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Review

The mortality rate of electroconvulsive therapy: a systematic review and pooled analysis

Tørring N, Sanghani SN, Petrides G, Kellner CH, Østergaard SD. The mortality rate of electroconvulsive therapy: a systematic review and pooled analysis.

Objective: Electroconvulsive therapy (ECT) remains underutilized because of fears of cognitive and medical risks, including the risk of death. In this study, we aimed to assess the mortality rate of ECT by means of a systematic review and pooled analysis.
Method: The study was conducted in adherence with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline. The ECT-related mortality rate was calculated as the total number of ECT-related deaths reported in the included studies divided by the total number of ECT treatments.
Results: Fifteen studies with data from 32 countries reporting on a total of 766 180 ECT treatments met the inclusion criteria. Sixteen cases of ECT-related death were reported in the included studies yielding an ECT-related mortality rate of 2.1 per 100 000 treatments (95% CI: 1.2–3.4). In the nine studies that were published after 2001 (covering 414 747 treatments), there was only one reported ECT-related death.
Conclusion: The ECT-related mortality rate was estimated at 2.1 per 100 000 treatments. In comparison, a recent analysis of the mortality of general anesthesia in relation to surgical procedures reported a mortality rate of 3.4 per 100 000. Our findings document that death caused by ECT is an extremely rare event.

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Key words: electroconvulsive therapy; mortality; safety; mood disorders; psychotic disorders

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Summations

- This systematic review with pooled analysis covered 15 studies with data from 32 countries reporting on a total of 766 180 ECT treatments. Sixteen cases of ECT-related death were reported in the included studies yielding an ECT-related mortality rate of 2.1 per 100 000 treatments (95% CI: 1.2–3.4).
- In the nine studies that were published after 2001 (covering 414 747 treatments), there was only one reported ECT-related death. Thus, the ECT-related mortality rate appears to have decreased over time.
- Our findings document that death caused by ECT is an extremely rare event. This information can be used to reassure concerned parties, including patients in need of ECT and their relatives.

Considerations

- This study only covers the mortality rate of modified ECT (performed under general anesthesia and with muscle relaxation) and not that of unmodified ECT (performed without general anesthesia and muscle relaxation).
- Systematic reviews and pooled analyses are susceptible to biases (e.g., measurement bias, selection bias, and publication bias). However, we have no reason to believe that such biases have affected the results of our study.
- The mortality rate reported in this analysis is likely to be a conservative estimate as eight of the deaths included in our analysis were described as being only plausibly caused by ECT; that is, they could be unrelated to ECT.

Introduction

Electroconvulsive therapy (ECT) was introduced in the 1930s and has remained a highly effective treatment option for severe mood disorders, delirium, and acute and chronic psychoses since then (1–4). Indeed, the results of the clinical studies that have established the efficacy and safety of ECT in specific disorders are among the most robust for any treatment in medicine (5, 6). Despite this solid evidence base, ECT remains feared because of concerns about cognitive and medical risks, including the risk of death (7, 8). Indeed, a British survey indicated that more than 20% of the surveyed individuals from the general population sample reported fear of death as a concern when considering ECT for themselves (8). Therefore, patients in need of ECT often refuse to receive the treatment, with potentially fatal consequences (9).

There are several large reports from various countries documenting the extent of ECT-related mortality (10–12). However, to the best of our knowledge, this literature has not been systematically reviewed to provide a full picture of the magnitude of ECT-related mortality worldwide.

Aims of the study

The scope of this study was to conduct a systematic review and pooled analysis of electroconvulsive therapy-related mortality in adherence with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guideline (13).

