clinical pain. Pooling the pain data from 7 studies with a general population control group, we did not find a statically significant difference in the prevalence of clinical pain among people with schizophrenia and the age- and sex-matched comparison group (RR = 0.99, 95%CI = 0.83–1.19). Similarly, pooling data from 3 studies and 94,043 people with schizophrenia and 4,248,284 controls, we also did not find a statistically significant difference in prevalence of headache (RR = 1.32, 95%CI = 0.85–2.07).

Clearly, our findings of high and comparable frequencies of pain among people with schizophrenia similar to age- and sex-matched controls are of concern since within the general population painful conditions are a leading cause of global years lived with disability (Vos et al. 2012, Murray et al., 2013). However, the detection, impact and management of clinical pain in schizophrenia have received minimal attention. Previous experimental research
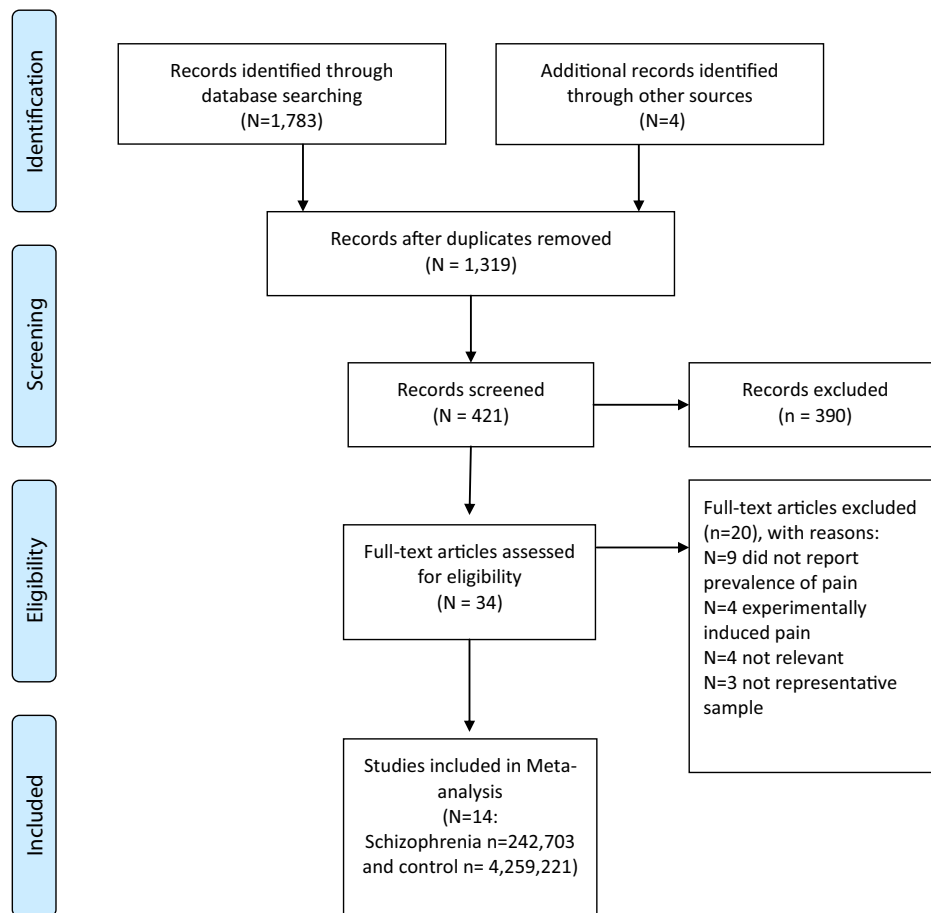
**Fig. 1.** PRISMA 2009 flow diagram for search strategy.

(Potvin and Marchand, 2008; Levesque et al., 2012) demonstrated that people with schizophrenia have a diminished response to painful stimuli, including drug-naïve populations. This is concerning since pain insensitivity in schizophrenia is associated with increased morbidity and mortality (Singh et al. 2006). Considering these experimental results, it is probable that the prevalence of clinical pain established in our study is a substantial underestimate, especially considering the high number of physical comorbidities in patients with schizophrenia (Leucht et al., 2007; De Hert, 2011a, 2011b) and reports of low reporting (Kuritzsky et al., 1999) and help-seeking behaviours (De Hert, 2011b) and underutilization of appropriate medical care (Watson et al., 1981; de Almeidaa et al., 2013).

