

# Electrocardiogram interpretation skills in psychiatry trainees

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**Aims and method** To assess the competence of psychiatry trainees in identifying major abnormalities in a 12-lead electrocardiogram (ECG). This was a three-stage prospective study. In stage 1, selected ECG traces were presented to the trainees. They were then asked to comment on any abnormalities of note on the ECG traces. In stage 2, an ECG e-book was made available to the trainees and the survey repeated. In stage 3, ECG workshop sessions were introduced in the mandatory teaching programme and the survey was repeated.

**Results** The number of correct responses after the introduction of the workshops were significantly more when compared with correct responses in stage 2 ( $P = 0.0002$ ), and stage 1 ( $P = 0.0091$ ). When compared with stage 1, the correct responses in stage 2 actually showed deterioration ( $P = 0.0284$ ).

**Clinical implications** Our study not only shows that providing access to an e-book is not enough to improve these skills, it also shows that ECG refresher sessions improved the diagnostic accuracy markedly.

**Declaration of interest** None.

Cardiovascular mortality is higher in patients with mental health diagnosis than the general population.<sup>1</sup> Cardiac events and sudden cardiac deaths have long been associated with mental illness. Hazard ratios for coronary heart disease mortality in people with severe mental illness compared with controls is 3.22 for people aged 18–49.<sup>2</sup> This risk increases with associated factors such as smoking and drug and alcohol misuse.<sup>3</sup> Therapeutic interventions in terms of psychotropic medications increase the risk of sudden cardiac deaths and fatal arrhythmias even further.<sup>4,5</sup> These factors are further complicated in certain groups of patients psychiatrists come across in their day-to-day practice:

- in patients with eating disorders (electrolyte abnormalities increase the risk of arrhythmias)
- in old age psychiatry (associated comorbidities – hypertension, diabetes mellitus, ischaemic heart disease)
- in liaison psychiatry (associated various physical comorbidities)
- in patients on high-dose antipsychotics
- in patients taking multiple psychotropic medications
- in patients with metabolic syndrome.

This necessitates that all psychiatric trainees are competent in identifying at least major abnormalities while interpreting electrocardiograms (ECGs) in clinical settings to aid accurate diagnosis, treatment and appropriate referral.

Our aim was to assess competence of psychiatric trainees in identifying major abnormalities in a 12-lead ECG.

## Method

Six ECG traces were obtained from real patients in clinical settings. Diagnosis and abnormalities present on the ECGs were confirmed with a senior registrar in cardiology. The ECG traces were then anonymised and presented to trainees at different levels of training. We chose to conduct this survey in teaching programmes/academic sessions to reach the maximum number of trainees anonymously and to make sure trainees did not confer or refer to textbooks or the internet, thereby simulating a clinical scenario as closely as possible. The survey questionnaire was distributed at the beginning of the academic sessions and collected at the end of the sessions. In addition to interpreting the six ECGs, the trainees were asked about their level of training, their current placement and how confident they felt in interpreting the ECGs.

The study was carried out prospectively in three stages. The first set of data (baseline) was collected at the induction meeting in August 2009 (stage 1). Following this, an ECG e-book was made available to all the trainees and the survey was repeated in February 2010 (stage 2). Afterwards, ECG workshop sessions were introduced in the local teaching programme and the survey was repeated again in March 2011 (stage 3).

## Results

Participation rates were relatively high, with 81% of trainees (38 out of 47) taking part at stage 1, 76% (32 out of 42) at

**Table 1** Trainee participation in different stages of the survey

	Stage 1, <i>n</i>	Stage 2, <i>n</i>	Stage 3, <i>n</i>
CT1	20	10	14
CT2	8	12	12
CT3	5	3	7
GP trainees	4	3	3
FY2	1	3	5
Total	38	31	41

CT, core trainee in psychiatry; FY2, foundation year 2 doctor; GP, general practice.

stage 2 and 87.5% (42 out of 48) at stage 3. The participants were core trainees in psychiatry (CT1–3), and general practice (GP) trainees and foundation (FY2) trainees on psychiatry placement. One questionnaire from stage 2 was discarded as it was returned after the deadline and one questionnaire from stage 3 was discarded as it was incomplete. The distribution of trainee levels is shown in Table 1.

