Electroconvulsive practice in Singapore: a cross-sectional national survey

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ABSTRACT

Introduction: The use of electroconvulsive therapy (ECT) in Singapore dates back to 1947. However, there is little local information on the clinical practice of ECT and its standards. We aimed to conduct a comprehensive national survey of ECT practice in Singapore.

Methods: A cross-sectional structured questionnaire assessing the types of ECT (e.g. electrode placement, stimulus parameters), indications, anaesthetic technique, dosing methods, monitoring of outcomes and credentialing was sent in 2015 to all ECT centres in Singapore via email to collect qualitative and quantitative data regarding ECT.

Results: Data was obtained from all ECT centres (n = 6), which represented ECT available in 23.1% of all hospitals and 50.0% of all psychiatric specialist centres. The rate of ECT was 5.89 treatments/10,000 residents per year and each patient received an average of 5.4 ECT per course. Only 7.0% of ECT was administered for continuation/maintenance ECT. The most common indication for ECT was depression (83.3%), with schizophrenia being the second most common. 83.3% of ECT was brief (0.5 ms) bitemporal ECT with age-based dosing, and 93.0% were conducted in an inpatient setting. All ECT were conducted under general anaesthesia, with propofol (66.8%) being the most common type of anaesthetic used.

Conclusion: The practice of ECT in Singapore was highly uniform. The rates and indications for ECT were consistent with other developed countries, with more use for schizophrenia. Future advances for ECT in Singapore include the use of individualised dosing based on empirical seizure threshold titration, expanded electrode placements and increased utilisation of continuation/maintenance ECT.

Keywords: ECT, electroconvulsive therapy, practice, Singapore, survey
INTRODUCTION

Electroconvulsive therapy (ECT) is a safe and effective treatment for mood disorders\(^1,2\) and schizophrenia.\(^3\) The mechanism of ECT is not completely understood, but is likely to involve changes in cerebral noradrenaline, serotonin and dopamine activities, permeability of the blood-brain barrier and neurogenesis.\(^4\) Common side effects include headache, myalgia and transient cognitive impairment,\(^5\) with an estimated mortality rate of 2.4 per 100,000 treatments.\(^6\) Many surveys have been conducted in several countries and regions worldwide, reflecting that ECT practice is highly heterogeneous.\(^7\) For instance, in Europe and Australia,\(^8-11\) ECT is primarily used for the treatment of depression, while in Asia, it is also frequently used for psychotic disorders\(^12-15\) and high suicide risk.\(^16\) The USA and most Asian countries use bitemporal ECT,\(^7,17-20\) while in Europe and Australia, the most prevalent electrode placement is right unilateral.\(^7,21\) While this information is valuable, specific data on ECT parameters (e.g. pulse width), anaesthetic technique, methods of dosing, monitoring of ECT outcomes and credentialing is still lacking. For this reason, we developed a questionnaire exploring detailed information about ECT practice. This survey was conducted in Singapore to provide insights into current ECT practice and identify areas for future clinical improvement.

Singapore is a small nation state at the tip of the Malaysian archipelago. It has a population of approximately 5.5 million people consisting of 74.3% ethnic Chinese, 13.3% Malays and 9.1% Indians. The average per capita gross domestic product in 2015 was USD 53,947.93.\(^22\) The lifetime prevalence of depression in Singapore is 5.8%, with a 12-month prevalence of 2.2%\(^23\) and mean annual cost of treatment at USD 7,638.\(^24\) Treatment of depression is estimated to give a 5.7-to-1 benefit-to-cost ratio.\(^25\) While equivalent figures for schizophrenia are not available in Singapore, it is widely accepted that the economic burden
of schizophrenia is significant, which is estimated between 0.02% and 1.65% of gross domestic product.\(^{(26)}\)

ECT is a highly effective short-term treatment for depression and should be considered for patients who have not responded to standard antidepressant therapy.\(^{(27)}\) There are currently 26 general hospitals and specialist centres of which 12 offer specialist psychiatry services.\(^{(28)}\) ECT was introduced in Singapore in 1947.\(^{(29)}\) However, since then, ECT practice has been little studied. General Asian surveys on ECT practice have included data on Singapore.\(^{(18,30,31)}\) These studies suggest that the usage of ECT for schizophrenia in Singapore was decreasing from 2000 to 2009 and that continuation ECT was performed by some centres in Singapore. Another survey published in 1992 examined the medicolegal implications of ECT practice in Singapore in a particular hospital.\(^{(32)}\) However, despite seven decades of ECT practice, specific data at a national level on the matter remains insufficient to guide further development of ECT services and policy in Singapore.

