

Luciano N Duro

Maria Cecília Assunção

Juvenal Soares Dias da Costa

Iná S Santos

Performance of lipid profile request between public and private sectors

ABSTRACT

OBJECTIVE: To evaluate the performance of lipid profile screening according to the mode of financing of medical appointments – public or private.

METHODS: A population-based cross-sectional study was carried out with a multi-stage sampling strategy. The study included 3,136 adults (≥ 20 years old) from the city of Pelotas, Southern Brazil, in 2006. The following indicators were calculated: coverage (proportion of screened individuals among those meeting screening criteria), focus (proportion of individuals meeting screening criteria among those who were tested), screening errors (tests in individuals not meeting screening criteria – overscreening – and no screening of individuals meeting the screening criteria – underscreening), and screening ratio (ratio between number of individuals who met screening criteria and the number who failed to meet screening criteria among all individuals tested). Bivariate analyses were performed using Chi-squared tests. 95% confidence intervals (95% CI) were calculated for all parameters assessed.

RESULTS: General coverage was 73.0% (95%CI: 70.8;75.2), and focus was 67.2% (95% CI: 64.7;69.3). In the public sector, compared to the private/health plan sector, coverage was lower (65.2% vs. 82.2%; $p<0.001$), focus was higher (74.7% vs. 62.3%; $p<0.001$), overscreening was lower (33.1% vs. 56.4%; $p<0.0001$), and underscreening was higher (34.8% vs. 17.8%; $p<0.0001$). Screening ratio was higher in the public (1.97) than in the private sector (1.46).

CONCLUSIONS: The evaluation of adequacy of lipid profile requests among the population can provide important information regarding the following of protocols for screening and following-up dyslipidemias in different healthcare systems and, within a same system, between different modes of financing. Evaluations of this type provide an opportunity to diagnose inequalities and plan efforts to ensure greater equity of care.

KEY WORDS: Lipids, diagnostic use. Hyperlipidemias, prevention & control. Single Health System. Health maintenance organizations. Cross-sectional studies.

Programa de Pós-Graduação em
Epidemiologia. Universidade Federal de
Pelotas. Pelotas, RS, Brasil

Correspondence:

Luciano N. Duro
R. Marechal Deodoro, 1160
96020-220 Pelotas, RS, Brasil
E-mail: lduro2002@yahoo.com.br

Received: 1/8/2007
Reviewed: 8/2/2007
Approved: 9/11/2007

INTRODUCTION

Cardiovascular diseases (CD) are the most important cause of death among adults worldwide,^a and dyslipidemia is one of its major risk factors.^{2,4} Studies have demonstrated the benefits of early detection of rises in serum levels of cholesterol and its fractions, given that treatment of these dysfunctions can

^a McKay J. The Atlas of Heart Disease and Stroke. Geneva: World Health Organization; 2004.

reduce CD-related mortality.^{2,10} (level of evidence I “consistent results from well-designed, well-conducted studies in representative populations that directly assess effects on health outcomes”).

Screening for dyslipidemia is currently performed according to guidelines proposed by specialized groups from different countries, whose role is not only to detect individuals with alterations, but also to identify those at greater risk of developing cardiovascular events in the future.^{2,4,12-14} Even though it is recommended that persons aged 20 years and older of both sexes obtain lipid profiles,^{2,4,9,13} risk of CD among men under 35 and women under 45 is low – less than 10% of these will suffer severe cardiovascular events in ten years.¹⁵ Therefore, in these age groups, systematic screening is performed only in the presence of risk factors for CD (level of evidence I). These factors include smoking, systemic arterial hypertension (SAH), history of first degree relative with early CD (male under 55 years; female under 65 years) or a single factor such as diabetes mellitus or previous CD.^a

Screening periodicity is still a matter of controversy. However, the majority of guidelines recommend screening at least every five years. Screening should take place at shorter intervals in case of borderline values, in persons with an indication or who are under medication, and in the presence of other risk factors for CD.^{9,13} In these cases it is recommended that screening take place every three years.

