

An Exploratory Report Of Chest Pain In Primary Care

A Report From ASPN

Abstract: Chest pain is important to patients and clinicians because it can signal a threat to life as well as present diagnostic and therapeutic challenges. Because prior clinical research has not provided clear guidance to primary care clinicians, the Ambulatory Sentinel Practice Network was interested in investigating chest pain as it presents and is managed in primary care. A contemporary exploratory study was required to characterize chest pain from a clinical perspective, to test the feasibility of investigating chest pain in a network of primary care practices, and to generate promising areas for investigation. This article provides a detailed distribution of demographic, diagnostic, and therapeutic variables associated with a convenience sample of 832 patients with chest pain. Most of the patients in this study were seen only by primary care clinicians in office settings. There were promising areas identified for further investigation, including an unexpected frequency of costochondritis in black women, clinician uncertainty in the management of patients with chest pain thought to be of gastrointestinal origin, constant vigilance for infrequent myocardial infarctions, perceived discordance between clinician and patient concerning the patient's chest pain, and the methodological requirement of improved delineation of episodes of chest pain. (J Am Board Fam Pract 1990; 3:143-50.)

Very little is accurately known of the incidence and geographical distribution of a variety of common ills which are daily met within our surgeries or in our patients' homes. It seems probable, therefore, that the first years of our research will be profitably spent in seeking out essential facts about the structure of general practice . . . (College of General Practitioners. Research Newsletter 1954; 3[January].)

Chest pain may signal imminent death, or it may be remarkably benign. Consequently, determining the nature and importance of chest pain is a persistent requirement of those who serve as the point of first contact for the concerns people bring to physicians. Of course, this is not news. Sir James Mackenzie emphasized a century ago the need to study symptoms in detail, and, indeed, there were careful delineations of chest pain that classified patients according to clinical descriptions.¹⁻³ These studies directed attention to the complex interplay of physiology, pathology, emotions, and life circumstances with the development, evolution, and clinical management of chest pain. A need to clarify terms,⁴ improve classification,⁵ and validate clinical assess-

ment⁶ accompanied the research and emphasized distinguishing the patient with chest pain who had a life-threatening condition such as angina. This emphasis was fueled by a growing technology, which is of potential benefit to appropriately selected patients, and it has persisted with enthusiastic efforts to improve the predictive accuracy of clinical decisions about patients who may have life-threatening disease.⁷⁻⁹

The importance and utility of these earlier investigations about chest pain to current, front-rank primary care medicine remain unclear. As Kilgore stated in 1926 in his address to the Section on Practice of Medicine at the 77th Annual Session of the AMA concerning angina and pseudoangina, "It seems as if we do not know exactly what we are talking about; but that, unfortunately, is exactly the fact."¹ This statement remains true today. Coronary heart disease mortality has declined in the United States without clarification of the specific reasons for the reduction.^{10,11} A renewed emphasis on family practice has been accompanied by an occasional published¹² and unpublished report* concerning chest pain, but with little clinical guidance. In-

From the Ambulatory Sentinel Practice Network, Denver. Address reprint requests to ASPN, 888 Dahlia Street, Denver, CO 80220.

Supported by a grant from the W.K. Kellogg Foundation.

*Henderson R, Tindall H. The symptom of chest pain in ambulatory practice (unpublished paper). Southcentral Pennsylvania PSRO, Ambulatory Care Review Demonstration Project. Contract No. HSA 105-74-132 Report, 1979.

vestigations of chest pain that might have been angina were reported in which normal or insignificantly obstructed coronary arteries were found,^{13,14} reminding clinicians of the necessity of the broader perspective of chest pain revealed in earlier clinical research. Even an efficacious approach to improved clinical decision making was not followed by effective implementation.¹⁵ This can be partially explained by observations that the patient populations presenting chest pain to primary care clinicians differ from patients investigated and reported in other studies of chest pain and coronary artery disease.¹⁶ There is evidence that the probabilistic decision rules developed in specialty centers may translate poorly to community practice.¹⁷ Furthermore, individual clinicians have varied widely in their use of probabilistic estimates, with some choosing to admit patients to the coronary care unit even though their probability estimates for myocardial infarction were less than 10 percent, while others have chosen not to admit with probabilities greater than 21 percent.¹⁸