As a part of the questionnaire, the trainees were asked how confident they felt in interpreting ECGs: 'very confident', 'fairly confident', 'could do better with some training' or 'not confident at all'. The results were worrying. As many as 66% trainees in stage 1, 62% in stage 2 and 24.3% in stage 3 indicated that they 'could do better with some training', whereas only 18% of trainees in stage 1 and 29% in stage 2 rated themselves as 'fairly confident'. By stage 3, trainee confidence seemed to have improved – 65.8% felt fairly confident interpreting ECG tests. Trainees who initially admitted to being 'not confident at all' (11% in stage 1) gained some knowledge with the additional learning materials and workshop sessions and the numbers fell to 10% in stage 2 and only 5% in stage 3. Rather worryingly, only few trainees felt 'very confident' in their ECG interpretation skills and this did not improve despite additional training (5% in stage 1 and stage 3, 0% in stage 2).

Total responses obtained in stage 1 were 228, which fell to 186 in stage 2 and then rose again to 246 in stage 3. To begin with, less than half the responses were correct, with 47% ( $n=107$ ) in stage 1 and 35% ( $n=65$ ) in stage 2, but by stage 3 the figure had improved markedly, to 78.8% ( $n=194$ ). When analysed by specialty, GP trainees and core psychiatry trainees were better to start with (44% and 45.4% of correct responses in stage 1 respectively), but foundation psychiatry trainees were well behind, with only 8% giving a correct answer in stage 1. Results in stage 2 fluctuated, and were 38% correct for GP trainees, 37.3% correct for core trainees and 11% correct for foundation trainees. By stage 3, however, they improved for all groups: GP trainees noted the slightest improvement to 44.5%, but both foundation and core psychiatry trainees seemingly benefited much more, with, respectively, 73.3% and 87.2% responses being correct.

The number of correct responses after the introduction of the ECG workshops (stage 3) was significantly greater than the number of correct responses after the introduction

of the e-book (stage 2): mean 33.17 v. 10.83,  $P=0.0002$ , standard error of the difference (s.e.d.) 2.41), and when compared with the baseline at stage 1 (mean 33.17 v. 17.83,  $P=0.0091$ , s.e.d.=3.71). When compared with the baseline, the correct responses in stage 2 actually showed deterioration (mean 10.83 v. 17.8,  $P=0.0284$ , s.e.d.=2.29).

The number of incorrect responses in stage 3 again was significantly lower than the number of the incorrect responses in stage 2 (mean 7.17 v. 19.0,  $P=0.047$ , s.e.d.=4.53) and stage 1 (mean 7.17 v. 18.5,  $P=0.033$ , s.e.d.=3.91). However, the incorrect responses did not show any significant reduction after the introduction of the e-book compared with the baseline (mean 19.0 v. 18.5,  $P=0.94$ , s.e.d.=6.89).

### ECG traces

There were six traces the trainees were asked to examine (see the online supplement to this paper):

- trace 1, prolonged QT interval
- trace 2, sinus tachycardia
- trace 3, atrial fibrillation
- trace 4, normal sinus rhythm
- trace 5, ST elevation myocardial infarction
- trace 6, complete heart block.

Results (correct and incorrect responses) for each trace at each of the three stages of the study are presented in Table 2.

#### Trace 1: prolonged QT interval

The trace showed a QT interval of 536 ms and QTc of 569 ms. Initially, it was hard for the trainees to identify the correct response (5.2% and 6.4% in stage 1 and 2 respectively), but significant improvement occurred by stage 3 (85.3% correct).

#### Trace 2: sinus tachycardia

The trace showed a sinus tachycardia at the rate of 155 bpm. Here the trainees performed better, with 55.2% correct responses in stage 1, 32.2% in stage 2 and 78% in stage 3.

#### Trace 3: atrial fibrillation

Trace 3 showed atrial fibrillation with a moderate ventricular response. Although initially not confident with identifying this trace (21% correct responses in stage 1, 16.1% in stage 2), trainees showed some improvement by stage 3 (60.9% responses correct).

#### Trace 4: normal sinus rhythm

This trace caused trainees less trouble than the previous three and most of the responses were correct in stages 1 and 3 (68.4% and 85.3% respectively), with just under a half correct in stage 2 (45.1%).

#### Trace 5: ST elevation myocardial infarction

In trace 5, ST elevation in leads V2 and V3 was shown with reciprocal changes in leads II, III and aVF. Over half of the responses were correct in all stages (52.6% stage 1, 54.8% stage 2, 73.1% stage 3).