Moreover, pain is a multidimensional experience with a strong emotional facet. Recent research has demonstrated that people with schizophrenia have a reduced ability to recognise their own pain and that of others (Wojakiewicz et al., 2013). A lack of expression of pain symptoms may lead to under detection and under treatment of pain conditions in persons with schizophrenia. In addition, it is possible that health care providers interpret patients' reports of pain differently when they see that a person has a diagnosis of schizophrenia and, thus, are less likely to assign different pain diagnoses. This lack of medical attention would be consistent with recent research suggesting that providers perceive patients' reports of pain differently based on demographic characteristics (Wandner et al., 2010, 2012). Further, the concern about under recognition of pain conditions in persons with schizophrenia is heightened by findings that their medical care can be fragmented or inconsistent, further contributing to inadequate care for this vulnerable clinical group (De Hert et al., 2011c; Vancampfort et al., 2011b).

Our results extend beyond the recent narrative review of Engels et al. (2014) in several ways. First, our results provided a quantitative confirmation that a third of people with schizophrenia experience clinical pain. Second, we found that there is no significant difference in the prevalence of all-cause clinical pain and of headache in people with schizophrenia compared to controls, at least when using the methods of simple reporting. Third, we investigated potential moderators of clinical pain in schizophrenia that were available within the literature. Finally, we focussed solely on naturally occurring clinical pain and excluded studies in which pain was elicited by a medical procedure that had been mixed into the clinical pain studies in the report by Engels et al. (2014).