Recent developments concerning the therapy of coronary artery disease have made more urgent the need to improve the management of chest pain at the primary care level. Immediate treatment of unstable angina with aspirin can reduce cardiac death or nonfatal myocardial infarction by 50 percent,¹⁹ and a similar reduction of mortality for patients with acute myocardial infarction is possible if streptokinase plus aspirin are started within the first 5 hours of symptoms.²⁰ However, in contrast to patients with coronary artery disease who benefit from speedy diagnosis and intervention, patients with noncardiac chest pain may suffer detrimental effects from a misdiagnosis of their symptoms as potentially cardiac in origin. Patients who have normal coronary arteries on angiography have a normal survival, but they are at high risk for continued functional disability. One-quarter to three-quarters continue on antianginal medication, 20 percent have a decrease in their job status because of cardiovascular reasons, and 50 percent remain unable to perform tasks requiring high metabolic demands.²¹

The differential diagnosis of chest pain, of course, includes much more than coronary artery disease. Esophageal disorders have been detected in 25 to 60 percent of patients with chest pain and

normal coronary arteries.^{22,23} Panic disorder is an important consideration.²⁴ A variety of musculoskeletal syndromes can cause chest-wall pain,²⁵ and psychosomatic factors have been described for a number of chest pain syndromes.²⁶⁻²⁸ Further complicating the primary clinician's role in understanding chest pain is the patient's particular concern about the etiology and meaning of the pain. Symptom resolution has been shown to be closely related to clinician-patient interaction and to the degree of agreement between clinician and patient on the definition of the problem.²⁹

From multiple perspectives there seems to be a need to reconsider chest pain from the position of the clinicians who first see patients with chest pain of all sorts. Because of the importance of chest pain in primary care and the potential benefit of extending or verifying prior clinical investigations, the Ambulatory Sentinel Practice Network (ASPEN)^{30,31} decided to pursue the investigation of chest pain. The collective power of the network presented new opportunities, but an initial description of what was happening with patients with chest pain was required. An exploratory study was designed to characterize chest pain from the perspective of primary care as represented in ASPEN to test the feasibility of investigating chest pain, to determine variation and distributions that would aid the design of studies, and to generate promising areas for investigation. This report presents the results of a pilot investigation and describes from the perspective of primary care clinicians a convenience sample of patients with chest pain, noting practice workload, selected clinical features, and selected aspects of the investigation and management of chest pain.

Methods

One hundred nine clinicians in 37 practices (with age and sex registers) in 18 states and three Canadian provinces participated in this study. The purpose, policies, composition, and methods of this practice-based research network, the Ambulatory Sentinel Practice Network, have been described elsewhere.^{30,31} For 13 consecutive weeks beginning May 20, 1985, the clinicians recorded data about each consultation with patients in their own practice during which chest pain was discussed, investigated, or treated in a face-to-face encounter (excluding patients already hospi-

talized). A report was filed regardless of whether the patient was making a first or return visit for chest pain or whether the chest pain was new or old. The clinicians reported weekly, using pocket-sized cards designed for rapid completion.³² If the same patient was reported more than once during the study period, only the data from the first visit were included in the data set. Based on these criteria, the records of 832 persons were reported and analyzed.

Selected demographic data, site of consultation, diagnosis, and disposition were recorded at each visit. Each weekly report also indicated total practice encounters for the week. Levels of concern about the chest pain as perceived by clinicians for both themselves and for the patient were reported. "Minimal" was defined as little or no concern about dying, and "moderate" was intermediate concern about dying. Clinicians also registered their confidence level with their diagnosis, indicating "tentative" if they had reasonable doubt about the reported diagnosis and "final" if the diagnosis reported was established at the time of the visit. The ASPN clinicians were aware of the intent of the study and its limited objectives.

Each report was reviewed at ASPN headquarters for completeness and consistency of data. ASPN staff phoned or mailed inquiries to practices to correct problems or to obtain missing data. Statistical comparisons were made using the chi-square test with $P < 0.05$ considered significant.

