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Factors Associated with Primary Care Physicians' Recognition of Cognitive Impairment in Their Older Patients

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Abstract

While there are accurate screens for cognitive impairment, there is as yet no evidence that screening improves outcomes including primary care physicians' (PCP) medical decision-making. PCPs' recognition of cognitive impairment being suboptimal, we investigated factors associated with improved recognition. Eligible patients were aged ≥ 65 years, without documented dementia or previous work-up for dementia, seen consecutively over two months by one of 13 PCPs. PCPs indicated whether they, the patient, or the family had concerns about each patient's cognition. We enrolled 130 patients with any cognitive concerns and a matched sample of 133 without cognitive

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concerns, and administered standardized neuropsychological tests. PCP's judgments of cognitive concern showed 61% sensitivity and 86% specificity against the neuropsychological standard. When combined with a Mini-Mental State Exam (MMSE) score ≥ 26 , PCP recognition improved in sensitivity (82%) with some loss in specificity (74%). True positives increased when PCPs' practices included more cognitively impaired patients and when patients reported poor memory. False positives increased when patients had diabetes, reported poor memory, or no or light alcohol consumption. Medical decision-making can be improved by the MMSE and greater exposure to cognitively impaired patients, but knowledge of certain risk factors for cognitive impairment negatively affected these decisions.

Keywords

Primary Care; Cognition disorders; diagnostic sensitivity; Mini Mental State Examination

Introduction

The exponential growth in the aging population is particularly relevant for primary care physicians (PCPs) who provide the majority of medical care for older people.¹ Primary care patients are older, sicker, and more cognitively impaired than the general population² and early cognitive decline is associated with greater use of primary care.³ The latest systematic review for the U.S. Preventative Services Task Force⁴ reported that brief cognitive tests can accurately screen for cognitive impairment but there is no evidence that screening improves PCP medical decision-making. Unfortunately, recognition by PCPs of cognitive impairment of any aetiology in the absence of frank dementia, shows relatively poor sensitivity of 44 to 55%, with better specificity of 87% to 88%.^{5,6} Few studies have examined patients' and physicians' characteristics associated with PCP recognition of cognitive impairment. Factors associated with false negative errors have previously been examined in a subsample of older women enrolled in a clinical trial⁵ and associations with false positive errors have not been explored. Additionally, earlier studies are limited by low physician response rates and non-representative samples. Thus our objectives were to examine the accuracy of PCP recognition of cognitive impairment in their patients without a diagnosis of dementia and to further investigate patients' and physicians' characteristics associated with accurate recognition. . The Mini Mental State Examination (MMSE)⁷ is the most thoroughly investigated screening instrument⁴ and has been recommended for the detection of dementia in individuals with suspected cognitive impairment.⁸ We specifically sought to determine whether the MMSE, combined with physician judgment, could improve the accuracy with which PCPs recognized cognitive impairment.

Methods

Patients and Setting

We conducted the study at a Canadian university teaching hospital family practice unit (FPU) of 13 PCPs serving over 9,000 predominantly English-speaking patients. All PCPs in this study were in family medicine. Eligibility required patients being at least 65 years and visiting their PCPs at least once during the recruitment period. To focus on early detection

of cognitive impairment, we excluded patients who had a documented diagnosis of dementia or who had been referred to and worked up by a specialist for a cognitive concern. Because of potential effects on cognitive performance, we also excluded those with current diagnoses of major depressive disorder, schizophrenia, or bipolar disorder; those not fluent in English; unable to read normal print with or without glasses; unable to hear normal conversation with or without hearing aids; acutely ill, delirious, or with a life expectancy of less than one year. Sunnybrook Health Sciences Centre Research Ethics Board approved the study.

Procedure

On the day of their PCP visits, during the recruitment period, we placed a Screening Checklist for the study in the electronic medical record (EMR) of patients who were at least 65 years old. To minimize selection bias, PCPs asked all their eligible patients about their willingness to take part in the study and also indicated on the Screening Checklist whether or not they, the patient, and/or the patients' family had cognitive concerns. If any of these responses were affirmative, we designated the patient as Any Cognitive Concern and recruited 130 consecutively seen patients for this group. We then randomly sampled a subgroup of 130 from the remaining patients without cognitive concerns, frequency-matched with the Any Cognitive Concern group by sex and age in five year birth cohorts. Agreeable patients were asked to provide written informed consent, complete a cognitive assessment, and provide additional background information (described below).