**METHODS**

A structured, detailed questionnaire, containing 54 questions (Appendix), was developed by two experienced ECT practitioners and researchers. The questionnaire was emailed to all ECT centres in Singapore (private and public) in 2015 and addressed to the head of department or head of ECT unit in these six public and private Singapore hospitals and specialist centres. Data was provided by one clinician per centre after conducting an audit of ECT data at five of six sites. Data collection lasted approximately six months. Hospitals were identified through inquiries to the Singapore Psychiatric Association and College of Psychiatrists (CPsych), Academy of Medicine, Singapore.

The questionnaire enquired about ECT governance, prescription, application (types of ECT – electrode placement and pulse width), anaesthesia technique, initial and subsequent
ECT dosing methods, clinical monitoring, clinical indications, ECT rates, continuation/maintenance ECT, and credentialing and privileging in 2015.

Descriptive analysis of the data was performed using IBM SPSS Statistics version 21 (IBM Corp, Armonk, NY, USA).

RESULTS
Six centres were surveyed and a 100.0% response rate was seen. This represented availability of ECT in 23.1% of medical facilities in Singapore and 50.0% of psychiatric specialist facilities.\(^{(33)}\) A total of 3,264 sessions of ECT were done for 602 patients in 2015. Among these, 3,034 sessions were inpatient acute sessions and 230 sessions were outpatient maintenance ECTs for 98 patients. This gave a treated person rate (TPR; defined as number of persons treated with ECT per 10,000 resident population per year) of ECT at 1.09/10,000 resident population per year in a country of 5.54 million residents.\(^{(34)}\) Each patient received an average of 5.4 sessions of ECT. There was a wide variation in the number of patients treated with ECT and number of ECT sessions conducted at each centre, with the largest centre performing 64.5% of all ECTs in Singapore. The other centres performed 17.9%, 6.9%, 5.1%, 4.2% and 2.5% of the ECT sessions. The largest centre had approximately 1,900 inpatient psychiatric beds while the other centres had 10–24 inpatient psychiatric beds each. The number of patients per centre ranged from 14–413 and the number of ECT sessions annually ranged from 81–2,072. Continuation/maintenance ECT was done at four centres, with the number of patients and sessions ranging from 1–93 and 9–204, respectively.

The two main indications for ECT were treatment-resistant depression (50.0% non-melancholic unipolar depression and 50.0% melancholic/psychotic unipolar depression) and treatment-resistant schizophrenia. Five of six centres (83.3%) reported depression as the main indication, with the remaining centre (also the largest ECT centre) reporting schizophrenia as
the main indication. Other indications for ECT included mania, schizoaffective disorder, catatonia and neuroleptic malignant syndrome. Diagnosis was made by clinicians using either the DSM IV-TR/DSM V or ICD 10 criteria. ECT was performed on adolescents aged 13 years and over in two centres and all centres offered ECT to both adult and geriatric populations. All patients were on concomitant psychotropic medication at the time of ECT.

There were formal processes for the credentialing of doctors who could prescribe ECT for all but one centre, the most common being holding qualifications as a psychiatrist (83.3%). All centres had formal credentialing procedures for doctors who administered ECT either requiring attendance at a formal ECT training course (66.7%) or holding qualifications as a psychiatrist (50.0%). ECT was administered by a mixture of psychiatrists (50.0%), psychiatry trainees and psychiatry medical officers (50.0%). Medical officers were fully registered medical doctors without postgraduate psychiatric qualifications.

The most common type of initial ECT dosing (83.3%) was age-based dosing (half age, full age, age-10 or suprathreshold method), with only two (33.3%) site using empirically derived seizure titration (Table I). The most common form of ECT prescribed was bitemporal ECT given with a brief pulse (83.3%, bitemporal 0.5 ms). Other forms were used only by a few hospitals (Table II). Subsequent ECT dosing was generally increased by 5%–10% machine energy, if the electroencephalogram quality decreased or the patient was not responding to treatment, using a combination of patient response, seizure quality and seizure duration. This was determined based on the ECT practitioner’s individual experience and clinical assessment. ECT was generally prescribed as a fixed number of treatments, generally 6 or 12 sessions (50.0%) thrice weekly (100.0%).