**Table 2** Summary of the results

	Stage 1	Stage 2	Stage 3
Total trainees, <i>n</i>	38	31	41
Total responses, <i>n</i>	228	186	246
Correct	107	65	194
Incorrect	111	114	48
No comments	10	7	4
Trace 1: prolonged QT, <i>n</i> (%)			
Correct	2 (5.2)	2 (6.4)	35 (85.3)
Incorrect	36 (94.7)	29 (93.5)	6 (14.7)
Trace 2: sinus tachycardia, <i>n</i> (%)			
Correct	21 (55.7)	10 (32.3)	32 (78.0)
Incorrect	14 (36.8)	21 (67.7)	9 (21.9)
No comments	3	0	0
Trace 3: atrial fibrillation, <i>n</i> (%)			
Correct	8 (21.0)	5 (16.1)	5 (60.9)
Incorrect	28 (73.6)	24 (77.4)	16 (39.0)
No comments	2	2	0
Trace 4: normal sinus rhythm, <i>n</i> (%)			
Correct	26 (68.4)	14 (45.1)	35 (85.3)
Incorrect	12 (31.5)	14 (45.1)	4 (9.75)
No comments	0	3	2
Trace 5: ST elevation myocardial infarction, <i>n</i> (%)			
Correct	20 (52.6)	17 (54.8)	30 (73.1)
Incorrect	16 (42.1)	12 (38.7)	9 (21.9)
No comments	2	2	2
Trace 6: complete heart block, <i>n</i> (%)			
Correct	30 (78.9)	17 (54.8)	40 (97.5)
Incorrect	5 (13.1)	14 (45.1)	1 (2.4)
No comments	3	0	0

*Trace 6: complete heart block*

This was the trace trainees had least trouble with and most gave a correct response: 78.9% in stage 1, 54.8% in stage 2, 97.5% in stage 3.

## Discussion

Interpreting ECGs is quite an anxiety-provoking task, not only for junior doctors but also for a good proportion of consultants. This is true in most of the medical specialties, except perhaps cardiology. Errors in interpretation of ECGs greatly influence patient management. They may result in inappropriate referrals as well as lead to a critical diagnosis being missed and no treatment offered. In their study, Srikanthan *et al* found that the management plan had to be changed in 8.9% of patients after a review of the ECGs by cardiologists following the initial diagnosis by junior doctors.<sup>6</sup>

Although the psychiatry trainees are constantly made aware of the importance of performing ECGs and their clinical implications, it is not unrecognised that ECG interpretation is often a neglected learning objective in psychiatry training. The expectation, however, is not to teach psychiatric trainees to make a complicated diagnosis from an ECG or to improve their skills to match those of a cardiologist, but to teach them, for example, how to differentiate between a sinus bradycardia and a new-onset atrial fibrillation in a patient with an eating disorder, in

order to aid accurate diagnosis, treatment and an appropriate referral. It can be argued that most of the ECGs now have a computer-generated report and hence it becomes unnecessary for us to even have this discussion. However, Willems *et al* and Southern & Arnsten have shown in their studies that the reliability of these programs is not proven and that computer-generated ECG reports should be read with caution.<sup>7,8</sup> The British Heart Foundation advises that computer-assisted ECG interpretation can identify important anomalies, but errors are common and such interpretation should not be accepted without visual inspection.<sup>9</sup>

All of us have access to books, the internet and several e-courses to improve our skills in this area, but a general lack of time in our busy schedules, the complexity of the subject and the absence of face-to-face discussion usually demotivate us. This study was performed because a need was recognised to incorporate ECG refresher sessions in the teaching programme to help the trainees keep their knowledge current and avoid de-skilling.

Our study showed that by incorporating an ECG workshop in the local teaching programme for trainees, their interpreting skills were significantly improved and they felt more confident with the ECGs. This is reflected very clearly in participation rates which had risen in stage 3 of the survey conducted after the workshop, as compared with stage 1 and 2 when trainees were more apprehensive and shy of being tested on something they were not very confident about.

## Limitations

One of the limitations of our study is the number of participating trainees. Also, because of rotations the trainee population had changed by the time the survey was finally repeated in 2011. The ECG traces used in the study mainly focused on the ability of the trainees to pick up major abnormalities and these were quite apparent, and we do understand that in real life things can be more complicated. Having said that, it cannot be argued more that there is a need in the training which is recognised by trainees across the country. Ours is the first study in this respect and it demonstrated a significant improvement after the workshops, which most trainees in stage 1 and 2 had indicated was what they needed.

Another limitation of the study was that it was conducted with the core trainees and did not involve higher trainees, associate specialists or consultants. Perhaps it would be useful to know whether the competence in these skills differs in trainees across different levels of training.

## About the authors

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