Due to the paucity and inconsistency in reporting of potential correlates, we were not able to clearly elucidate the explanatory factors associated with clinical pain in schizophrenia. However, our results suggest that neither age, sex, study quality nor type of pain measurement was a significant contributory factor. We did not have adequate data to investigate the influence of medication. Although antipsychotic medication is known to reduce pain (Seidel et al., 2010), antipsychotics do not appear to be the sole determining factor. This is exemplified by Potvin and Marchland (2008) who conducted a systematic review of experimental studies and found that drug-naïve people with schizophrenia have hypoalgesia and interestingly observed that this phenomenon extended to first degree relatives without any psychopathology (Hooley and Delgado, 2001; Jarcho et al., 2012). The likely mechanism by which pain awareness is altered in schizophrenia is highly complex (Jarcho et al., 2012). It may involve abnormalities in the central dopamine system, leading to a reduced assignment of valence, but it could also be due to the fact that people with schizophrenia have higher basal levels of synaptic
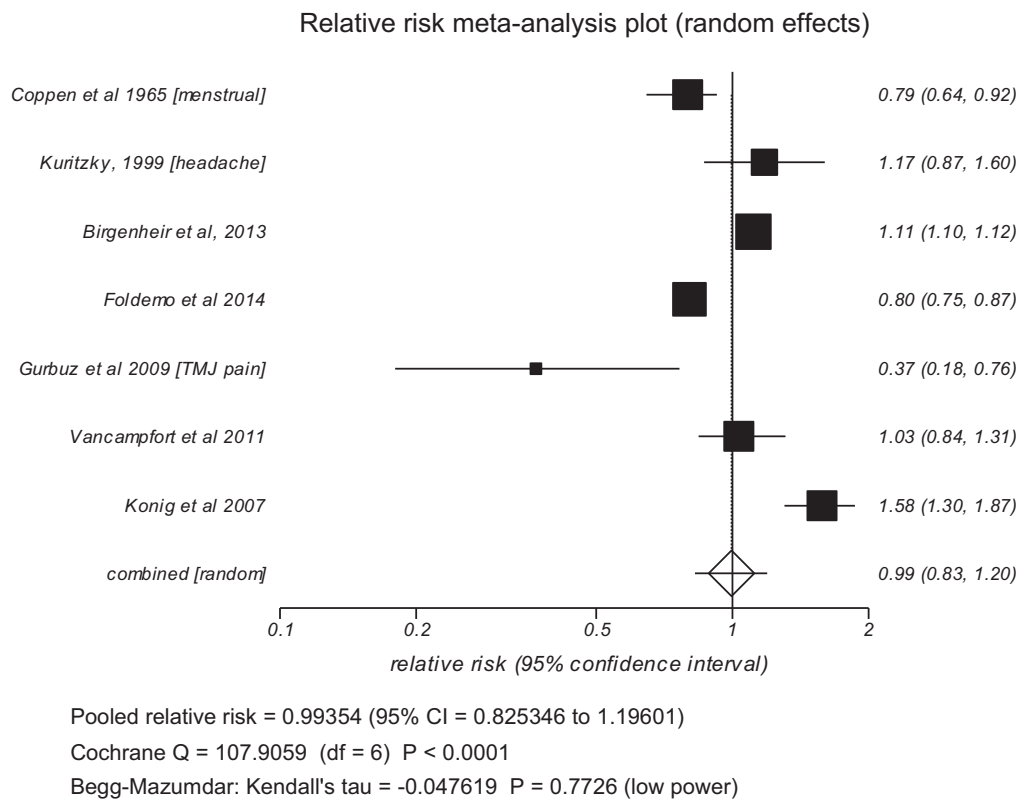
a)
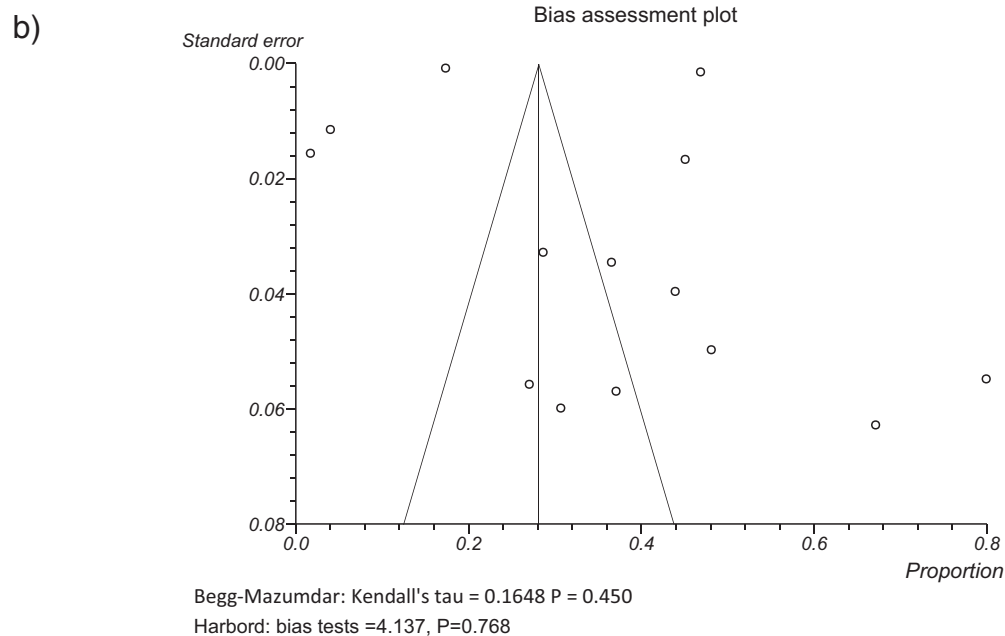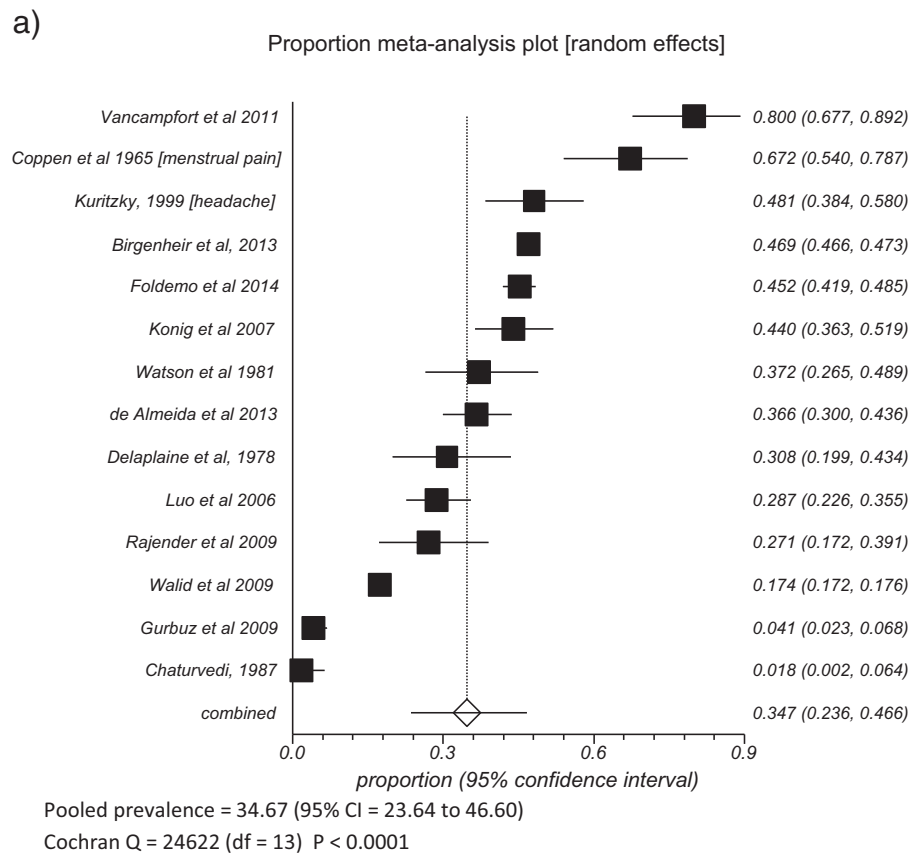
Fig. 2. a: Pooled prevalence of all clinical pain among 242,703 individuals with schizophrenia. Pooled prevalence = 34.67 (95% CI = 23.64 to 46.60). Cochran Q = 24,622 (df = 13) P < 0.0001. b: Funnel plot of main analysis. Begg–Mazumdar: Kendall's tau = 0.1648 P = 0.450. Harbord: bias tests = 4.137, P = 0.768.