Methods

Search strategy and selection criteria

We performed a systematic search of PubMed and Embase to identify all publications reporting quantitative data on ECT-related mortality. The following search terms were used in PubMed: ((("Electroconvulsive Therapy"[Mesh]) OR ("electroconvulsive therapy" OR "ECT" OR "electroshock")) AND (("Death"[Mesh]) OR ("Mortality"[Mesh]) OR ("death" OR "mortality" OR "fatal"))). An equivalent search was performed in Embase using the following search terms: 'electroconvulsive therapy'/exp AND ('mortality'/exp OR 'death'/exp) AND ('article'/it OR 'article in press'/it OR 'review'/it). The search was carried out on August 5, 2016.

The following inclusion criteria were employed in the selection of publications for the review and subsequent pooled analysis:

- To ensure sufficient data quality, only publications from peer-reviewed journals were included.
- To allow for calculation of mortality rates, only publications reporting on the total number of ECT treatments as well as the number of ECT-related deaths were included.
- As ECT performed under general anesthesia and with muscle relaxation (modified ECT) is considered to be best practice, we only included studies reporting on the mortality of modified ECT. Furthermore, only studies reporting on ECT treatment performed from 1970 and onwards were included to reliably reflect modern equipment/practice.
- We did not consider studies on 'intensive ECT' or 'regressive ECT' (ECT given several times per day) as these methods are incompatible with modern ECT practice. Intensive and regressive ECT was predominantly performed in the 1940s to 1960s, and most treatments were unmodified (without general anesthesia and muscle relaxation) (14).
- In accordance with a recent systematic review of anesthetic-related mortality (15), studies were only included if they reported on at least 3000 ECT treatments. This cutoff was chosen to reliably estimate a rare event (death) that occurs in maximum 1 of 1000 cases (ECT treatments) in accordance with 'the rule of three' sample size approximation (16). The inclusion of studies with smaller sample sizes would likely skew the results of the analysis (if cases of death were included in smaller studies due to chance or selection/publication bias).

The abstracts of all identified articles were screened independently by NT and SNS. No language restrictions were employed. In cases where a title or abstract indicated eligibility for inclusion, the full article was obtained and examined to assess whether it met the inclusion criteria outlined above. Furthermore, the references of the included articles were screened for further eligible studies. In cases of doubt regarding eligibility, a consensus decision was reached by all authors of this manuscript. Finally, where necessary, the authors of potentially eligible studies were contacted for clarifications. The ECT-related mortality rates were extracted from the eligible studies in collaboration between NT, SNS, and SDØ.

Definition of ECT-related mortality

We included cases of ECT-related mortality as reported by the authors of the included studies.

Typically, authors considered the two following aspects of causality when defining a death as ECT-related: time of death (during or soon after ECT) and probable ECT-related cause of death (e.g., cardiac arrest or aspiration pneumonia). Cases of suicide were not considered to be causally related to ECT as this would result in confounding by indication (10).

Pooled analysis of the ECT-related mortality rate

The ECT-related mortality rate was calculated as the total number of ECT-related deaths reported in the included studies divided by the total number of ECT treatments. The associated 95% confidence interval (95% CI) was calculated using the method described by Clopper and Pearson (the binomial exact confidence interval) (17). Furthermore, using the same statistical approach, a stratified analysis was performed in which pooled mortality rates from survey-based data (self-report) and register/chart review data (collected systematically), respectively, were calculated separately to determine whether the data collection method biased the mortality rates.

Results

The literature screening/selection process is illustrated in Fig. 1. The searches yielded 791 records in PubMed and 732 records in Embase respectively. After the removal of 176 duplicates, the total search comprised 1347 records.

We first reviewed the titles and abstracts and applied the selection criteria outlined in the methods section. This process led to the exclusion of 1316 records. In the second stage of the screening process, the 31 remaining full articles were read. Twenty articles that did not meet the inclusion criteria were excluded, leaving 11 articles for the review and pooled analysis. Finally, after reviewing the references of the 11 included articles, four further articles were identified, resulting in the final sample of 15 articles for the pooled analysis (see Table 1).