Results

Workload

The 832 patients made 989 visits with chest pain. Concurrently, the practices conducted 71,525 visits, yielding a workload estimate of 13.8 chest pain visits per 1000 visits. At least 4.5 patients per 1000 were seen with chest pain in a 13-week period, based on age and sex reports³³ from the 37 practices in which the combined patient population was 181,854 of all ages. From the perspective of the ASPN clinicians, chest pain was an office-based problem; only 4 percent were seen in the emergency room. Only 2 of the 832 patients were seen in the nursing home, and 4 were seen at home.

Clinical Features and Diagnosis

Persons of all ages and various races reported chest pain to the ASPN clinicians during the

study. Children represented 1 percent of the chest pain managed by these clinicians, and as expected, these children had a diagnostic distribution that differed from adults. Women, who visit ASPN practices more than men, equaled or exceeded men in each diagnostic category except trauma and myocardial infarction. In this investigation, as others in ASPN,^{34,35} white patients predominated, but there was a remarkably large number of black women diagnosed with costochondritis. Costochondritis was usually diagnosed in women, and almost one-third was diagnosed in black patients who comprised 9 percent of the study population. To a lesser extent, chest pain of gastrointestinal (GI) origin was diagnosed disproportionately in black patients. Overall, in this series of patients, the distribution of diagnoses made by the ASPN clinicians varied significantly by the patients' ages ($P < 0.0000$), sex ($P < 0.0082$), and race-ethnicity ($P < 0.0001$).

Almost two-thirds of all diagnoses were accounted for by three categories: angina; nonarticular chest-wall pain; and pain thought to arise from the gastrointestinal tract, including esophageal, gastric, duodenal, and gall bladder. With the exception of children, all age groups were represented in all diagnostic categories. Patients from 45-64 years of age constituted the age group with the largest percent of reported myocardial infarctions, and patients older than 64 years of age constituted the age group with the most angina. Patients 15-44 years of age emerged as the group of patients with the largest representation in all other diagnostic categories.

Investigation and Management

The ASPN clinicians recommended that 57 percent of these chest pain patients return for another visit concerning the chest pain, and only in three diagnostic categories were at least one-half of the patients asked to return: psychosomatic (52 percent), angina (83 percent), and gastrointestinal (56 percent). A notable 43 percent of patients with chest pain of GI origin were asked to come back in less than 1 month. The overall hospital admission rate was 7 percent, and the consultation rate was 7 percent, both occurring most often for myocardial infarction. ASPN clinicians ordered blood tests for only 15 percent of these patients with chest pain and electrocardiograms (ECGs) for only 21 percent. ASPN clinicians

Table 1. Distribution of Diagnostic, Demographic, Site of Treatment, and Disposition Variables for ASPN Patients with Chest Pain, n = 832.

Diagnosis	Diagnostic Certainty		Age				Race					Gender	
	Tentative	Final	0-14	15-44	45-64	65+	W	B	A	H	O	M	F
Psychosomatic (n = 62)	47.5%	52.5%	0.0%	58.1%	27.4%	14.5%	90.3%	6.5%	1.6%	1.6%	0.0%	40.3%	59.7%
Angina (n = 263)	28.9	71.1	0.0	7.2	37.7	55.1	96.2	2.3	0.4	0.8	0.4	49.8	50.2
Nonarticular chest-wall pain (n = 147)	34.7	65.3	1.4	45.6	34.0	19.0	89.8	8.8	0.0	0.7	0.7	44.9	55.1
Trauma (n = 27)	7.4	92.6	7.4	55.6	11.1	25.9	96.3	0.0	0.0	3.7	0.0	59.3	40.7
Costochondritis (n = 65)	16.9	83.1	0.0	49.2	33.9	16.9	66.2	30.8	0.0	3.1	0.0	26.2	73.8
Pleurisy (n = 36)	30.6	69.4	5.6	61.1	22.2	11.1	91.7	8.3	0.0	0.0	0.0	36.1	63.9
GI tract (n = 114)	60.5	39.5	1.8	43.0	32.5	22.8	82.5	14.0	1.8	0.9	0.9	49.1	50.9
Myocardial infarction (n = 24)	54.2	45.8	0.0	12.5	45.8	41.7	95.8	4.2	0.0	0.0	0.0	66.7	33.3
Other (n = 94)	55.3	44.7	2.1	43.6	25.5	28.7	84.0	9.6	1.1	3.2	2.1	46.8	53.2
Total (n = 832)	37.8	62.2	1.2	34.1	32.6	32.1	88.8	8.7	0.6	1.3	0.6	46.3	53.8

