Electrocardiography Teaching in Canadian Family Medicine Residency Programs: A National Survey
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OBJECTIVE: Electrocardiography (ECG) interpretation is an essential skill for a family physician. Teaching and learning electrocardiography is a difficult task, in part due to the erosion of knowledge when interpretation is not part of a daily activity. The objective of this study was to assess the current status of electrocardiography teaching in Canadian family medicine residency programs.

METHODS: A national survey was designed to specifically address the status of the ECG teaching curricula. This national survey was electronically sent to the family medicine program directors of all 17 Canadian accredited medical schools.

RESULTS: Approximately 75% of the schools responded to the survey. There was a great variance among Canadian family medicine residency programs with respect to the time allotment, ECG training location, training faculty, and teaching methods utilized. The goals of each respective program are also quite wide-ranging.

CONCLUSIONS: Family medicine residency programs across Canada are quite diverse regarding ECG training curricula and its goals. The need for a homogeneous way of teaching and evaluating has been identified.

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Electrocardiography (ECG) is vital in both inpatient and outpatient management.1,2 The National Family Physician Survey of the College of Family Physicians of Canada (CFPC) conducted in 1997/1998 outlined some of the clinical activities contributing to Canadian family physicians’ weekly work hours.3 Of responding Canadian family physicians/general practitioners, 41.6% performed ECG interpretation as part of their practice.3 In a 2002 report describing the practices of family physicians in Canada, it was found that 44.1% of physicians perform ECG interpretation as part of their medical practice.4 Thus, for family physicians, it is of paramount importance to accurately interpret ECGs. As primary caregivers, their competency in ECG interpretation and adequacy in ECG training is essential.

In Canadian medical schools, ECG interpretation is an important part of the curriculum. It is taught through didactic presentations, group teaching sessions, online modules, and repetitive observed interpretation as part of clerkship. There are many acceptable resources used throughout Canadian medical schools, and these range from textbooks to PowerPoint presentations by individual instructors to online resources. ECG interpretation education is overseen by faculty members and clinicians in many different stages of their training or practice.

These interpretation skills are then formally tested as part of the Medical Council of Canada Qualifying Examination.5 ECG interpretation is one of the expectations of competent physicians as demarcated by the Medical Council of Canada. This includes competency in identifying an abnormal ECG, diagnosing common conditions, recognizing the limitations of ECGs, and being able to select the appropriate circumstances in which an ECG is needed.5 Beyond this, ECG interpretation skills are reinforced throughout residency.

The Accreditation Council for Graduate Medical Education provides the program requirements for American family medicine training programs. The core curriculum is 20 months, with opportunities to learn in multiple settings being important. Community settings are varied, including rural, suburban, urban, and

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inner city.6 One sponsoring institution assumes responsibility for the program. In this, American family medicine training programs differ from Canadian programs. The sponsoring institutions range from medical school affiliated or not, medical school administered, medical school based, or military in type. In Canada there are 17 accredited family medicine residency programs, and each of these is affiliated with a university. These programs consist of both training in large urban centers as well as rural components. Since the 1970s, rural medicine programs have proliferated in Canada.7

The CFPC accredits the residency training programs across the country. It publishes a detailed document containing the requirements of a family medicine residency program in Canada. The training program must be based in a university department of family medicine, and each department must have a director of postgraduate education that holds a certification in family medicine (CCFP). Residents are required to spend a minimum of 8 months in a family medicine teaching practice during their training, with a minimum of 8 weeks in a rural family practice. The CFPC describes core procedural skills required as part of the family medicine residency training program. ECG interpretation is not included as one of the core procedural skills.8

The CFPC outlines the goals and objectives of family medicine residency training programs. These include the ability to manage chest pain, edema, fainting spells, palpitations, and syncope. The CFPC also outlines the defining features of competencies for certification as a family physician. Competencies include the diagnosis of serious arrhythmias (ventricular tachycardia and fibrillation, supraventricular tachycardia, atrial fibrillation, or second- or third-degree heart block), and ischemic heart disease. However, they make no specific mention of the degree of proficiency needed by family physicians in ECG interpretation.

The American College of Physicians describes recommendations for the training and competency of evaluating ECGs in medicine. They suggest that training should “provide physicians with knowledge of the pathophysiology of electrocardiographic abnormalities; the skills to recognize common normal, abnormal, and technical artifact patterns; and the opportunity to apply this knowledge in bedside clinical decision making.”

American guidelines for attaining competency in the interpretation of ECGs have previously been documented for internal medicine residents. These guidelines have mostly been through expert consensus and not necessarily evidence based.1 These guidelines have been quite varied as well. The American College of Cardiology/American Heart Association outline a minimum number of interpreted ECGs prior to competency and recently introduced passing an ECG certification exam as part of this determination.9 Other professional bodies do not provide a consensus on training guidelines.