The studies by Laitanantpong (32), Pike et al. (33), Chung et al. (34), Dennis et al. (35), and Olsen et al. (36) were among the studies that were considered for inclusion. We contacted the authors of these articles to determine whether the data from these studies met the inclusion criteria. Unfortunately, these five studies could not be included due to lack of information on the number of treatments given (Laitanantpong), whether treatments were modified or unmodified (Pike et al. and Chung), or due to insufficient/unavailable information on whether the reported deaths were attributable to ECT (Dennis et al. and Olsen et al.). The studies by Damm et al. (37) and

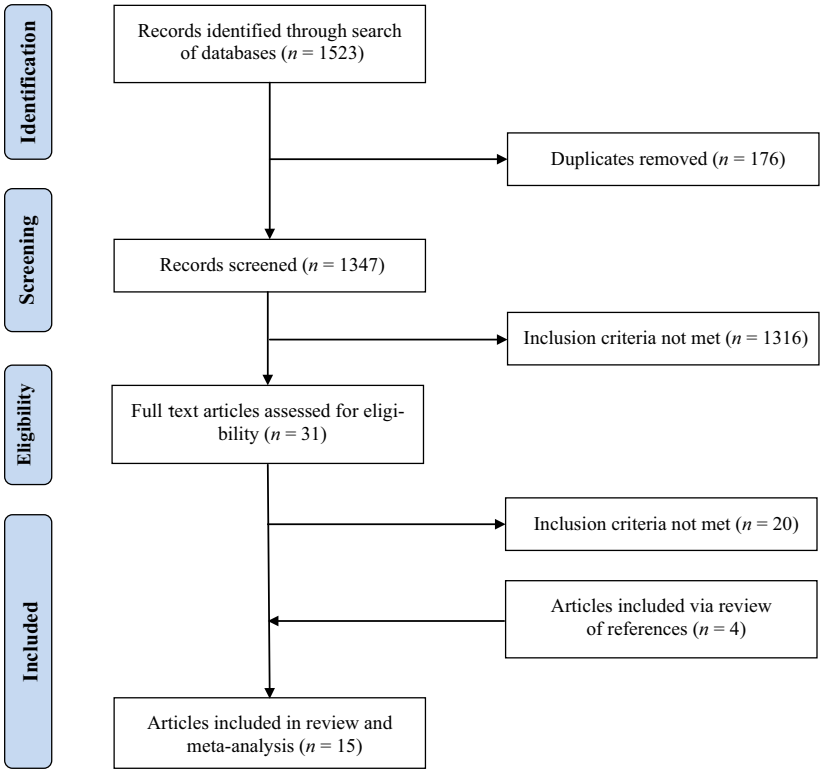

Fig. 1. PRISMA flowchart illustrating the study selection process. [Colour figure can be viewed at wileyonlinelibrary.com]

Table 1. Overview of the studies included in the systematic review and pooled analysis