The advantages of screening for dyslipidemia include improving prognosis of detected cases, allowing for less radical treatment among patients detected, and decreasing anxiety among patients with negative results. On the other hand, disadvantages include greater morbidity among cases whose prognosis is not modifiable, unnecessary treatment of patients with borderline results, unfounded reassurance of false-negative cases, and anxiety and greater morbidity among false-positive cases, in addition to the cost of testing, both for the individual and for the health care system. Likewise, positive results may require the prescription of medication that is not always available, both in the private (due to high cost) and public sectors. In Brazil, less than 50% of the population is known to have access to essential drugs, which may cause problems in treating detected dyslipidemia.^b In the absence of a formal screening program, as is the case in the city of Pelotas, Southern Brazil, the balance between advantages and disadvantages should guide the medical decision to request these and other tests for early diagnosis of asymptomatic individuals.

The present study was aimed at evaluating the performance of lipid profile screening according to mode of financing of medical appointments (public or private).

METHODS

The study was carried out in Pelotas, Southern Brazil, a municipality with an estimated population of 340 thousand, of which 93% lived in the urban area in 2006.^c We employed a population-based cross sectional study including adults (20 years or older) living in the urban area.

For sample size calculations, we assumed a prevalence of lipid profile requests of 38.6% (as detected in a prior study carried out in the same city),¹ 95% confidence level, and an acceptable error of 3 percentage points. To this number we added 10% for losses and refusals and multiplied the resulting number by 1.5 to account for the effect of cluster sampling. Determining the prevalence of lipid profile requests in the studied period would thus require 1,663 subjects.

Sampling was carried out in multiple stages, based on data from the 2000 Brazilian population census, conducted by the *Instituto Brasileiro de Geografia e Estatística* (IBGE - Brazilian Institute for Geography and Statistics). Each of the city's 404 census tracts was listed in increasing order of mean income of head of household. We then chose 120 of these tracts by systematic random selection with probability proportional to size.

In the next stage, all households in each selected tract were classified as residential or commercial. Based on the list of residences, we randomly selected an average of 12 households per tract (N=1,440 households). These were visited by a researcher, who handed out an introductory letter, invited the family to participate in the study, and collected information on the number, age, and sex of household members. These households were then revisited and individual questionnaires were administered by trained interviewers who were blinded as to the study's aims and hypotheses. Questionnaires had previously been tested in a pilot study carried out in a census tract not included in the study.

The initial sample comprised 3,353 adults. With 6.5% of losses and refusals, we interviewed a total of 3,136 subjects.

For quality control purposes, approximately 10% of interviews were repeated by supervisors using a shorter version of the questionnaire. Data entry was performed

^b United States. Department of Veterans Affairs. VHA/DoD clinical practice guideline for the management of dyslipidemia in primary care. Washington; 2001. Available from: http://www.oqp.med.va.gov/cpg/DL/DL_base.htm

^b World Health Organization. The World Medicines Situation. Geneva; 2004. Available from: http://www.searo.who.int/LinkFiles/Reports_World_Medicines_Situation.pdf

^c Instituto Brasileiro de Geografia e Estatística. Censo demográfico 2000. Rio de Janeiro; 2001.

twice, and inconsistencies and amplitude were checked using EpiInfo 6.04 software.

The variable *medical request for lipid profile* was self-referred by the subject, who should have had a medical appointment in the three years preceding the interview (excluding visits to emergency services). The question was formulated as whether the subject “had had a cholesterol test requested by a physician at least once.”

The adequacy of cholesterol test requesting was determined through an analysis of coverage, focus, screening ratio, and testing errors, as defined below:⁵

- Coverage – proportion of screened individuals among those meeting screening criteria.
- Focus – proportion of individuals meeting screening criteria among those who were tested.
- Screening Ratio – obtained by the division of two proportions: percentage of requests among individuals meeting screening criteria over percentage of requests among those not meeting these criteria.
- Testing errors – defined as tests requested among individuals with no or only one risk factor, excluding diabetes mellitus or CD (the “overscreening” rate) and the failure to request tests for individuals with two or more risk factors or with diabetes mellitus or established CD (the “underscreening” rate). These parameter definitions are presented in the Table.

