

# Yield of Review of Systems in a Self-administered Questionnaire.

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**Background:** Family physicians frequently screen new patients with questionnaires that include a standard review of systems. The diagnostic yield of such questionnaires is unknown.

**Methods:** We retrospectively compared results of 248 patient questionnaires with the clinicians' dictated medical record in a university-based family medicine practice. Any positive responses in the review of systems section were compared with the medical record to determine whether they resulted in a new diagnosis and a therapeutic maneuver.

**Results:** The case-finding yield for the review of systems section as a whole was 10.5 percent. This yield compares favorably with other screening maneuvers in clinical practice. Individual questions had yields of 0.0 to 1.6 percent. The positive predictive value for a given yes response on the review of systems, defined as new diagnoses divided by total yes answers, was 3.3 percent.

**Conclusions:** Compared with other case finding maneuvers in clinical practice, the review of systems questionnaire has a very acceptable yield. Its positive predictive value is low, however, and there are differences observed among physicians. Certain questions had a positive predictive value of 0.0 and could be deleted, which would produce a shortened review of systems section (J Am Board Fam Pract 1997;10:20-7).

Self-administered screening questionnaires are common in primary care settings and have been described in the literature for more than 45 years. The classic Cornell Medical Index contains 176 questions including those related to symptoms.<sup>1</sup> Although usually abbreviated to fewer queries, symptom-related questions or the review of systems (ROS) is a time-honored tradition in medicine. It is taught as an oral process in medical school; however, in many practices it is conducted with a self-administered questionnaire.

Although the comprehensive review of systems is considered an important component of the general medical evaluation, its yield as a case-finding maneuver has not been extensively studied. The screening ROS has been studied in general medicine inpatients for two specific organ systems, cardiopulmonary and gastrointestinal,<sup>2</sup> and in older ambulatory medicine patients where

the entire ROS was studied as a group.<sup>3</sup> In these studies, 5 to 7 percent of patients were found to have a new diagnosis using the verbal ROS process. To date there has been no additional comprehensive analysis reported of the yield of individual questions in the ROS. The goal of the present research was to determine the yield and positive predictive value for each of 20 ROS questions in a self-administered questionnaire.

In earlier studies that compared the results of questionnaires with medical records, the patient questionnaire was considered the reference standard.<sup>4</sup> Medical records that did not address a patient's report of a medical problem or symptom from the questionnaire were considered deficient. In the initial report of the Cornell Medical Index, a self-administered questionnaire with 140 ROS items, twice as many symptoms were recorded on the questionnaire as in the medical record. This finding led investigators to focus on improving the medical record.<sup>1</sup> More recent studies have used the medical record, rather than the patient questionnaire, as the reference standard. This reversal occurred because symptoms recorded by patients do not always translate into disease, especially serious disease for which meaningful treatments are available. A study at the Mayo Clinic, using a computer-processed questionnaire, found

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that physician-unsubstantiated or false-positive responses on the questionnaire occurred much more often than omissions in the medical record.<sup>5</sup>

Case finding is the term used to describe screening for unsuspected medical conditions during a clinical encounter. According to the methods described by the US Preventive Services Task Force, a screening test must satisfy two major requirements to be considered effective.<sup>6</sup> It must detect the target condition earlier than it would be detected without screening, and it must do so with considerable accuracy. Persons whose diseases are detected early should have a better clinical outcome than those whose conditions are detected later without screening. Target conditions must be clinically important or worthy of screening. A clinically important condition is defined as one that could potentially limit length of life, reduce patient functioning, or require long-term medication, and for which a proven efficacious treatment is available.<sup>6</sup>

Detection of these conditions is the ultimate goal of meaningful case finding. For example, the case-finding yield for invasive cervical cancer using Papanicolaou testing ranges from 0.1 to 0.15 percent, depending on the testing interval.<sup>7</sup> A recent large study found a yield for mammograms (a diagnosis of breast cancer) of 0.2 percent in women aged 40 to 49 years and 1 percent in women aged 50 years and older.<sup>8</sup> Screening procedures, such as routine electrocardiograms, chest radiographs, and biochemical profiles, have case-finding yields of 2 to 6 percent.<sup>3</sup>

This study began with the hypothesis that the case-finding yield for an ROS questionnaire is low, with many false-positive responses. We were also interested in finding out (1) what the ROS section adds and how often is it redundant to the chief complaint and medical history when a complete history and physical examination are done, and (2) whether there are differences in the way physicians use such a questionnaire.