KEY: W = White, B = Black, A = Asian, H = Hispanic, O = Other, M = Male, F = Female, ER = Emergency Room, NH = Nursing Home, Hsp = Hospital, ECG = Electrocardiogram.

proportionately ordered more ECGs for patients thought to have chest pain of psychosomatic (26 percent) or GI origin (28 percent) than for patients with angina (20 percent).

The ASPN clinicians were usually confident of their diagnosis at the time the patient was seen, reporting a final diagnosis for 62 percent of their patients. There was a remarkable range of certainty by diagnosis, however, from 93 percent for trauma to only 40 percent for chest pain of GI origin. Regardless of diagnosis there was approximately twice the level of consultation, hospitalization, and ordering of ECGs when the clinicians reported a tentative diagnosis. There was no statistical association between diagnostic uncertainty and the recommendation to return to the office.

The ASPN clinicians perceived minimal patient concern about chest pain in 44 percent of their patients with chest pain. Most patients diagnosed with chest pain of psychosomatic or gastrointestinal origin and with myocardial infarction conveyed at least moderate concern about their chest pain. Overall, the clinicians reported

similar or less concern than their patients. Clinicians were most concerned about patients with angina and myocardial infarction, and to a lesser but not unimportant extent for patients with "other" diagnoses and chest pain of GI origin. Particularly notable was a discordance between the clinicians' perceptions of their own and their patients' levels of concern in 43 percent of patients. When discordant, 80 percent of the time patients were perceived to be more concerned than clinicians (e.g., psychosomatic, GI, costochondritis), and 20 percent of the time clinicians perceived themselves to be more concerned than patients (e.g., myocardial infarction, angina). There was considerable variation in disposition when examined by the clinicians' levels of concern and also by concordance between patient and clinician concern. Dispositions differed among the diagnostic groups with insufficient numbers of patients in various groups. Not surprisingly, there was in general an inverse relation between a report of diagnostic certainty and a report of increased clinician concern.

Table 1 (continued).

Site of Visit					Disposition							
Office	ER	NH	Home	Other	No Return	Return	Consult	Hsp	Blood	ECG	Special Tests	Other
98.4%	1.6%	0.0%	0.0%	0.0%	32.3%	51.6%	9.7%	3.2%	6.4%	25.8%	8.1%	4.8%
95.4	3.0	0.0	0.8	0.8	4.2	83.3	8.7	8.0	20.2	19.8	11.0	3.8
98.0	2.0	0.0	0.0	0.0	43.5	49.6	3.4	0.7	8.2	12.2	7.5	8.2
96.3	3.7	0.0	0.0	0.0	63.0	29.6	0.0	0.0	0.0	0.0	18.5	11.1
100.0	0.0	0.0	0.0	0.0	44.6	44.6	0.0	0.0	3.1	15.4	6.2	10.8
97.2	2.8	0.0	0.0	0.0	44.4	33.3	0.0	11.1	19.4	11.1	41.7	11.1
93.0	3.5	0.9	0.9	1.8	30.0	56.1	6.1	2.6	9.6	28.1	22.0	7.0
54.2	41.7	0.0	4.2	0.0	0.0	8.3	29.2	91.7	58.3	75.0	29.2	0.0
91.5	6.4	1.1	0.0	1.1	36.2	40.4	9.6	8.5	19.1	25.5	34.0	13.8
94.6	4.1	0.2	0.5	0.6	27.0	57.3	6.8	7.3	14.5	20.9	16.1	7.2

Tables 1 and 2 provide a detailed distribution of the study variables organized by diagnostic category.