We considered as fulfilling criteria for screening all subjects with two or more risk factors for CD, such as age 38 or older for males and 48 or older for females; smoking; SAH; history of first degree relative with premature CD; or with a single risk factor such as diabetes mellitus or previously established CD.¹⁰

The two modes of financing of medical appointments were defined as *public sector* (including any units of the Brazilian Unified Health Care System – SUS); and *health plan or private* (health insurance/medical union plans or direct payment to the health professional). Place of appointment was determined by asking the subject where he or she usually seeks medical care when in need for an appointment. The analysis excluded subjects who mentioned emergency rooms or hospitals in answer to this question. We collected information on the following CD risk factors: sex, age (completed years), self-referred diagnosis of diabetes mellitus and SAH, smoking, and family history. We considered as smokers subjects who smoked at least one cigarette per day, and as former smokers those who had quit smoking for at least one month. Self-referred family history of CD was based on the reported existence of a first degree relative (parent, sibling, child) who developed or died of CD before age 55 for males and before age 65 for females.

We used the chi squared test in bivariate analyses to detect associations between mode of financing of medical appointment and screening requests. Statistical analyses were performed using Stata 9.2 software. All analyses took into account cluster sampling.⁶

The research project was approved by the Research Ethics Committee of the Universidade Federal de Pelotas, and all respondents signed a term of informed consent.

RESULTS

Subjects were mostly women (56.1%), of white skin color (84%), and had a mean age of 44 years (SD = 16.4). Regarding risk factors for CD, 28.2% of men were aged 35 years or older, and 27.1% of women, 45 years or older. Self-reported prevalence of SAH, diabetes mellitus, and CD were, respectively, 32.7%, 9.5%, and 9.3%. Of all subjects, 51% reported family history of CD and 11.3% reported early death in the family due to CD. There were 26.7% of smokers in the sample. The figure presents the structure of the studied sample. The prevalence of subjects fulfilling screening criteria among the total study population was 55.6% (1,745 subjects). Of these, 1,538 had had a medical appointment in the last three years, and 1,535 could recall information regarding test requests.

Medical appointments occurred more frequently among women of higher socioeconomic level. Among all subjects with medical appointments regardless of CD risk, prevalence of cholesterol dosage requests was 61.3% (Figure).

The Table presents the values for parameters obtained in the evaluation of the adequacy of dyslipidemia screening. Coverage of cholesterol screening requests was 73.2%, and focus was 67.2%. The screening ratio was 1.59, indicating that subjects with risk factors were almost 60% more likely to have tests requested than those without risk factors. However, 27% of subjects that fulfilled screening criteria were not tested (underscreening rate). On the other hand, 549 subjects that did not fulfill screening criteria had tests requested, leading to an overscreening rate of 46%. The total proportion of screening errors was 35.2%.

Separating appointments according to the different modes of financing showed that the majority of appointments took place through the public system (1,511 subjects, or 51.1% of the total). Mean number of appointments per subject was greater among SUS patients (23.3; SD=32.3) than among health plan or private patients (16.4; SD=23.7) ($p<0.001$) in the three year period. Prevalence of subjects fulfilling the triennial screening criteria differed between modes of financing ($p<0.001$): 58.4% (95%CI: 56.4;61.3) in the public sector (SUS) and 52.7% (95%CI: 50.1;55.2) among private/health plan clients.

Table. Definition of criteria for evaluating adequacy of screening for hypercholesterolemia and performance according to mode of financing of medical appointment. Pelotas, Southern Brazil, 2005.

Criteria of evaluation	Total	N	Public sector	N	Health plan/ private	N
Coverage (% and 95%CI)	73.2% (70.8;75.2)	<u>1123</u> 1535	65.2%* (61.7;68.8)	<u>499</u> 765	82.2% (79.4;85.0)	<u>594</u> 723
Focus (% and 95%CI)	67.2% (64.7;69.3)	<u>1123</u> 1672	74.7%* (72.5;76.9)	<u>499</u> 668	62.3% (59.2;65.4)	<u>594</u> 953
Screening ratio	1.59	<u>1123/1535</u> 549/1194	1.97	<u>499/765</u> 169/511	1.46	<u>594/723</u> 359/636
Overscreening (% and 95%CI)	46.0% (43.2;48.8)	<u>549</u> 1194	33.1%** (29.0;37.2)	<u>169</u> 511	56.4% (52.5;60.3)	<u>359</u> 636
Underscreening (% and 95%CI)	27.0% (24.8;29.2)	<u>412</u> 1535	34.8% (31.4;38.1)	<u>266</u> 765	17.8% (15.0;20.6)	<u>129</u> 723

* p<0,001

** p<0,0001

Coverage in the public health care system was 65.2%, and focus was 74.7%. Thirty-four percent of all requests were inadequate and, when separated by type of error, the most common (34.8%) was not requesting screening from subjects who met risk criteria (underscreening), which was significantly higher than in the private sector ($p<0.0001$). Overscreening rate (requesting screening for subjects who did not qualify) was 33.1%, and screening ratio was 1.97.