Neuropsychological test battery

Patients completed a battery of standardized neuropsychological tests to provide an independent reference standard of cognitive functioning. The test battery was individual administered to each participant by a trained psychometric and measured key cognitive domains of aging, including learning and memory (Delayed Recall and Discrimination subtests of Hopkins Verbal Learning Test, HVLT),⁹ processing speed (Trail Making Test, TMT, Part A),¹⁰ and executive function (TMT Part B¹⁰ and Clock Drawing Test, CDT).¹¹ Adapting criteria for multiple subtypes of mild cognitive impairment,^{12;13} patients were designated as cognitively impaired if they had two or more test scores below -1.5 SDs from the normative mean of the test. While not part of the reference standard, all patients also completed the Mini-Mental State Examination (MMSE)⁷. PCPs were not provided with any cognitive test results.

Patient Background and Medical Information

Demographic information, education, alcohol consumption patterns, and driving status were obtained from each patient by self-report. Patients completed the 15-item Geriatric Depression Scale (GDS)¹⁴ and indicated how they felt about their memory for a person of their age, on a scale of excellent, good, fair or poor. The results from these measures were not provided to the PCPs and thus not specifically used by them to judge whether the patient had a cognitive concern. We recognize, however, that patients shared their concerns with their physicians and this informed physicians' judgments. Medical conditions, and prescription and nonprescription medication used, were obtained from the EMR. Diseases were coded by two raters using the International Classification of Diseases, 9th Revision, Clinical Modification and differences were resolved by consensus.

PCP Demographic and Practice Characteristics

PCPs provided demographic information about themselves, their geriatrics training, practice characteristics, their views and routines regarding cognitive assessments of their patients, how often they questioned their patients about cognitive functioning, and their use of various cognitive tests in their practice.

Statistical Analysis

We examined the accuracy of PCP recognition of cognitive impairment in their patients without a diagnosis of dementia in several ways. First, we compared the PCP Cognitive Concern group (PCPs own concerns regardless of patient or family concerns) and No Cognitive Concern group on the neuropsychological measures, using multivariate analysis of co-variance (MANCOVA), controlling for age, sex and years of education, followed-up with ANCOVA if overall statistical significance was achieved. Secondly, using the neuropsychological reference standard of cognitive impairment, we calculated sensitivity, specificity, and likelihood ratios (LRs), first for the classifications of Any Cognitive Concern (PCPs, patient or family had concerns,) and second for PCP Cognitive Concern. To determine the effect of the MMSE on PCP recognition of impairment, we examined the combined accuracy of the classification based on Any Cognitive Concern and/or scoring below several MMSE cut-points. This was repeated with the classification based on PCP Cognitive Concern alone. We used LR's to determine which models led to a meaningful change from pretest to posttest probability of cognitive impairment, applying the following guide:¹⁵ a large change will be generated by LR's > 10 and < 0.1; a moderate change by LR's of 5 to 10 and 0.1 to 0.2; a small but potentially important change by LR's of 2 to 5 and 0.5 to 0.2; and too small a change by LR's of 1 to 2 and 0.5 to 1.

To explore patients' and physicians' characteristics associated with true positive judgments of PCP recognition of cognitive impairment, we first conducted a series of bivariate logistic regression analyses, including only those patients who met neuropsychological criteria for cognitive impairment. In the bivariate analyses, we modeled the association between each potential patient and physician characteristic (independent variables) on the outcome of PCP Cognitive Concern (dependent variable). We then fit a final stepwise logistic regression model, including only those variables that showed bivariate associations with PCP Cognitive Concern at $p = 0.05$. We repeated these analyses using forward and backward selection procedures until a final consistent model emerged. To examine patients' and PCPs' characteristics that were associated with false positive judgments, we conducted parallel bivariate and stepwise regression analyses including only those patients who were classified as cognitively unimpaired by the neuropsychological criteria. We used the Generalized Estimation Equation (GEE) method to take into account the fact that patients were clustered within physicians. We also estimated Area under the Curve (AUC) for each model, calculating its 95% confidence using 1000 bootstrap replications.