<table>
<thead>
<tr>
<th>Variable</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General information</td>
<td></td>
</tr>
<tr>
<td>General hospital</td>
<td>5 (83.3)</td>
</tr>
</tbody>
</table>

**Table I. ECT practice in ECT centres (n = 6) in Singapore.**
<table>
<thead>
<tr>
<th>Psychiatric hospital</th>
<th>1 (16.7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public</td>
<td>5 (83.3)</td>
</tr>
<tr>
<td>Private</td>
<td>1 (16.7)</td>
</tr>
<tr>
<td>No. of beds (psychiatric and non-psychiatric)</td>
<td>$1.225.8 \pm 549.2$ (345–1,900)</td>
</tr>
</tbody>
</table>

**ECT dosing**
- Titration method: 2 (33.3)
- Age-based: 4 (66.7)
- Suprathreshold: 1 (16.7)

**Increase in ECT dosing was based on**
- Seizure duration: 4 (66.7)
- Seizure quality: 5 (83.3)
- Clinical response: 5 (83.3)

**Main indication for ECT**
- Medication failure: 5 (83.3)
- Suicide risk: 1 (16.7)
- Aggression/agitation: 0 (0)
- Poor oral intake: 0 (0)
- History of good response to ECT: 0 (0)
- Patient preference: 0 (0)
- Medication intolerance: 0 (0)

**ECT population**
- Patient age (yr)
  - < 12: 0 (0)
  - 13–17: 2 (33.3)
  - > 65: 6 (100.0)
- Pregnant: 2 (33.3)

**ECT schedule**
- Twice weekly: 0 (0)
- Thrice weekly: 6 (100.0)
- < 6 sessions: 1 (16.7)
- 6–9 sessions: 4 (66.7)
- 10–12 sessions: 1 (16.7)
- > 12 sessions: 0 (0)

**How many sessions before ECT was considered ineffective?**
- 5: 1 (16.7)
- 6–9: 3 (50.0)
- 9–12: 2 (33.3)

**When was ECT stopped?**
- After fixed number of sessions: 3 (50.0)
- After patient recovered: 3 (50.0)

**ECT outcome monitoring**
- After every ECT session: 6 (100.0)
- > Once weekly: 0 (0)
- < Once weekly: 0 (0)

**Continuation/maintenance ECT**
- Flexible schedule: 1 (16.7)
- Fixed schedule: 4 (66.7)
ECT credentialing

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Prescriber</td>
<td>5 (83.3)</td>
</tr>
<tr>
<td>Practitioner</td>
<td>6 (100.0)</td>
</tr>
</tbody>
</table>

*Data presented as mean ± standard deviation (range). ECT: electroconvulsive therapy

<table>
<thead>
<tr>
<th>ECT electrode placement and pulse width</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Right unilateral brief pulse width</strong></td>
<td></td>
</tr>
<tr>
<td>1 ms</td>
<td>2 (33.3)</td>
</tr>
<tr>
<td>0.5 ms</td>
<td>1 (16.7)</td>
</tr>
<tr>
<td>0.25–0.3 ms</td>
<td>1 (16.7)</td>
</tr>
<tr>
<td><strong>Bitemporal brief pulse width</strong></td>
<td></td>
</tr>
<tr>
<td>1.0 ms</td>
<td>2 (33.3)</td>
</tr>
<tr>
<td>0.5 ms</td>
<td>5 (83.3)</td>
</tr>
<tr>
<td>0.25–0.3 ms</td>
<td>0 (0)</td>
</tr>
<tr>
<td><strong>Bifrontal brief pulse width</strong></td>
<td></td>
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<tr>
<td>1.0 ms</td>
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</tr>
<tr>
<td>0.25–0.3 ms</td>
<td>0 (0)</td>
</tr>
</tbody>
</table>

ECT: electroconvulsive therapy

The primary anaesthetics used were propofol (66.8%) and thiopentone (33.3%), although ketamine, remifentanil and etomidate were used as well by one centre. All centres used succinylcholine with anaesthesia. All anaesthesia was given by a consultant anaesthetist or an anaesthesia trainee under supervision by a consultant.

Pre-ECT assessments were fairly uniform across the centres, with full blood count, renal panel, electrocardiography and chest radiography being routinely ordered. All centres monitored patients’ blood pressure, pulse rate, electrocardiogram and electroencephalogram during the ECT procedure, with one centre doing carbon dioxide monitoring and electromyogram monitoring as well. Cognitive and efficacy rating scales were used in 83.3% (n = 5) and 66.7% (n = 4) of centres, respectively.