Authors	Published	Country	Period covered	Method	No. of patients	Patient Characteristics	No. of ECT treatments	No. of ECT-related deaths (and cause/mechanism of these deaths)
Heshe et al. (18)	1976	Denmark	1972–1973	Survey	–	Not available	22 210*	1 ('Described as having doubtful relationship to the ECT' (18)).
Pippard & Ellam (19)	1981	Great Britain	1980–1981	Survey	–	Not available	16 000	4 ('One death occurred during ECT and three others within 72 h of ECT which may therefore have been a contributory cause of death in from 1 in 4000 to 1 in 16 000 treatments' (19))
Kramer (20)	1985	USA	1977–1983	Register	18 627	<1% were aged below 18, 4% aged 18–24, 25% aged 25–44, 34% aged 45–64, 37% aged 65, or above. 69% were females. 93% were White, 3% Hispanic, 3% Black, 1% Asian, <1% Filipino, <1% American Indian	99 425	2 (No details provided)
Galletly et al. (21)	1991	Australia	1981–1985	Chart review	315	38% of the patients were above the age of 55 years. 56% of the treatment courses were assigned for depression, 23% for schizophrenia, 11% for schizoaffective disorder, 4% for mixed/atypical manic-depressive illness, 7% for other diagnoses	3903	None
Kramer (22)	1999	USA	1984–1994	Register	28 437	<1% were aged below 18, 2% aged 18–24, 23% aged 25–44, 25% aged 45–64, 49% aged 65 or above. Female patients received 69% of ECT. 92% were White, 4% Hispanic, 2% Black	160 847	3 (No details provided)
Schiwach et al. (23)	2001	USA	1993–1998	Register	8148	Not available	49 048	5 ('Only one death, which occurred on the same day as the ECT, could be specifically linked to the associated anesthesia. An additional four deaths could plausibly have been associated with the anesthesia' (23))
Nutall et al. (24)	2004	USA	1988–2001	Chart review	2279	Median age = 63 years. 62% were females. The American Society of Anesthesiologists (ASA) status of the patients was: ASA 1 (5%), ASA 2 (38%), ASA 3 (55%), and ASA 4 (2%)	17 394	None
Nothdurfter et al. (25)	2006	Germany	1995–2003	Chart review	455	38.5% had a 'F2' diagnosis (ICD-10†: Schizophrenia, schizotypal and delusional disorders) and 60.5% had a 'F3' diagnosis (ICD-10: Mood disorders). F2: mean age = 47 years. 59% were females. F3: mean age = 55 years, 59% were females	5482	None
Chanpattana (26)	2007	Australia	2002–2004	Survey	7469	<1% were aged below 18, 7% aged 18–24, 26% aged 25–44, 28% aged 45–64, 38% aged 65, or above. 63% were females. 82% suffered from major depression, 10% from schizophrenia, 5% from mania, 2% from catatonia, 1% from dysthymia	58 499	None
Saatcioglu & Tomruk (27)	2008	Turkey	2006–2007	Chart review	1531	1% were aged below 18, 15% aged 18–24, 65% aged 25–44, 18% aged 45–64, 1% aged 65, or above. Mean age = 35 years. 44% were females. 30% suffered from schizophrenia, 30% from mania, 13% from severe unipolar depression, 14% from other nonorganic psychotic disorders, 6% from schizoaffective disorder, 4% from psychoactive substance abuse, 3% from bipolar depression	13 618	None

Table 1. (Continued)

Authors	Published	Country	Period covered	Method	No. of patients	Patient Characteristics	No. of ECT treatments	No. of ECT-related deaths (and cause/mechanism of these deaths)
Chanpattana et al. (28)	2010	23 Asian countries	2001–2003	Survey	–	6% were aged below 18, 30% aged 18–24, 44% aged 25–44, 17% aged 45–64, 4% aged 65, or above. Male–female ratio: 1.56–1. 42% suffered from schizophrenia, 33% from major depression, 14% from mania, 7% from catatonia, 2% from drug abuse, 2% from dysthymia, 1% from other conditions	110 408‡	None
Watts et al. (29)	2011	USA	1999–2010	Register	–	Not available	73 440*	None
Pullen et al. (30)	2011	USA	2001–2009	Chart review	1440	Mean age = 56 years. 95% were white. No information on gender	8518	1§ ('Acute dyspnea after ECT treatment no. 2 . . . Patient died of multifactorial respiratory failure. Cardiogenic pulmonary edema a contributing factor' (30))
Canbek et al. (31)	2013	Turkey	2008–2010	Chart review	3490	Mean age = 35 years. 39% females. 52% suffered from psychotic disorders, 47% from affective disorders, 1% from other disorders	27 660	None¶
Østergaard et al. (10)	2014	Denmark	2000–2007	Register	9327	Not available	99 728	None

*The total number of treatments was estimated by the authors of the respective studies.

†ICD-10 = International Classification of Disease, 10th Revision.