Results

Patient and PCP Characteristics

All 13 PCPs in the FPU participated in the study (see Figure, Supplemental Digital Content 1, which demonstrates recruitment flow). PCPs reported cognitive concerns for 40 patients (PCP Cognitive Concern group) of 263 patients enrolled in the study. Of these 40, PCPs indicated that their concerns were shared in 30 cases by the patient (n=22), the family (n=1) or both (n=7). PCPs also classified 90 patients for whom they had no cognitive concerns but either the patient (n=78) or family (n=4) or both patient and family (n= 8) had concerns (designated Patient or Family Cognitive Concern group). The comparison group with no cognitive concerns comprised 133 patients. Patients' characteristics (Table 1) reveal a primarily Caucasian group of well-educated patients. Few had a history of stroke, most likely because many stroke survivors would have been excluded due to prior work-up for dementia. Patients' own reports of the quality of their memory were dichotomized as good (excellent or good) and poor (poor or fair). Patients who consumed alcohol were light to moderate drinkers, with only 1 patient reporting more than 2 alcoholic drinks per day. We dichotomized patient alcohol consumption as never or less than 1/day vs. more than 1/day.

Table 2 provides patients' scores on the five neuropsychological tests used to classify them as cognitively impaired or unimpaired, the frequency of this classification, and their MMSE scores. Table 3 shows PCPs' demographic and practice characteristics. All PCPs were trained in family medicine, all but one were female, and only two had further training in geriatrics. The proportion of patients aged over 65 ranged from 13% to 55% across PCP practices. All but one PCP agreed that cognitive assessment by PCPs improved patient outcomes and all PCPs had used either the MMSE or Montreal Cognitive Assessment (MoCA)¹⁶ at some time in their practice.

PCP Recognition of Cognitive Impairment

MANCOVA of neuropsychological test scores between PCP Cognitive Concern and No Cognitive Concern groups, controlling for age, sex and education, was significant overall, $F(5,164) = 10.11$, $p < 0.0001$. Follow-up pairwise comparisons between these two groups indicated significant differences ($P < 0.0001$) in HVLIT delayed recall and discrimination, TMT A and B, but not clock drawing, $p = 0.302$. On every test, the PCP Cognitive Concern group performed more poorly than the No Cognitive Concern group.

Table 4 provides the accuracy of PCP judgments against the neuropsychological classification of impairment. Given the strong performance of this well-educated group, the only MMSE cut points that included sufficient numbers of patients were 27 and 26 out of a possible 30. Only two classifications of cognitive impairment led to a meaningful change in the probability of a positive and negative posttest. The combination of PCP judgment and the MMSE cut point of 27 produced a small but potentially meaningful change of posttest probability of cognitive impairment, both for a patient with a positive test result and also for one with a negative test result.¹⁵ The MMSE cut point of 26 produced similar LR values.

Bivariate associations with PCP recognition of cognitive concern

Significant Odds Ratios (ORs) were found for two variables for the analyses examining true positive classification of patients in the PCP Cognitive Concern group: patient's subjective report of poor memory and the presence of cognitive impairment in more than 20% of patients in that PCP's practice (Tables 1 and 3). Five variables showed significant ORs for the analyses examining false positive classification of cognitively unimpaired patients: higher GDS score, subjective report of poor memory, alcohol consumption never or less than once a day, greater number of prescription and nonprescription medications, and diabetes mellitus (Table 1).

Final multivariate regression models

The variables that emerged from the stepwise model as being associated with true positive judgments and false positive judgments are provided in Table 5. Refitting the two final regression models, controlling for the potential effects of age, years of education and sex, did not change the outcomes. Using GEE we did not find any effect due to clustering within physicians.

Discussion

PCPs' detection of cognitive impairment should be both sensitive and specific. If PCPs' judgments are sensitive, but not specific, too many patients will be unnecessarily worked up; but if they are specific without being sensitive, too many patients who should have been worked up will be missed. We found that the relatively high specificity of PCP judgments of cognitive impairment was gained at the expense of overall low sensitivity, consistent with previous studies.^{5,6} Sensitivity improved from 61% to 82% when we classified patients as impaired based on either PCP cognitive concern or a MMSE score ≥ 26 , but specificity dropped somewhat from 86% to 74%. Our findings suggest that while clinical judgment alone would not meaningfully improve pretest detection, adding the MMSE would meaningfully improve the clinician's judgment beyond its pretest probability.

Several patient and physician characteristics influenced accuracy of recognition of cognitive impairment. Physicians' exposure to a greater proportion of cognitively impaired patients in their practices increased the true positive rate. Patients' reports of poor memory increased both the true and false positive rates. Thus, while it is important for PCPs to be aware of their patients' memory complaints, these complaints alone can lead to errors in recognition of cognitive impairment. The challenge for PCPs is to distinguish the so-called "worried well" from those who have genuine deficits.