All ECTs were done using the Thymatron system IV. 50.0% of the ECTs were conducted in a dedicated ECT facility, with the rest being performed in a general operating theatre recovery room. All centres offered ECT on an inpatient basis although outpatient ECT
was available at 50.0% (n = 3) of the centres. 66.7% (n = 4) of centres offered maintenance ECT; involuntary ECT was also available in 66.7% (n = 4) ECT centres.

**DISCUSSION**

The present ECT survey provided cross-sectional detailed information on ECT practice in Singapore in 2015. The main strengths of this survey included complete responses from all ECT centres in Singapore and the eliciting of detailed information about the types of ECT provided, anaesthesia used, dosing strategies, ECT monitoring, credentialing and rates.

ECT was first performed in Singapore at the Institute of Mental Health (IMH). Dr James Brown is credited with bringing ECT to Singapore in 1947 at the IMH (then called Woodbridge Hospital). In 1949, 5,220 ECT treatments were delivered to 420 patients at the IMH, most of whom had schizophrenia. It was reported that 130 patients were discharged with a recovery rate of 30.9%. The absolute number and TPR of ECT has fallen significantly since 1949, when the resident population was estimated at 940,824, giving a TPR of 4.46, which is almost four times higher than that in 2015, which was 1.09.

The current TPR in Singapore is in the lower range of those reported from other developed countries, such as the USA (range 2.39–5.1), Australia (range 1.6–4.4), Norway (range 2.4–4.3) and Belgium (range 4.3–4.7). This decrease in Singapore ECT TPR parallels the worldwide decrease in ECT usage after the advent of chlorpromazine for schizophrenia, combined with the stigma associated with physical treatments in psychiatry (e.g. lobotomy), which came with connotations of coercion and infringement of human rights in the period between the 1960s and 1980s. The past 50 years have seen significant advances in psychopharmacology that have offered alternative treatments to ECT. This global trend may have reached Singapore, as seen in the similar attitudes of Singapore psychiatrists towards the usefulness of ECT for depression and schizophrenia as other
psychiatrists in the world. In the year 2000, only 40% of Singapore psychiatrists believed ECT was useful for schizophrenia and 59% felt it was useful for depression.\(^{38}\)

ECT has been mostly practised as an inpatient procedure in Singapore despite evidence that it can be done safely and effectively as an outpatient procedure.\(^{39,40}\) One consequence of this is that newer psychiatric departments that did not have inpatient wards also discarded ECT, as it was largely regarded as an inpatient procedure. Personal conversations with clinicians in the newer specialist psychiatric centres also reveal the perceived lack of need for ECT as a treatment modality when psychiatric practice is outpatient-focused. This initial perception is slowly evolving with some of the newer psychiatric units establishing formal relationships with ECT centres to provide ECT to their outpatients. This has limited access to ECT for increasing numbers of psychiatric patients due to the difficulties involved in transferring care to a facility with ECT capability as well as psychiatrists tending not to prescribe or consider treatment that is not available at their own centre. In Singapore, only the more established psychiatric departments have ECT facilities and the three newest public psychiatric departments in Singapore did not have ECT capabilities at the time of study.

For several decades, there was little variability in ECT practice (age-based bitemporal ECT). This changed in 2015, when seizure titration-based right unilateral treatment was introduced in two centres and empirically based seizure titration introduced in one centre, suggesting that ECT practice had spread from the IMH to the more established psychiatric departments starting in the 1980s and stayed constant in the ensuing decades. While age-based ECT is known to result in higher ECT doses\(^{41,42}\) and have more cognitive side effects than ECT dosing based on empirically derived individual patient seizure thresholds,\(^{43}\) it was traditionally considered an effective and acceptable form of ECT, especially for bilateral electrode placements\(^{44,45}\) and easier to implement than seizure titration-based ECT
methods.\(^{44}\) In Singapore, a majority of ECT sessions has been performed using age-based strategies. This is probably a reflection of the perceived ease of use of age-based protocols and the absence of specialists trained in titration procedures. One possible consequence of this is the relatively low level of continuation/maintenance ECTs, with only 7% of ECTs conducted for continuation/maintenance ECT in our study. Continuation/maintenance ECT is uncommon in Asia,\(^{7}\) despite good evidence of its efficacy for patients\(^{46}\) who fail maintenance pharmacotherapy.