Discussion

This exploratory investigation shows that chest pain afflicts persons of all ages and various races and leads to a broad spectrum of diagnoses and a variety of interventions. Almost all of this enterprise occurs in the office setting without consultation or hospitalization. The portion that does involve hospitalization and consultation emphasizes the morbidity associated with atherosclerotic heart disease, an area that has attracted much research. What remains within the realm of primary care is a large burden of suffering and concern that has been relatively neglected. This study provides an indication of the impact on both patients and clinicians of gaps in our knowledge about chest pain at the level of primary care.

A principal objective of this pilot study was to identify opportunities for further investigations that would be important to primary care clinicians. Some of the abundant opportunities that were found are the following:

1. The relative lack of confidence when chest pain was presumed to be of GI origin, linked to the observed tendency of the ASPN clinicians to increase their use of various services when they were not certain of their diagnosis, indicates one fertile area for investigation. In this sample, some 14 percent of patients with chest pain were in this category, suggesting there may be a potentially large population of patients that could benefit from improved evaluation and management strategies.
2. The unexpected frequency of costochondritis in women, particularly black patients, if valid and not a spurious association, raises questions about the pathogenesis of this condition and also the use of this label in primary care practice.
3. The vigilance for atherosclerotic heart disease reported in management strategies and the perceived concern about dying make it obvious that primary care clinicians need more accurate and reliable tools, applicable in their offices, that distinguish patients with potentially life-threatening disease from those without.

Table 2. Levels of Clinician and Patient Concern about the Symptom Chest Pain at Time of Visit from Clinician Perspective, n = 832.

Diagnosis	Patient (PT) Concern			Clinician (CL) Concern			Concern Comparison		
	Minimal	Moderate	Extreme	Minimal	Moderate	Extreme	CL > PT	CL < PT	CL = PT
Psychosomatic (n = 62)	30.6%	58.1%	11.3%	87.1%	11.3%	1.6%	1.6%	59.7%	38.7%
Angina (n = 263)	52.5	39.9	7.6	42.0	54.6	3.4	18.2	11.8	70.0
Nonarticular chest-wall pain (n = 147)	46.9	49.0	4.1	88.4	11.6	0.0	1.4	44.2	54.4
Trauma (n = 27)	63.0	37.0	0.0	100.0	0.0	0.0	0.0	37.0	63.0
Costochondritis (n = 65)	47.7	49.2	3.1	100.0	0.0	0.0	0.0	52.3	47.7
Pleurisy (n = 36)	47.2	41.7	11.1	80.6	19.4	0.0	2.8	41.7	55.5
GI tract (n = 114)	28.1	63.1	8.8	71.1	27.2	1.8	4.4	51.8	43.9
Myocardial infarction (n = 24)	8.4	45.8	45.8	4.2	45.8	50.0	25.0	16.7	58.3
Other (n = 94)	45.7	45.7	8.6	68.1	24.5	7.4	9.6	31.9	58.5
Total (n = 832)	44.2	47.6	8.2	8.6	34.3	57.1	8.7	34.2	57.1

- The perception of discordance between the clinicians' and the patients' levels of concern identifies opportunities to unite patient and clinician in stronger agreement about the nature and importance of the patient's chest pain. Incomplete agreement between the doctor and patient at the level of primary care may lead to additional visits, recognized and unrecognized second opinions, additional tests of uncertain value, and patient and clinician frustration or dissatisfaction.
- In primary care there is a constant interplay of patients, comorbid conditions, time, and new patient concerns. Investigating chest pain will require sufficient methods to define episodes of chest pain carefully and to attend to where in the episode that enumeration, description, and intervention occur.

There are many limitations to this investigation, and they primarily derive from its scope. This study has the observer biases of primary care clinicians and lacks appropriate design to determine the incidence and prevalence of chest pain, accuracy of diagnoses, effectiveness of various management strategies, accuracy of clinician perceptions, existence of comorbid conditions, and explanation for identified variations. Underreporting could have contributed to underesti-

ating the frequency of events, such as chest pain managed in nursing homes and emergency rooms. Unmeasured variables, such as the expectations and needs of patients and clinicians, could influence more strongly than diagnosis such decisions as ordering an ECG. Consequently, explanations and recommendations about chest pain in primary care are inappropriate from this data set. However, the purpose of the investigation was not to answer such questions but to provide, in one group of primary care practices, a snapshot of what was going on with chest pain in primary care so that the direction, feasibility, and requirements of further investigations could be better understood. Until such studies are done, it seems likely that diagnostic uncertainty on the part of clinicians will lead to overinvestigation, perhaps excessive patient worry, and dissatisfying results.

