

Motives for requesting an electrocardiogram in primary health care

Motivos para requisitar um eletrocardiograma nos Cuidados de Saúde Primários

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Abstract *The management of requests for diagnostic exams presents its own inherent characteristics in primary health care and reflects the specific nature of the physician-patient relationship. The scope of the study was to identify the reasons for requesting an electrocardiogram (ECG) in primary health care. A cross-sectional study was conducted in an urban region in Portugal, establishing the motives to ask for an ECG consecutively over two years, starting on 01/03/2007 using data retrieved from structured forms filled out by the physician at the moment of requesting the exam. A total of 870 ECGs of 817 patients were included. Symptoms manifested during the patient visit justified 48.5% of the ECGs, and follow-up of cardiovascular risk factors motivated 25.2%. A global health examination accounted for 22.8% of the requests. Multivariate analysis showed that the presence of symptoms ($p < 0.001$), presence of any cardiovascular risk factor ($p = 0.002$), hypertension ($p < 0.001$), diabetes ($p = 0.002$), and urgency ($p < 0.001$) were the main factors associated with the requests. The requests for electrocardiograms are predominantly for clinical reasons as a result of patients symptoms. The integration of expectations and beliefs of the patients is present in the decision-making process.*

Key words *Electrocardiography, Primary health care, Routine diagnostic tests, Physician-patient relations*

Resumo *Introdução: A gestão do pedido de testes de diagnóstico apresenta características próprias nos Cuidados de Saúde Primários em função da natureza específica da relação médico-doente. Objetivo: Identificar os motivos para requisitar um eletrocardiograma (ECG) na prática de Cuidados de Saúde Primários. Métodos: Realizou-se um estudo observacional transversal dos motivos para o pedido de um ECG numa região urbana de Portugal, utilizando um formulário preenchido pelo médico no momento da requisição, por um período de 2 anos desde 1/03/2007. Resultados: Foram incluídos 870 ECG de 817 doentes. A presença de sintomas na consulta justificou 48.5%, e o seguimento de fatores de risco cardiovasculares representou 25.2%. O exame global de saúde representou 22.8% dos pedidos. A análise multivariada mostrou que a existência de sintomas ($p < 0.001$), a presença de qualquer fator de risco cardiovascular ($p = 0.002$), a hipertensão arterial ($p < 0.001$), a diabetes mellitus ($p = 0.002$), e o pedido de urgência na execução ($p < 0.001$) foram os principais fatores associados aos pedidos. Conclusão: Os ECG são requisitados sobretudo em resposta a questões de natureza clínica perante sintomas que os doentes apresentam. A integração das expectativas e crenças dos doentes está presente no processo de decisão médica.*

Palavras-chave *Eletrocardiograma, Cuidados de saúde primários, Testes de diagnóstico, Relação médico-doente*

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Introduction

The electrocardiogram (ECG) was first described in early XX century by Einthoven. Together with X-rays, this technology launched a new era of diagnostic possibilities, based on greater objectivity. The paradigmatic judgment of the physician has become questionable¹, thus empowering the patients' opinions. It remains an important test for study and follow-up of several cardiac and non-cardiac diseases, as described in 1992 report of the American College of Cardiology and the American Heart Association², but the evidence for its utilization in healthy people is scarce and points mainly for not using it³.

Despite the clinical evidence, in Primary Care, the special nature of doctor-patient relationship may induce some degree of deviation⁴. It's possible that a set of symptoms are valued not just in a strict medical way but as part of the holistic view of one patient, where the psychological and social interactions are relevant constraints in the final construct of consultation⁵. This approach is quite different from other specialties, more focused in the disease management, and justifies the specific study⁶⁻⁹.

In the case of ECG, portuguese official data show a sustained rise in number of tests ordered in Primary Care from 2.9% of visits in 1990 to 4.8% in 2008, costing more than € 8 million¹⁰, but there's no description about the motives to ask for the test.

The aim of this study was to identify the reasons which lead primary care physicians to ask for an electrocardiogram, checking for gender and age differences, and prospecting for their determinants.