In appointments financed by health plans or through the private sector, coverage was higher (82.2%; $p<0.001$), and focus was lower (62.3%; $p<0.001$). Regarding screening errors, 35.9% of screenings were found to be inadequate. In private appointments, overscreening was more frequent than underscreening (56.4% vs. 17.8%) and was significantly higher than that found in the public sector ($p<0.0001$). Screening ratio was 1.46.

DISCUSSION

Population-based studies allow us to study the various types of health care services available, rather than only those covered by traditional information systems. Such studies also allow us to determine the characteristics of patients and appointments and to evaluate the coverage of different procedures, data rarely obtained through an analysis of health care records.

Among the population that visited a physician in the three years preceding the study, three out of every five subjects had lipid profile tests, regardless of their risk status. With focus at around 67%, this means that one third of subjects who were screened did not fulfill the screening criteria. The screening ratio of 1.59, however, indicates that the frequency of lipid profile requests was greater among subjects with risk factors, which is adequate.

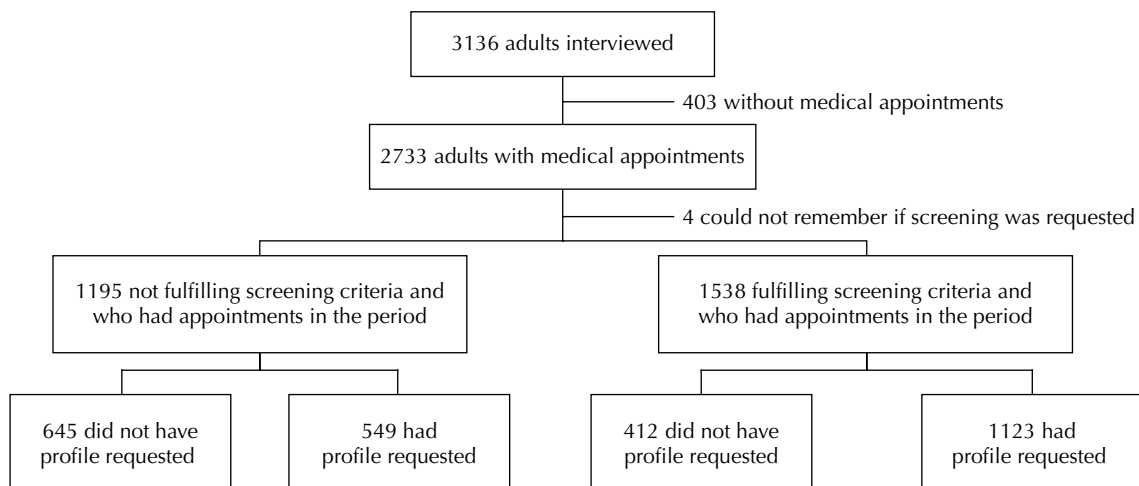


Figure. Flow chart of the study sample. Pelotas, Southern Brazil, 2005.

When evaluating cholesterol test requisitions separately according to mode of financing of the appointment, the public sector showed lower coverage, but with higher focus (75%). A potential explanation for lower coverage is that physicians, when seeing patients through the public sector, may be less attentive to prevention of chronic diseases than in private settings. Similar behavior has previously been described in the same city with regard to antenatal care.⁸ Higher focus, on the other hand, may indicate that professionals working in SUS are more rigorous in their criteria for requesting complementary tests, be it due to costs, quotas, or financial ceilings. In addition, probability in the public sector of subjects with SAH, diabetes mellitus, or diabetes mellitus-associated SAH having tests requested was 36%, 13%, and 47%, respectively. These proportions were greater than that among subjects who fulfilled only sex and age criteria, taken as a reference (data not shown). This finding indicates that screening occurs more frequently among subjects already showing cardiovascular morbidity. The selective targeting of screening to those in greatest need results in an increased positive predictive value (the probability of there being true positives among those with altered results), which may be desirable. However, improving performance in the public sector would require increased coverage. Other known risk factors (obesity, alcohol abuse, and lack of physical exercise) were also included in separate analyses (data not shown), and showed similar relationships with regard to the different modes of financing.