Conclusions

Prior excellent clinical research does not obviate the need to pursue currently available opportunities to improve our understanding of chest pain, a symptom that when mismanaged can lead to catastrophe, extraordinary expense, and counterproductive interventions. There are promising opportunities to improve the plight of many patients by extending our knowledge about chest pain at the level of primary care. The gradual

resurgence of family practice and the continuing evolution of practice-based research now invite further clinical research, which builds on earlier work that overall has not been followed yet with vigorous investigative effort. This exploratory study suggests that the management of chest pain in primary care is a particularly inviting target for expanded research.

Chest Pain Study Authors: Walter Rosser, M.D., Rugh Henderson, M.D., Maurice Wood, M.D., and Larry A. Green, M.D.

Participating Practices: *Canada* – British Columbia – Maple Ridge: Valley Medical Group; Ontario – Hamilton: Donald McLean, M.D., Kitchener: Steve Nantes, M.D.; Quebec – Wakefield: Centre de Medecine Familiale de Wakefield, Ltee. *United States* – Colorado – Bailey: Crow Hill Family Medical Center; Denver: Marry Eulberg, M.D., Mountain/Plains Family Practice; Englewood: Orchard Family Practice; Glenwood Springs: Mary Jo Jacobs, M.D. Florida – Fort Lauderdale: James Andersen, M.D.; Hialeah: Domingo Gomez, M.D.; Miami: Family Medicine Associates. Georgia – Claxton: Hames Clinic; Warrenton: Tri-County Family Medicine Center. Louisiana – Baton Rouge: Family Medicine. Massachusetts – Fitchburg: Fitchburg Family Practice Residency. Michigan – Escanaba: Upper Peninsula Medical Education Program. Minnesota – Excelsior: Milton Seifert, M.D. New Hampshire – Enfield: David Beaufait, M.D. and Mark Parker, M.D.; Manchester: Manchester Family Health Center; Monroe: Monroe Clinic. New York – Afton: Afton Family Health Center; Setauket: Alan Cooper, M.D.; Central Square: Central Square Health Services Center. North Carolina – Bakersville: Bakersville Community Medical Clinic; Banner Elk: Daniel Vinson, M.D.; Jackson: Roanoke Amaranth Community Health Group, Inc. Oregon – Reedsport: Dunes Family Health Care, Inc. Pennsylvania – Hallstead: Dennis Allen, M.D.; Honesdale: Highland Physicians, Ltd. Texas – Rosenberg: Isaac Kleinman, M.D. Utah – Tooele: Family Practice Group of Tooele. Vermont – Plainfield: The Health Center. Virginia – Aylett: Aylett Family Medical Center; Virginia Beach: Duane Lawrence, M.D. Washington – Cle Elum: Cle Elum Family Medicine Center. West Virginia – Scarbro: New River Family Health Center.

Board of Directors: Lorne A. Becker, M.D.; Eugene S. Farley, Jr., M.D.; William L. Freeman, M.D.; Jack Froom, M.D.; Larry A. Green, M.D.; Robert Haggerty, M.D.; Curtis Hames, Sr., M.D.; Jack Kirk, M.D.; Mark J. Magenheimer, M.D.; W.W. Rosser, M.D.; Milton H. Seifert, Jr., M.D.; Kerr L. White, M.D.; and Maurice Wood, M.D.

Research Management Group: William L. Freeman, M.D.; Larry A. Green, M.D.; Mark J. Magenheimer, M.D.; Eugene C. Nelson, Sc.D.; Frank M. Reed, M.D.; Professor Robin Roberts; Greg Stoddart, Ph.D.; and Kerr L. White, M.D.

Study Management Group: Ned Calonge, M.D., M.P.H.; Donald C. Iverson, Ph.D.; Rebecca S. Miller, M.S.; Linda J. Niebauer; and Frank M. Reed, M.D.