Methods

A cross-sectional observational study was conducted among patients who made an ECG requested by their General Practitioner (GP) in an urban health centre at the city of Oporto, Portugal.

The Health Centre of *S. João* was part of the health services research project of General Practice Department of Faculty of Medicine of Oporto University, aimed, among others, to innovate in health services administration and clinical care, testing the basis for the national Primary Care reorganization¹¹, while providing medical assistance to about 20 thousand patients, shared by 10 specialist family doctors.

One of the programs implemented was the realization of the ECGs inside the Health Centre, unlike the common practice where this service was engaged externally. Since 1999, the ECGs were performed by trained nurses in an electrocardiograph Cardiette start 100 H. Readings were made in the beginning by a cardiologist and since 2005 by 3 GPs with expertise¹². Reports were registered directly on patients' electronic clinical file.

We collected information about motives for requesting the ECG using a structured form, filled by doctors at request, including all the tests performed in health centre during a period of two years starting in 1/03/2007. Nine of ten physicians integrated this program. Data included also the presence of cardiac complaints, the urgency of request, the time (days) to perform the ECG, the presence of cardiovascular risk factors, previous history of cardiovascular disease, and general demographic data.

The main outcome was categorized into three dimensions for analysis: the presence of symptoms or signs in the visit, if it answered to any complaint mentioned by patient or observed by doctors; the follow-up of cardiovascular risk factors or previous cardiac disease, if no complaints were present and ECG was justified by disease follow-up; and routine health examination, if none of above. It included global health screening, sports medicine, preoperative procedure, and direct demand of patient.

Data were anonymized for register and further analysis according to ethical principles of Helsinki Declaration of World Medical Association and Oviedo Convention on Human Rights and Biomedicine.

Descriptive statistics measures were used. Confidence intervals were calculated by modified Wald method for 95% level of confidence. Qui-square test for categorical variables and Kruskal-Wallis test for continuous variables were used to check for associations. Multivariate analysis was performed by a multinomial logistic model, adjusted for age and gender. An *alpha* error of 0.05 was accepted. Microsoft Excel® 2007 and Statistical Package for Social Sciences® (SPSS 20.0, Chicago, IL, USA) were used for data support and analysis.

Results

We collected 870 orders of ECG for analysis, corresponding to 817 patients (56.4% of females) with a mean age of 54.8 years (\pm 19.0), 51.9 years

(± 19.0) for males and 57.0 (± 18.7) for females, which represented 4.5% of average population under observation during this period and 1% of all visits. Each doctor requested a mean of 96.7 ECG (± 59.7) varying through a minimum of 35 and a maximum of 191 ECG in 2 years observation. Table 1 shows basic clinical characteristics of population.

A total of 888 motives to ask for an ECG were identified. Symptoms or signs at visit justified 48.5% of requests (95%CI: 45.2-51.8%). In the other half, 25.2% (95%CI: 22.4-28.2%) of ECG were made for staging and follow-up of cardiovascular risk factors like hypertension or diabetes mellitus, and 2.3% (95%CI: 1.5 – 3.0%) for fol-

low-up of previous known cardiac disease. Global health examination justified 22.8% of requests (95%CI: 20.1-25.7%). In 1.3% (95%CI: 0.7-2.3%), ECG was performed by direct demand of patient, without a clear justification.

In the group of symptoms or signs at visit, chest pain was the main reason (36.6%), followed by palpitations (23.3%), presence of arrhythmia (16.7%), syncope or dizziness (9.4%) and dyspnoea (5.7%).

Table 2 shows univariate analysis of factors associated with ECG requests, after categorization of the primary outcome. The health routine examination was most common in younger ($p < 0.001$) males ($p < 0.001$). The presence of symp-

Table 1. Clinical characteristics of population.