In both Canada and America there are continuing medical education credits given to practicing family physicians after completion of residency. These credits can be attained through didactic courses and seminars directed at ECG interpretation as part of this determination.9 This would be beneficial in helping family physicians to maintain ECG skills interpretation competency throughout their practice. Since more than 40% of Canadian family physicians are interpreting ECGs as part of their practice, knowledge pertaining to whether or not these skills erode as a function of time is important in determining the need for continuing medical education.

A number of studies have been conducted on the accuracy and utility of ECG interpretation in various settings. These studies have demonstrated significant differences between medical students, residents, and attending physicians in correctly identifying acute conditions through ECG interpretation. Significant rates of misdiagnoses have also been identified.10 Therefore, we thought it would be important to evaluate the teaching methods used by the accredited schools responsible for family medicine residency training.

The aim of this study was to evaluate the current status of ECG training present in the curricula of family medicine residency programs across Canadian universities.

Methods

An electronic national survey consisting of seven questions was designed. It was used to assess the amount of teaching, the medical service providing the teaching (specifically internal medicine, cardiology, emergency medicine, or family medicine), the teaching methods used (bedside, computer based, lecture based), teaching location (hospital, catheter lab, ECG lab), assessment of skills (exam, OSCE, other) and the goals of ECG teaching as relating to the curriculum. The Queen’s University Ethics Review Board reviewed and approved the survey design and purpose prior to its implementation. This survey was sent electronically to the family medicine program directors at all 17 accredited medical schools in Canada. E-mails including a cover letter with statement of intent and explanation of study were sent three times to each program director or until an electronic response was received.

Results

Survey responses were received from 12 of the 17 Canadian schools (71%). Program directors from nine of the 12 responding schools provided complete responses. The data from these incompletely responding schools (University of Western Ontario, McGill University, and the University of Sherbrook) were not included in the survey comparison table (Table 1). However, since the responses from program directors at these three universities did include the overall goals of their family medicine residency...
training programs, these data were included in the analysis (Table 2).

Of the nine responding schools, one school does not devote any curricular hours to ECG specific training, three schools devote 2–4 hours from their entire residency program to ECG specific training, another three schools devote between 4–6 hours, and one school allot 10+ hours. Each of the nine responding schools reports that multiple faculties are involved in ECG interpretation training. Seven schools note the involvement of emergency medicine, and seven schools also note the involvement of family medicine faculty. Six schools report involvement of the cardiology faculty in ECG interpretation training. The University of Ottawa also employs rural faculty and guests from the faculty of family medicine in training their residents. The Northern Ontario School of Medicine cites self-directed learning as another entity responsible for this training (Table 1).

All nine schools reported the use of bedside training to instruct residents in ECG interpretation. Six schools also used lecture-based settings, and one school used computer-based instruction. As for the location of training, all nine hospitals utilized the hospital as a training site. One school cited use of the catheter lab. None of the schools used an ECG lab. Memorial University also used academic half days to train residents in ECG interpretation. Queen’s University and the University of Saskatchewan used the clinic setting to aid in ECG interpretation training. The Northern Ontario School of Medicine reported that they make use of the ER and office settings as appropriate for ECG interpretation training.

Of the nine responding schools, four stated that they used no formal methods to evaluate their residents in competency of ECG interpretation. The University of Alberta does utilize a written exam to test residents. The Northern Ontario School of Medicine uses ACLS training and an oral exam to assess ECG interpretation competency. The University of Saskatchewan assesses ECG competency using direct observations of residents and field notes. Dalhousie University completes an informal assessment using In-Training Evaluation Reports (ITERS).

Table 2 represents the goals of ECG teaching programs at each of the 12 responding schools as stated by the program director of each school. Of the three medical schools that did not provide complete responses to our survey, all three cited the expectation that ECG interpretation occurs through the undergraduate medical program as a reason for inability to complete the survey. At the 12 responding medical schools, the program directors’ perceptions of the goals of their program with respect to ECG interpretation range from specific proficiencies to nil expectations.

**Discussion**

ECG interpretation is an important aspect of a family physician’s practice. Our study aimed to qualify current ECG interpretation training programs present in family medicine residency programs across Canadian universities. Prior studies have reported on effectiveness of ECG training curricula in postgraduate training programs.
programs. Pines et al described the use of a variety of teaching and evaluation methods in American emergency medicine programs. They reported that program directors of the studied schools felt satisfied in their schools’ preparation of emergency medicine residents for ECG evaluation.11 Ginde et al, in their review, concluded that most of emergency medicine programs in their study have a formal ECG training curriculum, as indicated by survey responses from program directors, but there is a lack of a formalized ECG-reading competency assessment.12 They also reported on program director satisfaction indicating that the majority are satisfied with the training provided by their ECG training programs.