‡Data on ECT treatment were available from 23 countries across Asia. The study reported on a total of 110 408 modified treatments and 129 906 unmodified treatments. There were 3 ECT-related deaths reported in this study—all in patients treated with unmodified ECT (personal communication with the authors).

§This study focused on 'cardiac-related events' in relation to ECT and one death was reported. There was no mention of other deaths, and the corresponding author was unable to provide further information on the population (personal communication). We chose to include the study based on the assumption that other ECT-related deaths would have been mentioned in the paper, had they occurred.

¶The following statement was interpreted as no ECT-related deaths: 'No deaths occurred during ECT sessions, and no severe adverse events such as bone fracture, cardiac arrest, broken teeth, and others were observed' (31).

Baghai et al. (38) were not included as they reported on the same population as the study by Nothdurtfter et al. (25). Similarly, studies reporting on national subsamples (39–41) from the Asian study by Chanpattana et al. (28) were also not included.

The 15 included articles were published in the period from 1976 to 2014 and covered 32 countries from four continents (Asia, Australia, Europe, North America). The number of ECT treatments varied from 3903 to 160 847, and the total number of treatments included in the pooled analysis was 766 180. Nine studies did not report any ECT-related deaths, while five studies reported mortality rates varying from 1.9 (95% CI: 0.4–5.5) per 100 000 (20) to 25.0 (95% CI: 6.8–64.0) per 100 000 treatments (19). The ECT-related mortality rates for the individual studies as well as for the pooled sample (including stratification on survey data vs. register/chart review data) are shown in Fig. 2.

The total number of ECT-related deaths was 16 for the total of 766 180 treatments, yielding an ECT-related mortality rate of 2.1 per 100 000 treatments (95% CI: 1.2–3.4). The mortality rate calculated based on the survey data was 2.4 (95% CI: 0.8–5.6), and the mortality rate based on the register/chart review data was 2.0 (95% CI: 1.0–3.5). Notably, in the nine included studies that were published after 2001 (covering 414 747 treatments), there was only one reported ECT-related death.

We planned to assess the heterogeneity among the included studies using the I^2 method (42), which estimates the fraction of variability between studies that is not attributable to chance alone. However, as the ECT-related mortality rates were either zero or very close to zero in all studies (i.e., homogeneity), we did not pursue this further and concluded that the pooling of data was a reasonable approach. Also, based on the information shown in Table 1, the included studies are largely comparable in terms of the characteristics of the included patients (affective disorders is the most frequent indication for ECT, followed by psychotic disorders; more females than males receive ECT; and the average age of the ECT recipients is relatively high), with exception of the studies from Asia (schizophrenia and other psychotic disorders are the most frequent indications for ECT; more