	Total n = 817	Male n = 356	Female n = 461
Cardiac symptoms	448 (54.8%)	161 (45.2%)	287 (62.3%)
Previous cardiovascular disease history	116 (14.2%)	52 (14.6%)	64 (13.9%)
Anxiety	212 (25.9%)	69 (19.4%)	143 (31.0%)
Any CVRF	556 (68.1%)	231 (64.9%)	325 (70.5%)
Arterial hypertension	373 (45.6%)	144 (40.4%)	229 (49.7%)
Diabetes Mellitus	89 (10.9%)	43 (12.1%)	46 (10.0%)
Dyslipidemia	322 (39.4%)	121 (34.0%)	201 (43.6%)
Smoking habits	74 (9.1%)	57 (16.0%)	17 (3.7%)
Obesity	184 (22.5%)	63 (17.7%)	121 (26.2%)

CVRF – cardiovascular risk factor.

Table 2. Variables associated with the motives to ask for an ECG (univariate and multivariate analysis).

	Presence of symptoms or signs n = 420	Follow-up of CVRF or cardiac disease n = 241	Health examination n = 209	Univariate analysis	Multivariate analysis[§]
Gender (male)	34.0%	50.6%	54.5%	$p < 0.001^*$	$p = 0.006$
Age (mean, SD)	54.1 (± 19.6)	63.2 (± 14.8)	49.1 (± 19.0)	$p < 0.001^{**}$	$p = 0.495$
Time (days) to make ECG (median, min-Max)	2 (0-81)	5 (0-99)	5 (0-135)	$p < 0.001^{**}$	NS
Urgency of request	34.0%	0.8%	0.0%	$p < 0.001^*$	$p < 0.001$
CVRF	63.3%	93.8%	52.6%	$p < 0.001^*$	$p = 0.002$
HBP	41.4%	80.9%	22.0%	$p < 0.001^*$	$p < 0.001$
DM	8.6%	22.4%	2.9%	$p < 0.001^*$	$p = 0.002$
Dyslipidemia	38.6%	53.5%	28.7%	$p < 0.001^*$	NS
Smoker	8.3%	10.0%	8.6%	$p = 0.771^*$	NS
Obesity	21.7%	29.5%	17.7%	$p = 0.009^*$	NS
Other CVRF	3.3%	5.8%	1.9%	$p = 0.079^*$	NS
History of anxiety	34.8%	17.0%	18.2%	$p < 0.001^*$	NS
Presence of symptoms	100.0%	19.9%	8.1%	$p < 0.001^*$	$p < 0.001$
History of cardiac disease	16.4%	22.8%	5.7%	$p < 0.001^*$	NS

* Chi-square test; ** Kruskal-Wallis test; § multinomial logistic model adjusted for age and gender. CVRF – cardiovascular risk factor; HBP – high blood pressure; DM – diabetes mellitus; ECG – electrocardiogram; SD – standard deviation; NS – non-significant.

toms or signs at visit was associated to urgency of requests ($p < 0.001$) and to a faster execution of the test ($p < 0.001$).

Multinomial logistic regression model adjusted for age and gender (pseudo-R square by Cox and Snell = 0.720), showed that the motives to ask for an ECG depend mainly on the presence of any symptoms ($p < 0.001$), the presence of any cardiovascular risk factor ($p = 0.002$), arterial hypertension ($p < 0.001$), Diabetes Mellitus ($p = 0.002$), and the urgency at request ($p < 0.001$). (Table 2)

Discussion

The main reason to ask for an ECG in this primary care setting is the presence of symptoms or signs at the visit, particularly chest pain and palpitations. These findings are concordant with previous published papers and reflect the recommendations of the only published guideline². Fyfe e Maclean¹³, in 1975, studied a series of 300 ECGs, where chest pain was the main reason for requests, followed by breathlessness. Rutten, in 2000, found 57% of chest pain and 30% of palpitations on a consecutive series of ECG in primary care⁹. Molinari in a telecardiology network found 72% of calls for symptoms suggestive of heart disease and 28% for non-cardiac symptoms or routine control, with 33% of chest pain and 21% of palpitations¹⁴, and Scalvini described chest pain in 19% of patients referred to telecardiology¹⁵.