All neuropsychological test scores, except for clock drawing, were significantly different between the PCP Cognitive Concern and No Cognitive Concern groups, even after controlling for age, education and sex. Given that clock drawing is an easier test, it likely produced a ceiling effect in our well-educated, mildly impaired sample. Thus, our PCPs' judgments were in the right direction but of lower sensitivity for mild impairments.

Diabetes mellitus is a known risk factor for cognitive impairment.^{17,18} We found that patients having diabetes increased the odds of PCPs' false positive judgment, although post-

hoc analyses showed no differences in neuropsychological test performance between diabetic and non-diabetic patients. PCPs judgment might have been influenced by knowing that diabetes increases risk of cognitive impairment. Lesser alcohol consumption, another known risk factor for cognitive impairment,^{19;20} also increased the odds of PCPs over-calling cognitive impairment in unimpaired patients. Indeed, HVLT delayed recall test scores were significantly poorer in those who drank less. The association between alcohol consumption and cognition is a complex one as morbidity itself leads to less frequent use of alcohol. We found alcohol consumption was significantly negatively related to a complexity score, $p=0.02$, based on total medical conditions and medications.²¹ However, as only 9 patients with PCP Cognitive Concerns consumed more than one alcoholic drink daily, our findings require confirmation with a larger sample.

Strengths of this study include a representative sample of primary care patients based on recruitment of consecutively seen patients to avoid referral bias. We also used an independent neuropsychological reference standard for cognitive impairment, which tapped the principal domains affected by aging, including memory, executive function, and processing speed. Our test battery was relatively brief, designed to reduce patient fatigue. Our reference standard, however, did not involve clinical judgment nor did it measure functional abilities, preventing us from labelling patients as having met criteria for mild cognitive impairment (MCI). Our PCP sample was relatively small and included only one Family Practice Unit. Since our patients were well educated, could hear and see with aids, were mainly Caucasian, and did not have current psychiatric diagnoses, our findings should be replicated in a more diverse sample of patients. Furthermore, although the MMSE is the most thoroughly studied cognitive screen, is brief and relatively easy to administer, it lacks sensitivity.²² Other screening tests should be investigated for their ability to enhance PCPs' recognition of cognitive impairment in the absence of dementia.

In conclusion, our results suggest that the MMSE will improve PCPs' ability to accurately detect cognitive impairment in their patients without previous frank dementia. We also found that greater exposure to cognitively impaired patients decreased false negative errors, but certain known risk factors for cognitive impairment increased false positive errors.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Patient Characteristics and Results of Bivariate Logistic Regression Analyses of Factors Associated with Primary Care Physicians' (PCP) Judgments of Cognitive Concern

Characteristic	PCP Cognitive Concern [*] n=40	Patient or Family Cognitive Concern [†] n=90	No Cognitive Concern [‡] n=133	Odds Ratio (95% Confidence Interval)	
				True positives n=33	False positives n=140
Age, M ± SD, years	81.7 ± 5.8	77.6 ± 6.9	79.0 ± 7.0	1.0(0.9-1.1)	1.0(1.0-1.1)
Female, n (%)	20 (50)	36 (40)	53 (39.9)	1.4(0.4-5.8)	0.5(0.2-1.3)
Education, M ± SD, years	14.1 ± 4.2	15.2 ± 3.4	15.3 ± 2.8	0.9(0.8-1.1)	1.0(0.8-1.2)
Caucasian, n (%)	36 (90.0)	75 (83.3)	118 (88.7)		
Married, n (%)	19 (47.5)	58 (64.4)	74 (55.6)	1.8(0.4-8.0)	0.7(0.3-1.8)
Geriatric Depression Scale, M ± SD	3.1 ± 3.0	2.6 ± 2.4	1.5 ± 1.7	1.1(0.8-1.4)	1.4(1.1-1.8) ^{¶¶}
Poor subjective memory, n (%)	21 (52.5)	37 (41.1)	17 (12.8)	6.2 (1.3-30.2) ^{§§}	5.0 (1.8-14.5) ^{¶¶}
Driving a car, n (%)	25 (62.5)	74 (82.2)	106 (79.7)	0.6(0.2-2.6)	0.7(0.2-2.0)
Consumed Alcohol 1/day, n (%)	9(22.5)	20(22.2)	52(38.4)	0.6(0.1-2.7)	6.0(1.3-27.0) ^{§§}
Medications, M ± SD	10.1 ± 5.0	8.3 ± 4.2	7.6 ± 3.9	1.1(0.9-1.3)	1.1(1.0-1.2) ^{§§}
Co-morbidities, M ± SD	12.3 ± 6.7	9.8 ± 5.0	9.8 ± 5.5	1.0(0.9-1.2)	1.1(1.0-1.2) ^{§§}
Hypertension [§] , n (%)	28 (70.0)	54 (60.0)	80 (60.2)	3.4(0.7-16.1)	1.0(0.4-2.5)
Diabetes mellitus [¶] , n (%)	15 (37.5)	20 (22.2)	19 (14.3)	1.4(0.3-7.1)	5.3(1.9-14.8) ^{¶¶}
Stroke or TIA ^{**} , n (%)	5 (12.5)	9 (10.0)	6 (4.5)	2.1(0.2-22.9)	2.6(0.5-14.2)
Myocardial infarction ^{††} , n (%)	2 (5.0)	9 (10.0)	11 (8.3)	0.6(0.04-11.1)	0.6(0.1-4.8)
Malignant cancers, ^{‡‡} n (%)	19 (47.5)	30 (33.3)	41 (30.8)	1.3(0.3-5.4)	2.3(0.9-6.1)