Approximately 63.5% of the ECT sessions in Singapore were conducted in one centre (with 1,900 beds), which is the largest psychiatric hospital in the country. The next busiest centre provided 17.9% of ECT sessions despite having only 12 beds. The largest ECT centre was at a tertiary psychiatric institute that served as a referral site for the most severe cases of psychiatric disorders and the second largest site was the only private inpatient psychiatric ward that serves about a third of the psychiatrists in Singapore who were in private practice. The tertiary referral nature of the private psychiatric ward may account for the relatively high rates of ECT in that centre. This observation is consistent with recent evidence that in developed countries, ECT is preferentially available in private settings for non-minority patients with insurance coverage.\(^{47}\) Approximately half of the ECT at the largest centre was done for schizophrenia while the other centres primarily used ECT for the treatment of depression. This may reflect the development of mental health services in Singapore, wherein the National Mental Health blueprint\(^{48}\) focused care for psychotic disorders in the largest psychiatric centre in Singapore for effective use of limited resources and improved care for psychotic disorders, thus leading to a higher percentage of patients with schizophrenia in this centre. This would suggest that almost one-third of ECT in Singapore was performed for the treatment of schizophrenia, a figure that is much higher than of other developed countries\(^{7}\) but in line with other Asian countries.\(^{18}\) One reason for this is the potential effectiveness of
ECT for treatment-resistant schizophrenia\(^{(3,49)}\) and the lack of onerous legal barriers for patients with schizophrenia accessing ECT care\(^{(32)}\) that are faced in other developed countries.\(^{(50)}\) There is no specific legislation distinguishing ECT from other psychiatric treatment, and its involuntary application is governed by the Mental Health (Care and Treatment) Act,\(^{(51)}\) which states, *inter alia*, “A designated medical practitioner at a psychiatric institution who has examined any person who is suffering from a mental disorder and is of the opinion that he should be treated, or continue to be treated, as an inpatient at the psychiatric institution may at any time sign an order for the admission of the patient into the psychiatric institution for treatment; or in the case of an inpatient, for detention and further treatment of the person.”

Outside of the psychiatric institution, ECT can be prescribed in the patient’s best interest by the treating psychiatrist and with the relative’s consent, if the patient is assessed to lack capacity regarding ECT treatment. The principles of patient’s best interest are described in the Singapore Mental Capacity Act,\(^{(52)}\) which are essentially that a patient is assumed to have capacity unless it is established otherwise, and that the patient’s past and present wishes, feelings, beliefs and values are taken into account when considering what is in the patient’s best interest. ECT provided under conditions where patients lack capacity has been shown to be effective.\(^{(53)}\)

The method of ECT prescription is fairly consistent with half of the centres prescribing a fixed number of ECT sessions (range 6–9) and only 7.0% of all ECTs being done as maintenance ECT despite growing evidence that maintenance ECT is useful for preventing relapse.\(^{(54-56)}\) There is high variability in the average number of ECT sessions prescribed around the world, ranging from 22 in Sweden\(^{(57)}\) to 1 in Africa.\(^{(58)}\) In Asia, the average number of ECT sessions prescribed is 6–8 treatments.\(^{(7)}\) This high variability in the average number of ECT sessions prescribed is unlikely to result from differences in the
profiles of illness or patient characteristics between different geographical areas and may instead be related to differences related to resources or practice. Such variability may reflect both over- and under-treatment of patients, unless patient response is taken into account. Treatment guidelines, such as the American Psychiatric Association Task Force report on ECT,\(^{(59)}\) recommend prescribing ECT treatments based on clinical response within a range of ECT sessions rather than a fixed number of ECT sessions. Similarly, different treatment guidelines\(^{(60,61)}\) have different approaches towards pre-ECT investigations, such as chest radiography, which is uniformly performed prior to ECT for patients aged above 40 years in Singapore. The use of anaesthesia, in our study, was restricted to propofol or thiopentone, which is consistent with the practice in most of Europe and Australia.\(^{(31)}\)

Depression is a significant predictor for elderly suicide in Singapore.\(^{(62)}\) This earlier study showed that all ECT centres in Singapore offered ECT to patients above 65 years of age. This was salutary, as ECT is a highly effective treatment for geriatric depression\(^{(63)}\) despite the higher incidence of cardiovascular diseases in depressed geriatric patients, which may confer a higher anaesthetic risk during ECT. Such patients should have a full medical assessment to assess for fitness for ECT.

Our study was not without limitations. Data was gathered via a survey completed by the lead clinician at each site and hence data at the individual patient level was unavailable. Demographic details of the patient population were thus not included. Opinions of the authors regarding ECT in Singapore are also not reflective of the official positions of professional psychiatric bodies in Singapore.