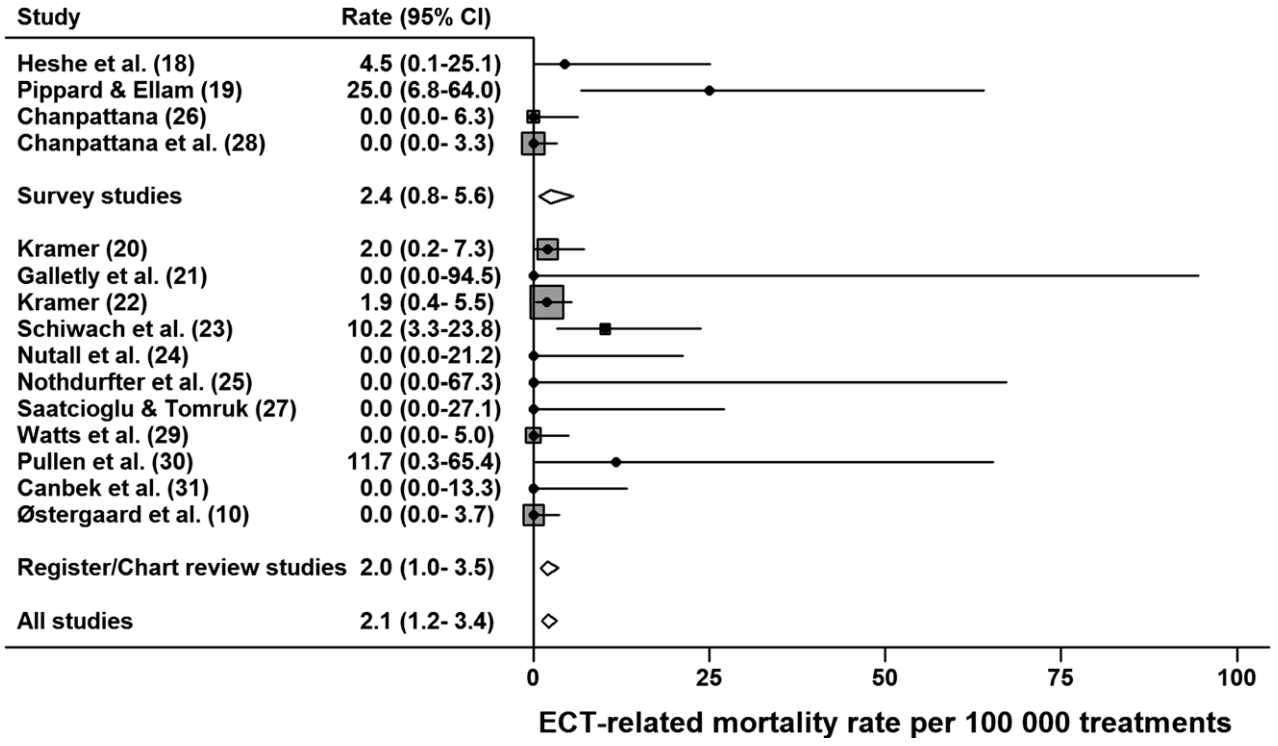

Fig. 2. Forest plot showing the ECT-related mortality rates of the included studies.

males than females receive ECT; and the average age of ECT recipients is relatively low). There were no ECT-related deaths reported in the studies from Asia.

Discussion

This systematic review and pooled analysis quantified the ECT-related mortality rate based on studies covering 766 180 ECT treatments administered over a time span of 40 years in developed and developing countries from four continents. The ECT-related mortality rate was estimated at 2.1 per 100 000 treatments. This mortality rate is likely to be a conservative estimate as eight of the deaths included in our analysis were described as being only plausibly caused by ECT; that is, they could be unrelated to ECT (18, 19, 23). Indeed, the mortality rate for individuals with mental disorders is known to be quite high compared to that of individuals without mental disorders. In a recent population-based study on major depressive disorder (MDD)—a prime indication for ECT—the mortality rate was estimated at 0.048 per year for individuals with MDD compared to 0.013 for individuals without MDD (43). Based on the results from our review and pooled analysis, if we calculated a crude, hypothetical ECT-related yearly mortality rate for an individual receiving ECT three times per week throughout a year (although this many treatments in a year is unrealistically high), it would equal 0.003 (0.000021 deaths per treatment × 3 treatments per week × 52 weeks per year). Thus, it follows that the fraction of the mortality rate in MDD potentially attributable to ECT is extremely low—or that some of the deaths attributed to ECT in this pooled analysis may be misclassified, and rather represent either chance events or consequences of the disorder for which ECT is employed. Lambourn and Barrington (44) address this possibility when discussing the causality between ECT and severe adverse events (including fatalities): 'The probability that these mishaps were related to the depressive state or to the concurrent prescription of antidepressives is emphasized by the observation that one patient scheduled for ECT suffered a fatal myocardial infarction only 2 h before he was due to receive treatment (he had not been given atropine). Another patient suffered a pulmonary embolus the day before she was due to start ECT' (44). Had these two deaths occurred 2 h/one day after ECT instead, they would be highly likely to be (falsely) considered as being caused by the treatment.

