in Canada. Direct-to-consumer advertising may have helped escalate niacin use, specifically Niaspan in the United States, with its prominent "intervention-style" ads.[11]

Our study is limited in that we did not have access to patient-level data to determine whether niacin prescribing was clinically appropriate. Our study only evaluated the prescription niacin market; niacin use likely exceeds our estimates since some niacin products can be purchased over the counter.

In conclusion, our study shows that prescription niacin sales are substantial and growing, even in the absence of contemporary supportive trial evidence. The discordance between sales and evidence should be a focus of professional dialogue about the role of this medication in the medical armamentarium.

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Study concept and design: Jackevicius and Krumholz.
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1. Boden WE, Probstfield JL, Anderson T, et al; AIM-HIGH Investigators. Niacin in patients with low HDL cholesterol levels receiving intensive statin therapy. *N Engl J Med*. 2011;365(24):2255-2267.

2. O'Riordan M. HPS-2 THRIVE misses primary end point: no benefit of niacin/laropiprant. http://www.theheart.org/article/1490635.do. Accessed December 21, 2012.

3. Coronary Drug Project Research Group. Clofibrate and niacin in coronary heart disease. *JAMA*. 1975;231(4):360-381.

4. Duggal JK, Singh M, Attri N, et al. Effect of niacin therapy on cardiovascular outcomes in patients with coronary artery disease. *J Cardiovasc Pharmacol Ther*. 2010;15(2):158-166.

5. Jackevicius CA, Tu JV, Ross JS, Ko DT, Krumholz HM. Use of ezetimibe in the United States and Canada. *N Engl J Med*. 2008;358(17):1819-1828.

6. Jackevicius CA, Tu JV, Ross JS, Ko DT, Carreon D, Krumholz HM. Use of fibrates in the United States and Canada. *JAMA*. 2011;305(12):1217-1224.

7. Statistics Canada Census. http://www12.statcan.ca/english/census01/home/Index.cfm. *Accessed April 3, 2010.*

8. US Census Bureau. American FactFinder. http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml. Accessed May 3, 2013.

9. Grundy SM, Cleeman JI, Merz CN, et al; National Heart, Lung, and Blood Institute; American College of Cardiology Foundation; American Heart Association. Implications of recent clinical trials for the National Cholesterol Education Program Adult Treatment Panel III guidelines. *Circulation*. 2004;110(2):227-239.

10. McPherson R, Frohlich J, Fodor G, Genest J; Canadian Cardiovascular Society. Canadian Cardiovascular Society position statement: recommendations for the diagnosis and treatment of dyslipidemia and prevention of cardiovascular disease. *Can J Cardiol*. 2006;22(11):913-927.

11. Niaspan—Pete's brother TV. http://vimeo.com/23689604. Accessed June 30, 2011.

Appropriate Use of Myocardial Perfusion Imaging in a Veteran Population: Profit Motives and Professional Liability Concerns

Myocardial perfusion imaging (MPI) is performed millions of times annually in the United States to assess patients for coronary ischemia. Some have expressed concern that MPI is being used inappropriately, possibly because of self-referral profit motives and professional liability fears.[1] To inform clinicians about situations in which patients are likely to benefit from MPI testing, appropriate use criteria (AUCs) for MPI were developed, last revised in 2009.[2] Prior investigations have applied AUCs to describe the magnitude and patterns of inappropriate testing. Rates of inappropriate testing have ranged from 7% to 24%.[3] We

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hypothesized that the single-payer environment of the Veterans Affairs (VA) health system, which eliminates self-referral profit motive and limits liability concern, will result in less inappropriate use of MPI.

Methods | We conducted a retrospective cross-sectional investigation of MPI ordered in a single VA medical center. Our institutional review board reviewed the protocol and waived the requirement for informed consent. Participants were identified from records of MPI performed using the VA Computerized Patient Record System, beginning December 2010. Demographic information, medical history, and information regarding symptoms were gathered to establish associations with inappropriate MPI ordering. Appropriateness categorization was performed on the basis of the 2009 criteria[2] and using a data collection instrument endorsed by professional societies and the Imaging in FOCUS initiative for assessment of appropriateness. Patient symptoms that prompted ordering of MPI were attributed to ischemia, unless specifically indicated otherwise. The primary outcomes were the proportion of inappropriate MPI tests and univariate associations between patient characteristics and the likelihood of an inappropriate MPI. Statistical analysis was performed using SPSS, version 20 (IBM). We used the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE)[4] statement in designing our investigation.