In Singapore, the challenges for ECT moving forward will include maintaining access to ECT for patients, noting that newer psychiatric departments lack ECT services, the use of more continuation/maintenance ECT, the use of consistent formal rating scales to document the effectiveness and cognitive side effects of ECT, and expanding the types of ECT
available to patients beyond age-based bitemporal ECT to the use of empirically derived seizure titration methods to optimise the efficacy and side effect profile of ECTs. A Section of Neurostimulation under CPsych, Academy of Medicine Singapore, has been established and will help drive the development of ECT via specialist training, standardised data collection and research in ECT. Quality of life is lower for patients with depression in Singapore and has been shown to improve after ECT in other countries.\(^{64}\) Further research in ECT is recommended, especially on its effect on patients’ quality of life and its local cost-effectiveness.

ACKNOWLEDGEMENTS

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REFERENCES


ECT SURVEY – Prescription and application of ECT in Singapore
To be completed by Chief Psychiatrist or ECT leading Psychiatrist

General information:

1. Name of your hospital/service: _________________________________

2. Position of person completing the form:
   - ECT lead psychiatrist
   - Chief Psychiatrist
   - ECT coordinator
   - Other. Please specify: _________________________________

3. What type of psychiatric facility your service is: (tick all applicable)
   - General Hospital
   - Psychiatric Hospital
   - University teaching hospital
   - Other. Please specify _________________________________

4. Is your facility public or private?
   - Public
   - Private

5. How many beds does your hospital have?
   - Total number of beds __________
   - Number of psychiatric beds __________

Prescription of ECT

6. Is ECT used in your psychiatric service? If the answer is no, you have now completed the survey. Stop here. Thank you.
   - YES
   - NO. If so, what are the reasons (tick the main reason):
     - We do not have an ECT service
     - We do not have adequate facilities to perform ECT
     - We do not have adequate training to perform ECT
     - We transfer patients who need ECT to another hospital
     - Our service considers that ECT is not an essential treatment in clinical practice
     - Our service considers that the side effects outweigh the benefits

Governance of ECT
7. Do you have a written ECT protocol or ECT guidelines in your facility?

- YES
- NO

8. Consent for ECT at your service is mostly given by:

- The patient
- Other. Please specify

9. Do you perform ECT on an involuntary basis?

- YES, if so who provides informed consent: 
- NO

10. Where is the ECT performed?

- Dedicated ECT Unit
- Operation theatre
- Other. Please specify

Prescription and Application of ECT
11. Who decides on the ECT treatment approach (electrode placement, dosing, other parameters, changes in dosing, etc)?

- Patient’s main treating psychiatrist
- Designated “ECT psychiatrist”
- Both
- Other (e.g. registrar), please specify

12. Which ECT machine do you use?

- Mecta Spectrum 5000
- Other Mecta machine, please specify
- Thymatron DGX
- Thymatron System IV
- Other. Please specify
13. Which combinations of electrode placement and pulse-width do you use (please tick all applicable and place “1” for the most commonly used combination):

<table>
<thead>
<tr>
<th></th>
<th>Right Unilateral (RUL)</th>
<th>Bitemporal (BT)</th>
<th>Bifrontal (BF)</th>
<th>Other – Please specify</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brief pulse: 1 ms</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brief pulse: 0.5 ms</td>
<td></td>
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<tr>
<td>Ultrabrief: 0.25 - 0.3 ms</td>
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14. Which anaesthetics do you use (tick all applicable and underline the most commonly used anaesthetic):

- □ Propofol
- □ Thiopentone
- □ Remifentanil (as sole anaesthetic)
- □ Ketamine (as sole anaesthetic)
- □ Etomidate
- □ Methohexital
- □ Other. Please specify_____________________

15. Do you use anaesthetics combined?

- □ YES, please tick all applicable:
  - □ propofol + remifentanil
  - □ thiopentone + remifentanil
  - □ propofol + ketamine
  - □ thiopentone + ketamine
  - □ Other combinations. Please specify_____________________

- □ NO

16. Do you change anaesthetics during the ECT course?

- □ NO
- □ YES. Why? ____________________________________________
17. Which muscle relaxant do you use?