The analysis of total screening errors showed no difference between public appointments and other modes of financing ($p=0.35$). However, the proportion of overscreening was lower in the public system. This finding is consistent with what was found in terms of focus, indicating once again a greater rigor on the part of physicians when considering a patient as a candidate for lipid profile screening. The screening ratio of 1.97 indicates that the probability of fulfilling the criteria among screened subjects is twice that of not fulfilling these criteria.

The inversion of values of coverage and focus in the private as compared to the public sector may be due to less stringent control of expenses with complementary tests when compared to SUS, although such control does exist in the private sector. Screening errors also showed an inversion, with an increased rate of test requirements among patients not at risk (overscreening). Screening ratio was 1.46 – lower than that of SUS – due to decreased focus and a higher number of unnecessary tests.

In privately paid appointments, the probability of overscreening was 3.2 times greater than that of underscreening. This is in contrast with what was seen

in the public sector, in which this ratio was 0.95. We understand that it is easier to request tests from patients in the private or health plan sectors, regardless of level of risk.

Our data indicate that there are differences in the form of care provided to the population with regard to lipid profile requests in different appointment locations. This is also seen for other interventions, such as c-sections.¹⁶ A study carried out in Canada,⁵ aimed at evaluating the effectiveness of a dyslipidemia screening program, showed lesser coverage and comparable screening ratio to that of the present study, albeit among different populations not separated according to mode of financing. Studies conducted in the United States^{3,7,11} show that health insurance involvement increases the likelihood of screening for several diseases in different groups of individuals.

Physicians seeing patients through the public sector request lipid profiles less often, but when they do so, it is with greater focus. Professionals working through the private sector are more likely to request lipid profiles inadequately, generating greater costs and increasing the risk of iatrogenesis. Such findings are probably markers for other characteristics of care, such as access to medical appointments and other types of tests and treatments, which may affect population-wide health indicators.

The protocols available and most widely used worldwide originate from developed countries, such as the United States and the United Kingdom, which concentrate drug production, and where drug consumption is increasingly greater. A consequence of this process may be the establishment of ever more sensitive directives for the detection of diseases treatable with such drugs. In the Brazilian public sector, on the other hand, the availability of antilipemics is scarce, and access to these drugs is limited.

The present results should be interpreted in light of their potential limitations. Among these is the fact that recall time was limited to three years. This is the maximum interval recommended between lipid profiles among individuals at risk. Choosing a shorter recall period would lead to the risk of interpreting non-testing as inadequate even though testing may be still within the recommended timeframe for the patient's risk level. However, such an interval could lead to recall bias, with certain subjects responding negatively as to the presence of screening due to inaccurate recall. The direction of such bias, if present, would be towards reduced coverage.

Another potential source of bias arises from the lack of verification of information on the outcome – such as, for instance, requesting to see a copy of the test results.

⁸ Santos IS, Baroni RC, Minotto I, Klumb AG. O Fenômeno Camaleão e a Qualidade na Atenção Pré-natal. Buenos Aires: Sociedad Iberoamericana de Información Científica (SIIC) S.A.; 2002. p.1-3.

The direction of such bias would depend on the analyzed group, and would be more likely to occur among subjects with lower schooling. The latter are typically users of the public sector; bias would therefore result in a potential reduction in coverage among this group.

A third limitation resides in the uncertainty about whether the usual location of the subject's medical appointments was actually that which generated the lipid profile request. This may have generated errors in classification with respect to mode of financing. The direction of such errors is unpredictable.

Evaluating the adequacy of lipid profile requests among the population may provide important information on adherence to screening protocols and on follow-up of dyslipidemias in different health care systems and, within the same system, of different

modes of financing. Evaluations of this sort provide the opportunity to diagnose inequalities and to plan efforts to ensure the greatest possible equity in terms of health care quality.