A related aspect to consider when interpreting the results of this study is that the association between ECT and death is very likely to be confounded by indication for the following reasons: ECT is often used for patients with mental disorders who cannot tolerate medications due to

cardiovascular or other general medical conditions or for patients with life-threatening disorders such as neuroleptic malignant syndrome (NMS), malignant catatonia, or delirium. Such patients are inherently at a relatively high risk of dying due to their overall disease burden. Therefore, these conditions may act as confounders in the association between ECT and mortality—inflating the mortality estimates of ECT. If such confounding by indication is present, the mortality rate attributable to ECT may be lower than that estimated by our analysis.

It is also worth noting that the ECT-related mortality rate of 2.1 per 100 000 treatments calculated in this study is significantly lower than the 4 per 100 000 treatments reported previously in the selective review by Abrams in 1997 (45). Thus, it appears that the ECT-related mortality rate has decreased over time. This notion is further supported by the fact that in the nine studies from this review that were published after 2001 (covering 414 747 treatments), only one ECT-related death was reported. There are several likely reasons for the observed decrease in ECT-related mortality over time; the most important probably being that the safety of general anesthesia, a fundamental part of modified ECT, has increased significantly during this period. In a recent review, Bainbridge et al. (15) showed that the mortality rate associated with general anesthesia in relation to surgery has decreased significantly over the past decades from 5.2 per 100 000 in the 1970s–1980s to 3.4 per 100 000 in the 1990s–2000s, despite concomitant increases in American Society of Anesthesiologists (ASA) risk status and complexity of the patients. This indicates that the reduced mortality is not due to patient selection but rather due to actual improvement in the anesthetic procedures, which has probably also reduced the mortality of modified ECT.

Another potential explanation for the reduced ECT-related mortality over time was suggested by Fink: 'Death rates are lower in the more recent studies than in the older. Perhaps, the difference in incidence may be related to the use of curare as a muscle relaxant and the frequency of "missed seizures" in the earlier treatments' (46). Curare has been replaced with a safer drug, succinylcholine, and missed seizures, which increase the risk of bradyarrhythmias, are now more easily identified through electroencephalogram (EEG) monitoring. It is quite likely that these factors have also contributed to the reduced mortality, but due to incomplete data on the anesthetic procedures (including muscle relaxant drugs) and seizure monitoring by EEG employed in the included studies, we were unable to subject this hypothesis to empirical testing.

While this systematic review focused exclusively on modified ECT, we noticed that the mortality rates reported for unmodified ECT (without anesthesia and muscle relaxation) were also low (28, 47). However, in a study reporting mortality rates for a very large number of both unmodified (n = 110 408) and modified (n = 129 906) ECT treatments across 23 Asian countries, there were three cases of death related to unmodified ECT and no cases of death related to modified ECT (28). There may be many factors contributing to this finding, which are not direct consequences of the differences between unmodified and modified ECT per se (e.g., coincidence, report bias, unmodified ECT, staff being less trained/experienced in resuscitation), but it is also possible that unmodified ECT in itself is associated with higher death rates than modified ECT. Subjecting that hypothesis to empirical testing in a randomized controlled study is probably not possible for ethical reasons (if modified ECT is available in a trial, the possibility of being randomized to unmodified ECT can rightfully be considered as unethical) and statistical power (e.g., hundreds of thousands of patients would need to be randomized to allow for detection of differences in mortality rates between the two treatment arms). Also, it seems that institutions using unmodified ECT are mainly doing so because it is not feasible to conduct modified ECT due to constraints on time (unmodified ECT takes significantly less time to administer compared to modified ECT), and/or staff (anesthesiologists in particular) and/or funding. In other words, institutions using unmodified ECT would readily change to modified ECT if they were relieved of these constraints (48).