- Succinylcholine
- Other. Please specify ____________________________

18. Is pre-oxygenation (prior to anaesthetic induction) a part of the anaesthetic procedure?

- YES
- NO

19. Is hyperventilation (prior to the ECT stimulus) a part of the anaesthetic procedure?

- YES
- NO

20. Is endotracheal intubation performed before ECT?

- Yes, routinely
- Yes, only in selected patients
- No

21. Who does the anaesthetic assessment?

- Consultant anaesthetist
- Anaesthesia registrar
- Both/either
- Other. Please specify ____________________________

22. Who performs the anaesthetic procedure for ECT?

- Consultant anaesthetist
- Anaesthesia registrar
- Both/either
- Other. Please specify ____________________________

23. Who applies the ECT stimulus?

- Consultant psychiatrist (non ECT specialist)
- ECT Psychiatrist (designated psychiatrist for ECT)
- Psychiatry Registrar
- Other, please specify ____________________________
24. Who decides when the ECT stimulus should be given after anaesthetic induction:

- Psychiatrist
- Anaesthetist
- Both
- Other. Please specify______________________________

25. Which tests are done routinely before ECT?

- Blood tests
- ECG
- Chest X ray
- Other. Please specify______________________________

26. How is the initial ECT dosing performed? Tick all applicable and underline the most commonly used method.

- By titration method (e.g. measure of seizure threshold)
  If so, please specify subsequent dose levels for each type of ECT given (e.g. Brief RUL - 3 times seizure threshold (ST); BT 0.5 ms – 2 x ST, etc)
  - ____________________________
  - ____________________________
  - ____________________________

- By Aged based method
  - “Half –age” (i.e. % energy = half patient’s age) for BL ECT
  - “Age” (i.e. age = % energy) for UL ECT
  - Other. Please specify________

- Other. Please specify________

27. What are the criteria for increasing ECT dose over the treatment course? (tick all applicable)

- By seizure duration
- By seizure quality
- By clinical response
- Subsequent dosing is not adjusted
- Other. Please specify______________________________

28. What monitoring is performed during the ECT treatment? Tick all applicable
Indication & Reasons for ECT

29. What is the main clinical indication to prescribe ECT in your centre? Tick all applicable and underline the most common indication.

- Unipolar Major Depression
  - Melancholic
  - Psychotic
  - Atypical
  - Other, please specify

- Bipolar disorder
  - Major depression
  - Psychotic depression
  - Mania
  - Mixed

- Schizophrenia/Schizoaffective
  - Positive psychotic symptoms

- Schizoaffective
  - Major depression
  - Mania
  - Mixed

- Catatonia
  - Unipolar depression
  - Bipolar
  - Schizophrenia
  - Organic
  - Neurodevelopmental

  - Neuroleptic malignant syndrome

  - Other (specify):


30. Please tick the main reason for ECT prescription in your centre:

- Failure of medication
- High suicide risk
- Severe aggression/agitation
- Inadequate oral intake
- Previous good ECT response
- Patient preference
- Intolerable medication side effects

31. Is ECT applied in the following populations? Tick all applicable:

- Children ≤ 12 years old
- Adolescents 13-17 years old
- Pregnant women
- Elderly ≥ 65 years old
ECT and concomitant medications

32. WHICH medications are usually withdrawn prior to the start of the ECT course?

- Antidepressants
- Antipsychotics
- Lithium
- Anticonvulsants
- Benzodiazepines
- Stimulants
- None

33. Are medications changed during the ECT course?

- YES
- NO

ECT frequency and number of sessions:

34. What is the most typical frequency for acute ECT treatment in your facility?

- 3 ECT per week
- 2 ECT per week
- Other. Please specify ____________________________

35. How many sessions on average are administered in the acute course?

- ≤ 6 ECT sessions
- 6 – 9 ECT sessions
- 9 -12 ECT sessions
- ≥ 12 ECT sessions

36. What number of sessions is typically given before ECT is considered ineffective?

_________________________________________________

37. When is ECT stopped?

- After a certain number of ECT sessions, please specify how many______________
- After patient is recovered

“ECT augmentation”:

38. Is “ECT augmentation” used?

○ No
○ If yes, please tick below main reason:
  ○ EEG seizure quality poor – to enhance seizure quality
  ○ ECT seizure duration is short - to prolong seizure duration
  ○ Poor clinical response
  ○ Other, please specify: ________________________________

39. Do you use any of the following strategies for “augmentation” of ECT?

○ No
○ If yes, please tick all applicable below:
  ○ Adjunctive ketamine
  ○ Adjunctive remifentanil
  ○ Hyperventilation
  ○ Caffeine
  ○ Other. Please specify ________________________________