Monitoring of risk factors is one of the fronts of action of the CARMEN Initiative (*Conjunto de Acciones para la Reducción Multifactorial de Enfermedades No transmissibles*, a strategy of the Pan-American Health Organization and of affiliated countries, including Brazil)⁸ for the reduction of chronic diseases and CD in the Americas. In conclusion, in order to improve the profile of CD-related morbidity and mortality among the population, health care services must incorporate into daily practice preventative measures of demonstrated effectiveness. The present study provides subsidy for designing initiatives aimed at training Brazilian health care professionals with emphasis on prevention.

REFERENCES

1. Capilheira MF, Santos IS. Fatores individuais associados à utilização de consultas médicas por adultos. *Rev Saude Publica*. 2006;40(3):436-43.
2. Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults. Executive Summary of The Third Report of The National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, And Treatment of High Blood Cholesterol In Adults (Adult Treatment Panel III). *JAMA*. 2001;285(19):2486-97.
3. Gordon NP, Rundall TG, Parker L. Type of health care coverage and the likelihood of being screened for cancer. *Med Care*. 1998;36(5):636-45.
4. Guidelines for using serum cholesterol, high-density lipoprotein cholesterol, and triglyceride levels as screening tests for preventing coronary heart disease in adults. American College of Physicians. Part 1. *Ann Intern Med*. 1996;124(5):515-7.
5. Hutchison B, Birch S, Evans CE, Goldsmith LJ, Markham BA, Frank J, et al. Selective opportunistic screening for hypercholesterolemia in primary care practice. *J Clin Epidemiol*. 1998;51(10):817-25.
6. Kish L. Sampling Organizations And Groups Of Unequal Sizes. *Am Sociol Rev*. 1965;30:564-72.
7. Nelson KM, Chapko MK, Reiber G, Boyko EJ. The association between health insurance coverage and diabetes care; data from the 2000 Behavioral Risk Factor Surveillance System. *Health Serv Res*. 2005;40(2):361-72.
8. Pan American Health Organization. CARMEN: An initiative for integrated prevention of noncommunicable diseases in the Americas. Washington; 2003.
9. Pearson TA, Blair SN, Daniels SR, Eckel RH, Fair JM, Fortmann SP, et al. AHA Guidelines for Primary Prevention of Cardiovascular Disease and Stroke: 2002 Update: Consensus Panel Guide to Comprehensive Risk Reduction for Adult Patients Without Coronary or Other Atherosclerotic Vascular Diseases. American Heart Association Science Advisory and Coordinating Committee. *Circulation*. 2002;106(3):388-91.
10. Pignone MP, Phillips CJ, Atkins D, Teutsch SM, Mulrow CD, Lohr KN. Screening and treating adults for lipid disorders. *Am J Prev Med*. 2001;20(3 Supl):77-89.
11. Potosky AL, Breen N, Braubard BI, Parsons PE. The association between health care coverage and the use of cancer screening tests. Results from the 1992 National Health Interview Survey. *Med Care*. 1998;36(3):257-70.
12. Santos RD, Giannini SD, Santos RD, Fonseca FH, Moriguchi EH, Maranhão RC, et al. III Diretrizes Brasileiras Sobre Dislipidemias e Diretriz de Prevenção da Aterosclerose do Departamento de Aterosclerose da Sociedade Brasileira de Cardiologia. *Arq Bras Cardiol*. 2001;77(Supl3):1-48.
13. US Preventive Services Task Force. Screening adults for lipid disorders: recommendations and rationale. *Am J Prev Med*. 2001;20(3 Supl):73-6.
14. US Preventive Services Task Force. Screening for coronary heart disease: recommendation statement. *Ann Intern Med*. 2004;140(7):569-72.
15. Wilson PW, D'Agostino RB, Levy D, Belanger AM, Silbershatz H, Kannel WB. Prediction of coronary heart disease using risk factor categories. *Circulation*. 1998;97(18):1837-47.
16. Yazlle MEHD, Rocha JSY, Mendes MC, Patta MC, Marcolin AC, Azevedo GD. Incidência de cesáreas segundo fonte de financiamento da assistência ao parto. *Rev Saude Publica* [periódico na Internet]. 2001 [acesso em 17/07/07]; 35(2):202-6. Disponível em: <http://www.scielo.br/pdf/rsp/v35n2/4406.pdf>