^{*} PCP Cognitive Concern includes those for whom PCP had a concern regardless of patient or family concerns.

[†] Patient or Family Cognitive Concern includes those for whom the patient or family had a cognitive concern but the PCP did not.

[‡] No Cognitive Concern includes those with no cognitive concerns.

[§] Hypertension includes International Classification of Diseases (ICD) 9 code 401

[¶] Diabetes mellitus includes ICD 9 codes 249, 250

^{**} Stroke or TIA, transient ischemic attack, includes ICD 9 codes 431, 432

^{††} Myocardial infarction includes ICD 9 codes 410, 411, 412

^{‡‡} Malignant cancers include ICD9 codes 140-209

^{§§} $p < 0.05$

^{¶¶} $p < 0.005$

Table 2
Patient Performance on the Neuropsychological Test Battery, MMSE and Cognitive Impairment Status by Primary Care Physicians' (PCP) Judgments of Cognitive Concern

Characteristic	PCP Cognitive Concern [*] n=40	Patient or Family Cognitive Concern [†] N=90	No Cognitive Concern [‡] N=133
HVLT Delayed Recall, M ± SD, Range 0 -12	5.1 ± 4.0	7.4 ±3.7	9.1 ±2.9
HVLT Discrimination, M ± SD, Range 0-12	8.9 ±2.6	10.0 ± 2.0	10.6 ±1.5
Trail Making Test, Part A, M ± SD, Range 0-180 seconds	32.4 ±23.9	23.4 ±11.9	19.4 ±7.7
Trail Making Test, Part B, M ± SD, Range 0-180 seconds	82.0 ±49.2	57.5 ±39.2	48.9 ±30
Clock Drawing Test, , M ± SD, Range 0-15	13.03 ±2.0	13.4 ±2.1	13.6 ±1.7
MMSE, M ± SD, Range 0-30	27.3 ± 2.3	28.1 ±2.0	28.2 ±1.8
Cognitive impairment [§] , n (%)	20 (50.0)	22 (24.4)	13 (9.8)

HVLT= Hopkins Verbal Learning Test; MMSE = Mini-Mental State Examination.

^{*} PCP Cognitive Concern includes those for whom PCP had a concern regardless of patient or family concerns.

[†] Patient or Family Cognitive Concern includes those for whom the patient or family had a cognitive concern but the PCP did not.

[‡] No Cognitive Concern includes those with no cognitive concerns.

[§] Cognitive impairment includes patients who have two or more neuropsychological test scores greater than 1.5 SD below the normative mean for the test.