ECT outcomes monitoring:

40. At your centre, all patients having ECT must be reviewed by the clinician prescribing ECT? (with clinical notes entered in the file):

○ After every ECT treatment
○ At least twice per week
○ At least once per week
○ Less than once per week

41. Do you use formal rating scales to assess the clinical state of patients receiving ECT?

○ NO
○ YES. When?
  ○ Pre-ECT. Specify which ones ________________________________
  ○ Post- ECT. Specify which ones ________________________________

42. Do you use formal rating scales to monitor cognition during the ECT course?

○ NO
○ YES. When?
  ○ Pre-ECT. Specify which ones ________________________________
  ○ Post- ECT. Specify which ones ________________________________
43. In your experience, Which are the most common side effects due to ECT? Please tick all applicable and underline the most frequent:

- [ ] Cognitive side effects
- [ ] Headache
- [ ] Falls
- [ ] Muscle pain
- [ ] Teeth injuries
- [ ] Fractures
- [ ] Delirium
- [ ] Cardiovascular problems (e.g., arrhythmias)

**Continuation/Maintenance ECT:**

*(Continuation ECT refers to ECT given within 6 months of completing an acute course, to prevent relapse. Maintenance ECT refers to ECT given beyond the first 6 months, to prevent recurrence.)*

44. Is continuation/maintenance ECT prescribed in your centre?

- [ ] YES
- [ ] NO, please state why

45. What is the main indication for Continuation/Maintenance ECT?

- [ ] Unipolar Major Depression
  - [ ] Melancholic
  - [ ] Psychotic
  - [ ] Atypical
  - [ ] Other, please specify

- [ ] Bipolar disorder
  - [ ] Major depression
  - [ ] Psychotic depression
  - [ ] Mania
  - [ ] Mixed

- [ ] Schizophrenia/Schizoaffective
  - [ ] Positive psychotic symptoms

- [ ] Schizoaffective
  - [ ] Major depression
  - [ ] Mania
  - [ ] Mixed

- [ ] Catatonia
  - [ ] Unipolar depression
  - [ ] Bipolar
  - [ ] Schizophrenia
  - [ ] Organic
  - [ ] Neurodevelopmental
  - [ ] Neuroleptic malignant syndrome

- [ ] Other (specify):

46. Is continuation/maintenance ECT prescribed using a fixed protocol or a flexible protocol?
Developed by Dr Veronica Galvez and Prof Colleen K Loo
SyNC Sydney Neurostimulation Centre,
University of New South Wales


- Fixed protocol (fixed frequency, e.g., each week for the first month, fortnightly for the second month, etc)
- Flexible protocol (e.g. variable frequency depending on patient’s clinical state)

47. When is continuation/maintenance ECT stopped?
   - After 6 months
   - After a year
   - Variable, depending on _________________

Number of ECT sessions/courses/patients:

48. How many ECT sessions were administered in your centre over 2015?
   Number of acute ECT sessions: _________________________
   Number of maintenance ECT sessions: _________________________

49. How many ECT courses were given in your centre in 2015?
   Number of acute ECT courses: _________________________
   Number of maintenance ECT courses: _________________________

50. How many patients received ECT in your centre in 2015?
   Number of patients receiving acute ECT: _________________________
   Number of patients receiving maintenance ECT: _________________________

Credentialing & Privileging

Prescribing
51. Is there a formal process at your institution for approving a list of practitioners who are able to prescribe ECT treatment independently, without supervision?
   - Yes
   - No
52. If yes, is this based on a formal assessment of competence in ECT skills?

- No
- Yes – If yes, it is based on which of the below (tick all applicable)
  - Holds qualifications as a psychiatrist
  - Has prescribed ECT in the past
  - Has attended a formal ECT training course
  - Has “x” years of experience as a psychiatrist. Specify “x”_____________________
  - Others, please specify_____________________________

**Performing ECT treatments**

53. Is there a formal process at your institution for approving a list of practitioners who are able to give ECT treatment independently, without supervision?

- Yes
- No

54. If yes, is this based on a formal assessment of competence in ECT skills?

- No
- Yes – If yes, it is based on which of the below (tick all applicable)
  - Holds qualifications as a psychiatrist
  - Has prescribed ECT in the past
  - Has attended a formal ECT training course
  - Has “x” years of experience as a psychiatrist. Specify “x”_____________________
  - Others, please specify_____________________________

Thank you for completing the questionnaire.