Results | We identified 332 MPI studies performed between December 1, 2010, and April 11, 2011. The population of patients was predominantly male with high prevalence of obesity, diabetes mellitus, hypertension, and hyperlipidemia (**Table**). Coronary artery disease and abnormal electrocardiogram results were also common findings. Chest pain was the most commonly reported individual symptom (49.4%); however, typical angina was rare (0.6%). Positron-emission tomography was used for 304 patients (92%) and single-photon-emission computed tomography for the remaining 28 patients (8%).

For all but 4 patients (1%), an indication from the 2009 AUCs could be identified. Study indications were 78% (n = 259) appropriate, 13% (n = 42) inappropriate, and 8% (n = 27) uncertain (eFigure in Supplement). The most common inappropriate MPI indications included testing of patients with low pretest probability who could have undergone treadmill electrocardiogram testing (7 patients [16.7% of total inappropriate MPI]) and asymptomatic patients with low coronary heart disease risk (7 patients [16.7% of total inappropriate MPI]) (eTable in Supplement). Of the 9 preoperative MPI tests reviewed in this investigation, 6 were inappropriate and 3 were appropriate.

Patient characteristics were compared with MPI indications to identify factors associated with inappropriate MPI ordering (Table). The absence of symptoms was associated with a nearly 5-fold higher likelihood of inappropriate testing (odds ratio [OR], 4.80 [95% CI, 2.39-9.66]; $P < .001$). Both chest pain (OR, 0.07 [95% CI, 0.02-0.20]; $P < .001$) and diabetes mellitus (OR, 0.37 [95% CI, 0.17-0.80]; $P = .01$) were associated with a lower likelihood of inappropriate testing.

Discussion | In this retrospective cross-sectional investigation regarding the appropriate use of MPI in a VA health care setting, we observed that a substantial portion of MPI tests were ordered for inappropriate indications. The findings are in contrast to our initial hypothesis but are similar to those of another VA-based investigation, the results of which were published during our investigation.[5]

Our hypothesis was based on unique characteristics of the VA patient care environment. First, no self-referral or profit motives exist. Second, whereas the Federal Tort

Table. Characteristics, Symptoms, and Univariate Associations With Inappropriate Testing in 332 Patients

Characteristic	Value	Odds Ratio (95% CI)	*P* Value
BMI, median (SD)	32.3 (6.9)	...	...
Female sex, No. (%)	12 (3.6)	1.39 (0.29-6.66)	.68
Comorbidities, No. (%)			
Overweight (BMI > 25)	296 (89.2)	1.29 (0.43-3.87)	.65
Obese (BMI > 30)	108 (32.5)	1.49 (0.77-2.92)	.24
Diabetes mellitus	130 (39.2)	0.37 (0.17-0.80)	.01
Hypertension	269 (81.0)	0.50 (0.24-1.02)	.05
Hyperlipidemia	259 (78.0)	0.62 (0.30-1.26)	.18
CAD	148 (44.6)	0.57 (0.28-1.14)	.11
Abnormal ECG result	179 (53.9)	1.63 (0.83-3.20)	.16
Symptoms, No. (%)			
Chest pain	164 (49.4)	0.07 (0.02-0.20)	<.001
Dizziness	25 (7.5)	1.19 (0.39-3.67)	.76
Palpitations	18 (5.4)	0.35 (0.05-2.68)	.29
Dyspnea	127 (38.3)	1.05 (0.54-2.03)	.89
Fatigue	25 (7.5)	0.24 (0.03-1.81)	.13
Syncope	16 (4.8)	2.17 (0.66-7.07)	.19
None	73 (22.0)	4.80 (2.39-9.66)	<.001

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); CAD, coronary artery disease; ECG, electrocardiogram.