## Methods

During the summer of 1995, we studied the medical records of every second new adult patient, aged 18 years or more, who enrolled for care at the University of California at San Francisco (UCSF) Family Medicine Clinic during 1994. All new clinic patients completed a standard, multi-

ple-page history form that included sections on chief complaint, medical history, habits, and family history, in addition to 20 ROS questions (Figure 1). The questionnaire, including the ROS questions, was developed at UCSF by a group of experienced family practice and internal medicine physicians in the late 1980s. The ROS is an abbreviated version of those found in physical diagnosis textbooks. It includes only those questions its authors thought, based on their clinical experience, had a high yield. After completing the questionnaire, patients were seen by a physician for a 30-minute new-patient visit that included a comprehensive physical examination. The practice included 9 board-certified family physicians, 2 women and 7 men, who ranged in age from 33 to 63 years. Three physicians were in clinic 2 half-days a week, the remainder practiced 6 to 7 half-days a week.

The new-patient visit generated a dictated and transcribed history and report of the physical examination, which will be referred to as the medical record. Charts with uncompleted ROS sections or hand-written medical records were excluded. Patient questionnaires were reviewed systematically, and ROS data were recorded. The medical record, including data from any subsequent visits, diagnostic tests, and referrals, was examined in charts with yes responses on the ROS section of the patient questionnaire to determine the percentage of patient responses that generated a new diagnosis with a therapeutic intervention by the clinician.

Each yes response in the patient questionnaire was categorized as follows, depending on how the relevant data were recorded by the clinician in the medical record: either (1) new diagnosis; or no new diagnosis because (2) the problem was addressed in the patient's original or chief complaint, (3) the problem was addressed on review of the patient's medical history or high-risk behaviors, (4) the problem was evident on physical examination (eg, obesity), (5) the problem was addressed by the provider, but no new diagnosis was made (addressed, deemed benign), or (6) no documentation was found in the transcribed history and physical examination notes to indicate that the problem was addressed. In addition, new diagnoses were studied to find out whether any intervention or treatment resulted.

Charts were reviewed by a trained research as-

**Please indicate if you have any of the following problems NOW:**

	Yes	No	Comments
1. Severe or unusual headache	_____	_____	_____
2. Hearing problems	_____	_____	_____
3. Problems with vision (other than nearsightedness or farsightedness)	_____	_____	_____
4. Sinus problems or hay fever	_____	_____	_____
5. Hoarseness	_____	_____	_____
6. Problems with teeth or gums	_____	_____	_____
7. Severe skin problems	_____	_____	_____
8. Weight loss or gain	_____	_____	_____
9. Chest pains or discomfort	_____	_____	_____
10. Shortness of breath	_____	_____	_____
11. Cough or phlegm	_____	_____	_____
12. Stomach problems (pain, nausea, or vomiting)	_____	_____	_____
13. Diarrhea or constipation	_____	_____	_____
14. Blood in bowel movements or black bowel movements	_____	_____	_____
15. Difficulty or pain on urinating or blood in urine	_____	_____	_____
16. Painful joints	_____	_____	_____
17. Sexual difficulties	_____	_____	_____
18. Depression	_____	_____	_____
19. Severe sleep problems	_____	_____	_____
20. Severe stress	_____	_____	_____
21. Other, describe:	_____	_____	_____
			_____
			_____

**Figure 1. Review of Systems.**

sistant (KS), and medical data were interpreted by an experienced family medicine faculty physician (MEV). Audits of every 10 chart reviews showed 90 percent agreement between the assistant and the principal investigator. Disagreements were discussed and resulted in mutual assignment of data to one of the six categories described above. Patient and chart data were coded for anonymity and entered directly into the computer for analysis. Two different statistical software packages, Excel<sup>9</sup> and SPSS,<sup>10</sup> were used for data analysis. The protocol was approved by the UCSF Committee on Human Subjects Research.