In a review of two primary care centers in USA, Milhorn found the main reasons to ask for an ECG were chest pain (28%), abnormal rhythm (15%), and hypertension (12%), with health screening accounting for 24% of request⁶. Some years before, in England, Fyfe found just 1% for routine health examination and 2% for reassurance, and considered it a surprisingly low result¹³.

Although the evidence of the preventive value of ECG in healthy population is scarce and recommendations suggest not to use it^{3,16}, we may assume a potential benefit of the periodic health evaluation by improving the adherence to some preventive measures and lowering the patient's worry, justifying its continuity in practice¹⁷. In our study, almost a quarter of ECG was requested for health routine evaluation, meaning more attention to patients' motivation factors, than some kind of clinical motives or defensive practice. The symbolism of the heart, linked to

the source of spiritual and emotional life, creates a strong effect in patients, making them more receptive to evidence based message, even if reassurance is the only prescription to improve patients' complaints.

The question of patients' direct demand of test is discussed by Thom when he suggests that further investigation to incorporate patients' preferences in decision is needed¹⁸, once doctors and patients have different expectations about the utilization of diagnostic tests, particularly if they aren't routinely recommended in daily practice^{19,20}. Cohen described a series of 295 tests requested directly by patients, counting for 2.4% of total requests during seven months²¹. The presence of symptoms justified 60% of tests, prevention of disease 25.4% and family history 7.1%. Our study doesn't allow this kind of categorization. Though, it's possible that some requests categorized as symptoms in consultation meet in fact the patients' hidden agenda²², translated to a clinical language, which would lower the proportion found. Quick interpretation of ECG is important to allow the integration of the history and physical findings with any abnormalities present²³.

The proportion of visits that lead to a request of an ECG is smaller than we could expect by the official national data. Several facts contribute to explain it: the continuity of care and the doctor-patient relationship established over time, leading to better use of health services⁴, and the fact that all population have their own doctor, chosen by each one, which increases the confidence in care and reduces the pressure to a defensive practice of physicians and patients.

The consecutive nature of this series, including all patients who made the test in the health centre, is a strength of this study and counteracts the convenience sampling. It's possible that some tests had been lost by lack of registry in electronic files or because they were engaged to external surgeries, but they account to a marginal proportion, not likely to weaken our conclusions. Also, we noticed that the majority of requests have just one motive expressed by doctors. It may reflect the critical judge of the physicians in the moment of asking for the test, even because this question had the chance of an open answer. It's possible that doctor merely pointed chest pain to ask for the ECG, despite the presence of other complaints like palpitations, breathlessness and feeling of apprehension, reflecting it as the key symptom to an acute coronary syndrome. Another condition to highlight is the cluster feature

of doctors included, as far as they work together for several years in the same health centre, thus creating some kind of homogeneity in their individual clinical decisions. Nevertheless, an analysis of the requesting profile by doctor shows significant differences between them ($p < 0.001$), with individual characteristics weighting in the medical decision, in line with what is suggested in the literature²⁴⁻²⁶.

This article focuses on the question of the reasons for requesting an ECG in a Primary Care Service. Overall analysis shows that the ECG is requested for patients' cardiac symptoms and follow-up of cardiovascular risk factors, particularly hypertension and diabetes mellitus, in a decision level oriented for the clinics. However,

the significant proportion of non-specific reasons preserves an open field for the integration of feelings and beliefs of the patients.

This is relevant for the definition of public health priorities at the level of the accessibility to health care assistance. One of the criticisms most often listen about guidelines is the lack of applicability to the individual patient²⁷. The incorporation of data that reflect the everyday reality can improve this aspect and bring the policy guidelines to a level closer to the citizen²⁸, accepting them as full partners in their own care²⁹. This kind of attitude, defining the evidence based practice³⁰, is more integrative and may create more value to the patients, to the professionals and to the health system.

Collaborations

P Santos, C Martins, L Sá, A Hespanhol e L Couto participated equally in all stages of preparation of the article.

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