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Claims Act permits medical malpractice lawsuits against federally employed physicians, the substantial majority of claims are resolved through administrative processes. Only 3 judgments against the US government were recorded for tort claims in 2010.[6] We did not detect a significant reduction in inappropriate testing in the VA environment, which suggests a lesser role of defensive medicine and self-referral in the inappropriate use of MPI. A recent survey of cardiologists did not find any association between ownership of diagnostic equipment (MPI, catheterization laboratory, computed tomography scanner, or echocardiography laboratory) and concordance with appropriateness categories.[7]

The magnitude and pattern of inappropriate testing in our investigation are similar to those in prior reports.[3] Hendel et al[8] observed similar common inappropriate MPI indications, as well as significant associations between asymptomatic patients and inappropriate testing (OR, 22.5 [95% CI, 15.2-33.2]) and lower likelihood of inappropriate testing in patients with diabetes mellitus (OR, 0.4 [95% CI, 0.4-0.5]).

Reasons for the observed patterns of ordering MPI are unclear. Conceivably, commonalities in medical training, independent of postgraduate practice environment, could contribute to an exaggerated perception of benefit of MPI in asymptomatic patients and those at low risk of coronary heart disease. This exaggerated perception of the benefit would also seem to hold true for preoperative risk assessment, with the majority of preoperative MPI in our study having been inappropriately ordered.

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1. Cerqueira MD. Eighth Annual Mario S. Verani, MD Memorial Lecture: nuclear cardiology in the era of multimodality cardiac imaging: can we survive? *J Nucl Cardiol*. 2010;17(2):177-187.

2. Hendel RC, Berman DS, Di Carli MF, et al. ACCF/ASNC/ACR/AHA/ASE/SCCT/SCMR/SNM 2009 appropriate use criteria for cardiac radionuclide imaging: a report of the American College of Cardiology Foundation Appropriate Use Criteria Task Force, the American Society of Nuclear Cardiology, the American College of Radiology, the American Heart Association, the American Society of Echocardiography, the Society of Cardiovascular Computed Tomography, the Society for Cardiovascular Magnetic Resonance, and the Society of Nuclear Medicine. *Circulation*. 2009;119(22):e561-e587.

3. Hendel RC, Thomas GS. The time and place for appropriate radionuclide imaging: now and everywhere. *J Nucl Cardiol*. 2011;18(6):997-999.

4. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP; STROBE Initiative. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *Ann Intern Med*. 2007;147(8):573-577.

5. Nelson KH, Willens HJ, Hendel RC. Utilization of radionuclide myocardial perfusion imaging in two health care systems: assessment with the 2009 ACCF/ASNC/AHA appropriateness use criteria. *J Nucl Cardiol*. 2012;19(1):37-42.

6. United States Government Accountability Office. *VA Uses Medical Injury Tort Claims Data to Assess Veterans' Care, but Should Take Action to Ensure That These Data Are Complete.* Washington, DC: United States Government Accountability Office; 2011. Report 12-6R VA Health Care.

7. Lin FY, Rosenbaum LR, Gebow D, et al. Cardiologist concordance with the American College of Cardiology appropriate use criteria for cardiac testing in patients with coronary artery disease. *Am J Cardiol*. 2012;110(3):337-344.

8. Hendel RC, Cerqueira M, Douglas PS, et al. A multicenter assessment of the use of single-photon emission computed tomography myocardial perfusion imaging with appropriateness criteria. *J Am Coll Cardiol*. 2010;55(2):156-162.

Editor's Note

Why Physicians Order Tests

In a Department of Veterans Affairs (VA) medical center, use of myocardial perfusion imaging was inappropriate in approximately 20% of studies, a proportion that is similar to that reported from other practice settings in the United States. The facts that VA physicians are salaried and malpractice claims are very uncommon suggest that there are other reasons that physicians order inappropriate tests. These might include exaggerated belief in the accuracy and clinical benefit of tests, lack of understanding of the potential harms (including radiation exposure and false-positive results), and a cultural value for "doing more." This study was small and conducted at a single VA medical center, so the findings should be viewed as hypothesis generating. Nevertheless, it suggests that the culture of overordering is ingrained and we need to carefully consider approaches to reducing inappropriate care that focus on physician knowledge and culture.

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