striatal dopamine compared to healthy people and exhibit an increased amphetamine-induced striatal dopamine release than controls (Jarcho et al., 2012).

4.1. Clinical implications

The fact that approximately one third of people with schizophrenia experience clinical pain is important, especially when this may be an underestimate. We therefore recommend that identifying patients who currently have or who are at high risk for experiencing pain should be a clinical imperative. A key element to address this point is the training and education of psychiatrists who are in an ideal place to oversee the pharmacological management of pain (Elman et al, 2011; Stubbs et. al, in press). We advocate that systematic assessment of pain should be undertaken as part of the management of patients with schizophrenia and that pain should be monitored during the course of treatment.

Relative risk meta-analysis plot (random effects)

Coppen et al 1965 [menstrual]	0.79 (0.64, 0.92)
Kuritzky, 1999 [headache]	1.17 (0.87, 1.60)
Birgenheir et al, 2013	1.11 (1.10, 1.12)
Foldemo et al 2014	0.80 (0.75, 0.87)
Gurbuz et al 2009 [TMJ pain]	0.37 (0.18, 0.76)
Vancampfort et al 2011	1.03 (0.84, 1.31)
Konig et al 2007	1.58 (1.30, 1.87)
combined [random]	0.99 (0.83, 1.20)

relative risk (95% confidence interval)

Pooled relative risk = 0.99354 (95% CI = 0.825346 to 1.19601)

Cochrane Q = 107.9059 (df = 6) P < 0.0001

Begg-Mazumdar: Kendall's tau = -0.047619 P = 0.7726 (low power)

Fig. 3. Relative risk of clinical pain in people with schizophrenia compared to age and sex matched controls. Pooled relative risk = 0.99354 (95% CI = 0.825346 to 1.19601). Cochrane $Q = 107.9059$ (df = 6) $P < 0.0001$. Begg–Mazumdar: Kendall's tau = -0.047619 $P = 0.7726$ (low power).

The potential benefits of early identification and treatment of pain may not only include a reduction in pain and of its impact on the individual, but may also extend to improvement of mental health outcomes. Knowledge about the factors that are associated with a high likelihood of clinical pain can help identify patients at increased risk. However, according to our moderator analysis, there were no significant differences between men and women, indicating that both sexes require the same attention. In addition, in the current meta-analysis, age did not explain differences in prevalence estimates, indicating that the presence of clinical pain should be a concern across the lifespan.