## Results

There were 301 new-patient questionnaires available for study. Of these questionnaires, 53 were excluded because the ROS section was incomplete or the medical record was handwritten. Of the 248 questionnaires remaining, 204 had at least one yes response in the ROS section. The medical records for these patients were reviewed, and clinician response was categorized according to the six categories described above.

The descriptive statistics of the studied patient population are presented in Table 1. The patient population was young (average age 42.6 years, SD 15.5 years, range 18 to 87 years), 54.8 percent female, mostly insured, and well educated. Only 14.1 percent were current smokers. These findings are comparable to those of the excluded group and the practice as a whole.

### *Yield of the ROS Questionnaire*

Twenty-six new diagnoses were recorded in the medical records of the 248 patients studied (Table 2). Twenty-three of the patients with new diagnoses had only one new diagnosis. Under "Action Taken" in Table 2 counseling included imparting information and advice regarding personal behaviors to reduce the risk of subsequent illness or injury. If the 20 ROS questions are considered as a single test, 26 new diagnoses in 248 patients resulted in a yield of 10.5 percent. There were 785 yes responses in the 248 charts, resulting in the yield of 26 of 785 single yes responses, or a positive predictive value of 3.3 percent.

Seven questions, dealing with sinus problems or hay fever, hoarseness, weight loss or gain, cough, diarrhea, depression, and sexual difficulties, had a yield of 0.0, raising the possibility that

**Table 1. Patient Characteristics From Review of 248 Charts.**

Characteristics	Number	Percent
Sex		
Female	136	54.8
Male	112	45.2
Insurance		
Private	176	70.9
Medi-Cal	34	13.7
Medicare	4	1.6
Uninsured	8	3.2
Unanswered	26	10.5
Marital status		
Single	82	33.1
Married	107	43.1
Divorced	27	10.9
Widowed	10	4.0
Live with partner	12	4.8
Unanswered	10	4.0
Education		
High school or less	47	18.9
Some college	34	13.7
College degree	90	36.3
Graduate degree	52	21.0
Unanswered	25	10.1
Smoker		
Yes	35	14.1
No	209	84.3
Unanswered	4	1.6

some of these questions could be deleted. The result would be a shortened ROS section with the same yield. In this study psychosocial diagnoses were detected with questions regarding stress and sleep difficulties.

### *Characteristics of Yes Responses*

Table 3 displays the frequency of positive responses for each of the 20 ROS items on the patient questionnaire and the clinician response as recorded in the medical record. Table 3 also includes the yield and positive predictive value for each question.

Of the 785 yes responses, 215 (27.4 percent) were recorded by clinicians as part of the patient's chief complaint. Presumably these problems were the driving force behind the patient's visit to the clinician and did not need screening by a patient ROS questionnaire.

For 95 patients (12.1 percent) the symptom generating the yes response in the ROS section was noted in the medical record under medical history. The patient questionnaire also has a brief past medical review section. Although the ROS