In our study, we found great variability across Canadian universities as far as the hours spent, location, and personnel involved in ECG teaching in family medicine residency programs. In terms of total time devoted to ECG interpretation, some spend greater than 10 hours, others less than 2 hours in a 2-year period. The location of teaching seems to center in hospitals. Since the access to ECGs is greatest in the hospital setting, this is usually an appropriate teaching location. The fact that a variety of personnel are involved in ECG teaching speaks to the utility of this tool in medicine, but at the same time, it opens an interrogation mark on the disparity of the quality reached by different programs.

ECG interpretation is a skill that needs to be maintained beyond the undergraduate medicine level.13 The majority of ECG training does occur in the undergraduate medical

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<tr>
<th>School</th>
<th>What are the goals of your residency program as pertaining to ECG training?</th>
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<tr>
<td>Memorial University</td>
<td>Preparation to handle patients in a small hospital ER, wards, and clinical.</td>
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<tr>
<td>Queen’s University</td>
<td>Achieve competence to assess an ECG at the primary care level. Recognize rhythms requiring immediate intervention or that are potentially dangerous.</td>
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<tr>
<td>University of Saskatchewan</td>
<td>Achieve efficiency in reading acute ECGs and manage accordingly.</td>
</tr>
<tr>
<td>University of Montreal</td>
<td>None for the moment, teaching achieved through clinical courses–residents are trained as need. Specific testing does not occur–assessment through general family medicine residency assessments.</td>
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<tr>
<td>University of Western Ontario</td>
<td>Did not complete survey: We don’t currently have an ECG curriculum—it is done ad hoc during FM training, internal medicine, and ER.</td>
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<td>McGill University</td>
<td>Did not complete survey: Expect residents to have learned basic ECG interpretation as medical students. We do not give formal ECG lectures to residents. ECGs are reviewed throughout the 2-year residency in the clinical settings in which the residents find themselves: in their family medicine clinics, internal medicine wards, pediatric wards, ICU, CCU, care of the elderly, palliative care, etc.</td>
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<tr>
<td>University of Sherbrooke</td>
<td>Did not complete survey: No formal testing. Consider that ECG teaching completed before residency. ECG related learning is up to the residents own volition.</td>
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<tr>
<td>University of Manitoba</td>
<td>Achieve ability to diagnose dangerous situations.</td>
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<tr>
<td>Dalhousie University</td>
<td>Be able to read ECG and form initial interpretation. The resident will identify and manage acute coronary ischemic events and common dysrythmias (A fibr, PAT, heart blocks, V fib, V T, asystole).</td>
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<td>University of Ottawa</td>
<td>Expect residents to be able to make a basic assessment of an ECG, to evaluate rate and rhythm, to recognize the major arrhythmia patterns, to assess for ischemia and previous damage. We have begun offering the ACES program to our residents as part of the residency program.</td>
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<tr>
<td>University of Alberta</td>
<td>Currently do not have an ECG training program, and the experience differs from resident to resident. ECG skill assessment is done during rotations by supervising preceptors and assessed during our benchmarking exam in November each year. It is also assessed during practice SAMPs, one to two questions per year.</td>
</tr>
<tr>
<td>Northern Ontario School of Medicine</td>
<td>To have residents solidify an approach to reading ECGs.</td>
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curriculum (Table 2). Residency programs need to identify a method of quantifying ECG interpretation for family medicine residents. Prior experiences showed that ECG exams (using real cases) could be a useful educational tool.1,3,14

A set of 10 ECGs with 20 classic abnormalities (including bundle branch blocks, AV blocks, supraventricular arrhythmias, ventricular arrhythmias, ST-segment changes, and most frequent electrolyte disorders) could be set up to test ECG interpretation skills. This exam should be given to family medicine residents of different years. If residents of the first year are able to perform better, the exam could be useful to test the hypothesis that erosion of knowledge due to lack of practice is part of the problem.

The results of such a test (at a national level) could be also helpful in guiding the discussion about homogenizing the curricular aspects of ECG teaching across Canadian universities. The recognized lack of homogeneous ECG teaching by this survey highlights the need for a national consensus on how, where, and by whom family medicine residents should receive ECG training. The results of the survey indicate that ECG instruction seems to be limited and inhomogeneous in Canadian family medicine residency programs.

Limitations

The survey design for collecting data limits the study since leading questions may have biased the results. Since only 12 of 17 Canadian schools responded, sampling error as well as reporting bias may limit the study conclusions.

Conclusions

ECG training curricula in family medicine residency programs across Canada are quite diverse. The quantity of hours spent and the training faculties involved and methods of evaluation are not uniform. Preferred teaching methodologies include bedside, lecture based, and computer based learning and utilize clinical, didactic, and electronic teaching styles. It is possible that the discrepancies in ECG training curricula that were noted in this study affect ECG interpretation. By evaluating Canadian family medicine residents in ECG interpretation it may be possible to better understand the proficiency of Canadian family medicine residency in ECG interpretation training.

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References