Table 3
Characteristics of Primary Care Physicians (PCP) and their Practices and Results of
Bivariate Logistic Regression Analyses of Factors Associated with PCP Judgments of
Cognitive Concern or No Concern

Characteristic	Value*	Odds Ratio (95% Confidence interval)	
		True positives N=33	False positives N=140
Age, years	43.6 ±7.1	1.1(0.9-1.2)	1.0(0.9-1.1)
Female	12 (92.3)		
Geriatric training beyond residency	2 (14.4)	1.4(0.2-8.9)	1.2(0.4-3.9)
>20% of patients in practice are cognitively impaired	9 (69.2)	6.6 (1.3-34.1) [†]	1.0(0.3-3.1)
> 35% of patients aged ≥ 65	6 (46.2)	1.0(1.0-1.1)	1.0(1.0-1.0)
Conducts cognitive assessment when learn of family history of dementia	5 (38.5)	3.4(0.8-14.8)	1.2(0.4-3.1)
Often asks patients about cognitive function	5 (38.5)	3.3(0.7-15.9)	0.9(0.3-2.3)
Agrees cognitive assessment by PCP important	12 (92.3)		
Agrees cognitive assessment by PCPs leads to better patient outcomes	9 (69.3)	1.6(0.5-4.8)	0.7(0.4-1.4)
Has used MMSE or MOCA in practice	13 (100.0)		

MMSE = Mini-Mental State Examination; MoCA = Montreal Cognitive Assessment

* All values are n (%) except for age which is Mean ± SD

[†] p<0.05

Table 4
Accuracy of Primary Care Physicians' (PCP) Judgments of Cognitive Concern Using Neuropsychological Test Performance as the Reference Standard for Cognitive Impairment

Classification of impairment, n	Sensitivity 95% CI	Specificity 95% CI	LR+ 95% CI	LR- 95% CI
Any Cognitive Concern* (n=130) vs. No Concern (n=133)	76.4 63.0-86.8	57.7 50.7-64.5	1.8 1.5-2.2 [‡]	0.4 0.3-0.7 [‡]
PCP Cognitive Concern [†] (n=40) vs. No Concern (n=133)	60.6 42.1-77.1	85.7 78.8-91.1	4.2 2.6-6.9	0.5 0.3-0.7 [‡]
MMSE 26 (n=51) vs. 27 (n=212)	52.7 38.8-66.3	89.4 84.4-93.3	5.0 3.1-8.0	0.5 0.4-0.7 [‡]
MMSE 25 (n=26) vs. 26 (n=237)	36.4 23.8-50.4	97.1 93.8-98.9	12.6 5.3-29.9	0.7 0.5-0.8 [‡]
Any Cognitive Concern* or MMSE 26 (n=153) vs. remaining (n= 110)	89.1 77.8-95.9	50.0 43.0-57.0	1.8 1.5-2.1 [‡]	0.2 0.1-0.5
Any Cognitive Concern* or MMSE 25 (n=138) vs. remaining (n= 125)	85.5 73.3-93.5	56.3 49.2-63.1	2.0 1.6-2.4 [‡]	0.3 0.1-0.5
PCP Cognitive Concern [†] or MMSE 26 (n=63) vs. remaining (n=110)	81.8 64.5-93.0	74.3 66.2-81.3	3.2 2.3-4.4	0.3 0.1-0.5
PCP Cognitive Concern [†] or MMSE 25 (n=48) vs. remaining (n=125)	75.8 57.7-88.9	83.6 76.4-89.3	4.6 3.0-7.0	0.3 0.2-0.5

LR = likelihood ratio; CI = confidence interval.

* Any Cognitive Concern includes concerns by PCP, patient or family.

[†] PCP Cognitive Concern includes those for whom PCP had a concern regardless of patient or family concerns.

[‡] LR too small to produce a meaningful change in posttest probability.

Table 5
Multivariate Stepwise Regression Models of Factors Associated Associated with Primary Care Physicians' Judgments of Cognitive Concern in Patients with Cognitive Impairment (True Positives) and in Patients without Cognitive Impairment (False Positives)

Characteristic	Odds Ratio (95% CI)	
	Patients with cognitive impairment (odds of true positive) n=33 AUC (95% CI) 0.8 (0.7- 0.9)	Patients without cognitive impairment (odds of false positive) n=140 AUC (95% CI) 0.8 (0.8-0.9)
>20% of patients cognitively impaired	7.9 (1.2-52.0) *	
Poor subjective memory	7.3 (1.2-44.5) *	16.7 (4.0-69.37) ‡
Never or seldom consumption of alcohol		10.7 (1.8-63.0) ‡
Diabetes mellitus		8.5 (2.4-29.4) ‡

Note: AUC = area under the curve, CI = confidence interval

* P <0.05

‡ p<0.01

‡ p<0.001