**Table 2. New Diagnoses by Patient Demographics, Question, and Action Taken.**

Age	Sex	Question	Diagnosis	Action Taken
32	M	Headache	Tension-type headache	Ibuprofen
26	F	Headache	Tension-type headaches	Exercises
46	F	Headache	Migraines	Propranolol, ibuprofen
47	F	Headache	Psychosocial problems	Supportive counseling
67	M	Hearing	Perforated eardrum	Safety measures, counseling
34	F	Hearing	Cerumen impaction	Ear irrigation
68	F	Hearing	Mild presbycusis	No treatment
69	F	Hearing	Presbycusis	Hearing aid
67	M	Vision	Mixed refractive error	Corrective lenses
33	F	Vision	Myopia	Corrective lenses
68	F	Teeth	Tooth decay	Referral to dentist
36	M	Skin	Tinea pedis	Nonprescription medication, environmental
71	M	Chest	Coronary artery disease	Coronary artery bypass graft after persistent chest pain
67	M	Chest	Gastritis, reflux	Antacids
34	F	Chest	Mitral valve prolapse	Dental prophylaxis counseling
55	M	Shortness of breath	Chronic obstructive pulmonary disorder	Smoking cessation counseling
27	M	Stomach	Gastritis secondary to nonsteroidal-anti-inflammatory drug (NSAID)	NSAID discontinued
58	F	Stomach	Gastritis	Histamine H <sub>2</sub> blocker
63	F	Blood in stools	Tubular adenoma, severe dysplasia	Polypectomy
67	M	Urinary tract symptoms	Urethral calculi	Surgical removal
39	F	Joints	Lateral epicondylitis	Counseling: work station, joint position, overuse
53	M	Joints	Achilles tendinitis	NSAIDs, heel lift, exercises
43	M	Joints	Lateral epicondylitis	Counseling: joint position and overuse in sports
28	F	Sleep	Sleep disorder psychosocial problem	Counseling: sleep habits and general counseling
31	M	Stress	Psychosocial problem	Supportive counseling
53	F	Stress	Depression	Antidepressant medication

section studied asked patients whether they "have symptoms now," it appears that patients often included in this category symptoms that had occurred only in the past.

In 10 patients (1.3 percent) the problem generating a yes response on the ROS section was evident on physical examination. All 10 patients had checked recent weight loss or gain. On review of height and weight recorded in the medical record, we found the body weight to be 20 percent above ideal weight. These cases were not included in Table 2 because presumably the most basic of physical measurements could take the place of the ROS weight-related question. This group of 10 patients probably represented a minority of overweight patients in the study group. Although this

question did not result in a new diagnosis, it could be used to introduce a discussion about weight loss or a recent history of weight gain.

The largest category in Table 3 is "Addressed, No New Diagnosis" and includes 33.8 percent of yes responses. The clinician discussed the problem with these patients and documented that the symptoms were trivial or that upon further testing (eg, audiology) no new diagnosis was made.

The category "Not Documented" in the medical record contained 173 responses (22.3 percent). In these medical records there was nothing in the dictated history and physical examination that referred to the yes response. Because of the study design it is unknown whether the lack of documentation is attributable to the symptoms



**Table 3. Characteristics, Positive Predictive Value, and Yield of Positive Responses for Review of System (ROS) Items.**

Review of Systems Question	Yes Responses	New Diagnoses	Chief Complaint	Medical History	Not Documented	Addressed, No New Diagnosis	Physical Examination	Positive Predictive Value	Yield
Headache	65	4	23	3	15	20		6.15	1.6
Hearing	43	4	8	5	5	21		9.30	1.6
Vision	45	2	6	11	7	19		4.49	0.8
Sinus	65	0	13	10	9	33		0.00	0.0
Hoarseness	6	0	1		3	2		0.00	0.0
Teeth	42	1	0	0	26	15		2.38	0.4
Skin	22	1	9	6	3	3		4.55	0.4
Weight	57	0	9	1	18	19	10	0.00	0.0
Chest	56	3	24	2	9	18		5.36	1.2
Breath	40	1	11	2	12	14		2.50	0.4
Cough	33	0	7	7	8	11		0.00	0.0
Stomach	33	2	13	4	4	10		6.06	0.8
Diarrhea	36	0	5	4	11	16		0.00	0.0
Blood in stool	14	1	4	2	1	6		7.14	0.4
Urination	15	1	6	4	2	2		6.67	0.4
Joints	81	3	40	22	5	11		3.70	1.2
Sexual	12	0	1	2	6	3		0.00	0.0
Depression	40	0	12	8	12	8		0.00	0.0
Sleep	40	1	9	2	10	18		2.50	0.8
Stress	40	2	14	0	7	17		5.00	0.8
Total No. (%)	785 (100)	26 (3.3)	215 (27.4)	95 (12.1)	173 (22.3)	266 (33.8)	10 (1.3)		

ROS question—a question pertaining to problems with the subject listed. See Figure 1.