Previous authors have stipulated that the apparent reduced pain sensitivity and reporting of pain should be a grave concern to clinicians since there may be underlying comorbidities that may be unreported leading to under treatment, thus, predisposing to poor health outcomes (Jarcho et al., 2012). For instance, Jarcho et al. (2012) stated that the absence of pain can mask the need to medical treatment and might actually result in premature mortality. Considering that painful myocardial infarction is a leading cause of death and concern among this group, clinicians should encourage patients to recognise any pain and facilitate treatment. The reduced ability of an individual to express pain does not negate the fact they may be experiencing great discomfort and distress (Bonnot et al., 2009). Recent review evidence suggests that this population has a reduced behavioural reactivity to pain, while there is no clear evidence of any real analgesia due to the illness (Bonnot et al., 2009), hypoalgesia may be possible, at least in subgroups of patients, such as those with severe negative symptoms. However, guidelines have been developed to help the detection of pain in other populations such as dementia (Hadjistavropoulos et al., 2010), in whom pain assessment can be equally challenging. This increased attention to pain assessment and management has led to movements to develop population specific pain scales and appropriate interventions to manage pain. Previous authors have stipulated that it should be the concern of psychiatrists to help detect and manage pain (Elman et al., 2011) and psychiatrists

will have an integral role in the identification and treatment of pain in people with schizophrenia. Antipsychotics have been used to treat chronic headaches, painful joints and diabetic neuropathy with mixed results (Jarcho et al., 2012).

4.2. Limitations

Upon conducting our review, we encountered numerous limitations within the literature that need to be considered when interpreting our results. First, pain was assessed at cross sectional intervals throughout each of the included studies, although and the reporting of pain will likely differ according to the individual's current mental health status. Second, we did not have adequate data to conduct moderator analysis on the influence of psychiatric symptoms on the reporting of pain. Importantly, we did not have adequate data to assess the influence of antipsychotic medications. Overall, the moderator analysis was limited due to the paucity of reported patient and treatment characteristics and inconsistencies in the literature. Therefore, prospective longitudinal studies that assess pain prevalence and severity over time and in relationship to mood and psychotic symptoms and treatments are essential. Third, we encountered a wide range of pain assessment methods and few authors used a validated pain assessment scale. Subsequently, information about the severity, location, variability, and interference of pain during activities was most often lacking. Moreover, only three studies reported on the frequency of site-specific pain and only headache was considered. Fourth, all of the meta-analytic results were substantially heterogeneous. Fifth, we included 7 non-comparative studies that received low methodological quality ratings. However, our subsequent moderator analysis demonstrated that this did not have any influence on the observed results. Finally, within the current design, we were unable to disentangle the possibility of lower pain sensitivity and/or underreporting and under treatment as relevant

factors for the similar pain frequencies found in people with schizophrenia and age- and sex-matched control subjects.

4.3. Future research and directions

It is currently unknown how many patients with schizophrenia have pain issues that are undiagnosed or untreated and what complications may arise as a consequence (including the influence on psychiatric symptoms). Therefore, healthcare providers should pro-actively assess and treat pain. Future studies are needed to better understand health care providers' decision making with regard to the prevention, diagnosis of and, if needed, treatment of chronic pain among people with schizophrenia. Both all-cause and specific-cause/site pain conditions should be assessed and reported on. Future research should also explore the extent to which those with schizophrenia are more or less responsive to physical therapy and pharmacological treatments for pain. We also need to be aware that particular pain conditions may be under-, or over reported by patients and/or under- or over diagnosed by their health care providers. Thus, the present findings require replication using standardized assessments of the psychiatric and pain conditions. Assessments using the same international standardized criteria and formats (AGS, 2009) would partially address these inconsistencies. In addition, clear data on demographic variables (e.g., including socio-economic status) and psychiatric symptoms should be gathered, as these are likely very important. Similarly, future studies should report on the treatments applied for pain or the psychiatric symptoms. It is currently unknown to which extent a particular treatment might influence the prevalence or course of pain conditions.

In conclusion, within this large meta-analysis, we established that clinical pain occurs at an equal prevalence compared to age- and sex-matched controls and affects a third of people with schizophrenia. It is essential that treating psychiatrists seek to provide adequate assessment and treatment of pain in people with schizophrenia. Future research should attempt to understand the underlying factors associated with pain, in particular psychiatric symptoms, and investigate strategies to improve the assessment and management of pain in people with schizophrenia.

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.schres.2014.10.017.

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