There are a number of limitations to consider when interpreting the results of our analyses. Most importantly, this type of study is sensitive to biases, of which measurement bias, selection bias, and publication bias may be of particular relevance in regard to this specific effort. Measurement bias occurs when the assessment of the study outcome is skewed. In this study, such a bias could have occurred if cases of death are either systematically over- or under-attributed to ECT in the included studies. In our review of the included data, we noted that the definition of ECT-related death was not the same for all of the studies and not always clearly defined (18, 20, 22, 26, 29, 40). Therefore, a measurement bias may have occurred, but determining the direction of such a bias (whether death has been systematically over- or 'under-attributed' to ECT) is not possible based on the data at hand. Selection bias may also affect the results of our

study as some of the included studies report mortality rates based on surveys (as opposed to register/chart review-based data) with varying response rates from the targeted treatment sites (18, 26, 28). If treatment sites with substantial ECT-related mortality rates have not replied to the survey (self-selection), it will have caused bias. As data on survey non-responders are not available, we cannot determine whether such a bias exists. However, as shown in Fig. 2, the mortality rates calculated based on the survey data and the register/chart review data, respectively, were virtually identical, which indicates that such a bias is absent. Furthermore, although our search of the literature was quite broad (1347 records were screened), we may have missed relevant publications in our review. However, if this has indeed occurred, it is most likely to have happened at random and will therefore not have caused bias. Finally, we cannot exclude that publication bias affects this systematic review. This will have occurred if studies on ECT-related mortality conveying a particular type of result, for example, high mortality rates, have been less likely to be published for various reasons. It is not possible to determine whether such a bias exists.

Another aspect to consider is that the studies in this review have generally included unselected ECT populations encompassing young and old, as well as those with or without somatic comorbidities. It is therefore worth noting that ECT is generally also considered to be safe in adolescents (49, 50), the elderly (51–53), the pregnant (54–57), and individuals with cardiovascular disease (58–61), pulmonary disease (58, 62, 63), and intracranial masses (64, 65).

The risk of ECT (or any other medical procedure requiring general anesthesia) is higher in patients with a large burden of general medical comorbidity. Patients with grave general medical and psychiatric illness are sometimes offered ECT even when it is clear that the risk of complications or death is much higher than in a general medically healthy cohort. It is possible that a small number of ECT-related deaths in such patients have not been reported in some of the studies (for instance, the survey-based studies) included in this review. However, we have no reason to believe that this has biased our results significantly, as witnessed by the practically identical pooled ECT-related mortality rates calculated based on the survey data and the register/chart review data respectively.

It is reasonable to conclude that this study demonstrates that the ECT-related mortality rate is extremely low. It therefore provides further evidence that the widespread fear of electrocution or death by other causes in relation to ECT (7, 8) is unjustified. Also, when discussing the mortality associated with a specific medical procedure, it is absolutely essential to consider the mortality associated with not employing the procedure. In the case of ECT, the mortality of the conditions in which the treatment is used is substantial. Three prominent examples are mood and psychotic disorders with severe suicidal ideation (66, 67), catatonia (11), and delirium (68, 69). For all of these conditions, ECT has a rapid and potentially life-saving effect (1, 3, 11, 12). Indeed, it is quite certain that the mortality of not receiving ECT when the treatment is indicated (9) far exceeds the ECT-related mortality, which these data demonstrate, is extremely low. It is our hope that this message can offer reassurance to patients in need of ECT and their relatives, as well as the general public.

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Declaration of interest

NT, SNS, and SDØ declare no conflict of interests. GP reports grants from NIMH and support for clinical trials from St. Jude Medical, Alkermes, Lundbeck, Proteus, and the Stanley Foundation. CHK reports grants from NIMH and personal fees from UpToDate, Psychiatric Times, Northwell Health, and Cambridge University Press. In addition, CHK has a patent for a foam bite block for ECT.

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