Yes responses—number of times yes column was checked on the new-patient questionnaire for this particular ROS question.

Positive predictive value—percentage of the yes responses that led to a new diagnosis (new diagnoses divided by yes responses).

Yield—new diagnoses divided by total sets of ROS studies (n = 248).

being trivial or because the problem was overlooked.

### Physician Comparison

Table 4 displays the breakdown of yes responses for the 9 clinicians in this study. Four clinicians (A-D) saw 157 (77.0) percent of the patients, and each had at least 30 patient records reviewed (range 33 to 49). Numbers in parentheses in Table 4 reflect the percentage breakdown of the yes responses for each physician and can be used to compare among physicians. For physicians A through D, the range of new diagnoses for individual clinicians was 0.7 to 7.2 percent with an average of 3.7 percent. Clinician D had eight new diagnoses, which, upon further review of the data, included 3 patients with hearing problems, 1 with tendinitis, and 1 with sleep disorder. Clinician C had only one new diagnosis, that associated with blood in the stool. The other categories with notable variance are “Not Documented” and “Ad-

dressed, No New Diagnosis.” Because these two categories could include so-called false-positive or trivial complaints, it is interesting to add the two together and then compare the 4 clinicians. All 4 clinicians had 50 to 56 percent of yes responses in this larger category, which takes into consideration different levels of documentation for the medical encounter. There were, therefore, differences observed in the way in which individual physicians responded to yes answers in the screening questionnaire.

### Discussion

This study compared the yield of the ROS section in a self-administered patient questionnaire with the medical record of a clinical encounter. It is debatable how many of the problems in Table 2 are clinically important, benefit from early diagnosis, and have a proven efficacious treatment. A diagnosis was defined as clinically important if the condition could potentially limit length of life or

**Table 4. Comparison of Data Among Physicians.**

Physician, No. of Patients	Yes Responses No.	New Diagnoses No. (%)	Chief Complaint No. (%)	Medical History No. (%)	Not Documented No. (%)	Addressed, No New Diagnosis No. (%)	Physical Examination No. (%)
A, 49	206	6 (2.9)	67 (32.5)	17 (8.3)	58 (28.2)	57 (27.7)	1 (0.5)
B, 39	157	6 (3.8)	41 (26.1)	28 (17.8)	22 (14.0)	58 (36.9)	2 (1.3)
C, 36	140	1 (0.7)	46 (32.8)	19 (13.6)	51 (36.4)	22 (15.7)	1 (0.7)
D, 33	111	8 (7.2)	23 (20.7)	16 (14.4)	14 (12.6)	47 (42.3)	3 (2.7)
E, 13	32	0 (0.0)	7 (21.9)	5 (15.6)	0 (0.0)	19 (59.4)	1 (3.1)
F, 11	52	5 (9.6)	11 (21.2)	3 (5.8)	4 (7.7)	28 (53.8)	1 (1.9)
G, 10	35	0 (0.0)	11 (31.4)	0 (0.0)	4 (11.4)	19 (54.3)	1 (2.9)
H, 9	42	0 (0.0)	9 (21.4)	6 (14.3)	20 (47.6)	7 (16.7)	0 (0.0)
I, 4	10	0 (0.0)	0 (0.0)	1 (10.0)	0 (0.0)	9 (90.0)	0 (0.0)

patient functioning, or require long-term medication. More rigorous criteria, used by the US Preventive Services Task Force and described in the introduction, would decrease the diagnostic yield of Table 2. For many of these diagnoses published reports are scarce or nonexistent regarding importance to patient, the benefit of early diagnosis, or efficacy of treatment. The decision to include a diagnosis is, therefore, somewhat subjective. Rather than subjectively exclude potentially unimportant conditions in the results, Table 2 includes every diagnosis found in the medical record. One could argue that rigorous criteria are suitable for expensive or painful tests and less suitable for merely asking questions.

Our study examined the record for 6 months to 1 year after the initial new-patient visit and found the questionnaire had a relatively low positive predictive value. Relatively few of the total yes responses led to clinically important diagnoses (26 of 785), so that the positive predictive value of a single yes response was 3.3 percent. Compared with the yield of the entire ROS section, the yield of individual questions more closely resembled a single test and ranged from 0.0 to 1.6 percent. Examination of the seven questions with a yield of 0.0 raises the issue of whether to use the medical record as the reference standard. For example, were critical issues ignored by the busy clinician, or does this screening instrument have truly low positive predictive value for certain questions? These questions cannot be answered by a retrospective review of medical records; a separate patient interview or longitudinal study of records would be necessary.

In this study a positive ROS response was first examined to determine whether it had already

been discussed under chief complaint or medical history or was evident on physician examination, and the remaining positive responses were studied to find out whether they yielded a new, clinically important diagnosis. In all we found that 40 percent of the yes responses from the ROS section of the questionnaire were redundant to the chief complaint, medical history, or physician examination, and 55 percent either were addressed and considered benign or "not documented" in the medical record. Thus more than one half of yes responses on a ROS questionnaire could be attributed to benign or trivial complaints that require valuable time in the clinical encounter.

Table 4 illustrates the variety of ways clinicians use the screening ROS when dictating the findings from the medical history and physical examination. The yield of the screening ROS varied depending in part on the individual clinician's style of recording problems in the medical record. Differences in the number of new diagnoses could be explained by the tendency for some physicians to diagnose and document potentially unimportant conditions, whereas others might not have chosen to list such conditions in the patient's medical record. Likewise, physicians varied when documenting false-positive or trivial complaints. In summary, there are differences in the way physicians use the ROS questionnaire, and the results of this study were affected by the style of the physicians studied.

Future studies could address the nature of these differences and their importance, if any. Not all physicians can set aside 30 minutes for a new-patient visit; instead, they work in new patients when illnesses arise. We believed it was important to review the yield of the ROS questionnaire

when the physicians did have this time, because our findings could help direct the use of a clinician's time as reimbursement becomes increasingly capitated.

The population studied (patients of an urban, academic family practice) might limit the generalizability of this study. The average patient was younger and more educated than the average population for most family physicians. Also the percentage of smokers in the studied group was considerably lower than the national average and reflects the average for the San Francisco Bay area. These factors would suggest a healthier population than average. Furthermore, we used an abbreviated ROS questionnaire. If a longer ROS questionnaire, such as the Cornell Medical Index, were studied, the results might show a lower or higher positive predictive value.

Overall, the yield for the screening ROS appears to be acceptable when compared, for example, with the relatively low yield of Papanicolaou smears, which require an invasive examination and generate a laboratory charge (even though it is arguable whether any of the diagnoses in Table 2 can be compared with invasive cervical cancer). This yield supports the findings of earlier studies that show the ROS to be a cost-effective screening test in asymptomatic patients seeking medical care.<sup>2,3</sup> The positive predictive value appears low; however, the incidence and prevalence of undiagnosed clinically important conditions in this population are unknown. In less-healthy populations, the yield could be much higher.

The value of the ROS might lie less in its ability to detect new diagnoses than in its ability to rule out other conditions. Some clinicians believe patient satisfaction is increased with the medical encounter if they know all of their concerns have been addressed. Yet such a questionnaire could remind patients of potentially trivial symptoms at the expense of the physician's time. This study suggests that there would be few life-threatening consequences from eliminating the ROS section

from a self-administered questionnaire. While the ROS fulfills the criteria for an acceptable screening tool, individual clinicians must decide whether it is worth their time and effort in a rapidly changing medical environment.

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