References

- Kilgore ES. Angina pectoris and pseudoangina. A clinical study with especial reference to lancinating pain. *JAMA* 1926; 87:455-9.
- Harrison TR. Clinical aspects of pain in the chest: I. Angina pectoris. *Am J Med Sci* 1944; 207:561-87.
- White KL, Grant JL, Chambers WN. Angina pectoris and angina innocens: diagnosis and management of chest pain. *Psychosom Med* 1955; 17:128-38.
- Miles HHW, Cobb S. Neurocirculatory asthenia, anxiety and neurosis. *N Engl J Med* 1951; 245:711-9.
- Research Committee, Council of the College of General Practitioners. Acute chest infection in general practice. *Br Med J* 1956; 1:1516.
- Rose GA. Principles of measurement. In: Rose GA, Blackburn H, eds. Cardiovascular survey methods. Geneva: World Health Organization 1968:32-9.
- Pozen MW, D'Agostino RB, Mitchell JB, et al. The usefulness of a predictive instrument to reduce inappropriate admissions to the coronary care unit. *Ann Intern Med* 1980; 92:238-42.
- Pozen MW, D'Agostino RB, Selker HP, Sytkowski PA, Hood WB Jr. A predictive instrument to improve coronary-care-unit admission practices in acute ischemic heart disease. *N Engl J Med* 1984; 310:1273-8.
- Lee TH, Cook EF, Weisberg M, Sargent RK, Wilson C, Goldman L. Acute chest pain in the emergency room. Identification and examination of low-risk patients. *Arch Intern Med* 1985; 145:65-9.
- Feinleib M, Thom T, Havlik RJ. Decline in coronary heart disease mortality in the United States. In: Gotto AM, Paoletti R, eds. Atherosclerosis reviews. New York: Raven Press, 1982:29-42.
- Feinleib M, Havlik RJ, Thom TJ. The changing pattern of ischemic heart disease. *J Cardiovasc Med* 1982; 7:139-48.
- Blacklock SM. The symptom of chest pain in family practice. *J Fam Pract* 1977; 4:429-33.
- Ockene IS, Shay MJ, Alpert JS, Weiner BH, Dalen JE. Unexplained chest pain in patients with normal coronary arteriograms: a follow-up study of functional status. *N Engl J Med* 1980; 303:1249-52.
- Pasternak RC, Thibault GE, Savoia M, DeSanctis RW, Hutter AM. Chest pain with angiographically insignificant coronary arterial obstruction. Clinical presentation and long-term follow-up. *Am J Med* 1980; 68:813-7.
- Corey GA, Merenstein JH. Applying the acute ischemic heart disease predictive instrument. *J Fam Pract* 1987; 25:127-33.
- Philbrick JT, Horwitz RI, Feinstein AR, Langou RA, Chandler JP. The limited spectrum of patients studied in exercise test research. Analyzing the tip of the iceberg. *JAMA* 1982; 248:2467-70.
- Young MJ, McMahon LF Jr, Stross JK. Prediction rules for patients with suspected myocardial infarction. Applying guidelines in community hospitals. *Arch Intern Med* 1987; 147:1219-22.

18. McNutt RA, Selker HP. How did the acute ischemic heart disease predictive instrument reduce unnecessary coronary care unit admissions? *Med Decis Making* 1988; 8:90-4.
19. Cairns JA, Gent M, Singer J, Finnie KJ, et al. Aspirin, sulfinpyrazone, or both in unstable angina. *N Engl J Med* 1985; 313:1369-75.
20. Basinski A, Naylor CD. Aspirin and fibrinolysis. *Lancet* 1988; 2:1188-9.
21. Papanicolaou MN, Califf RM, Hlatky MA, et al. Prognostic implications of angiographically normal and insignificantly narrowed coronary arteries. *Am J Cardiol* 1986; 58:1181-7.
22. Craven MA, Waterfall W. The esophagus as a source of non-cardiac chest pain. *Can Fam Physician* 1988; 34:663-8.
23. DeCaestecker JS, Blackwell JN, Brown J, Heading RC. The oesophagus as a cause of recurrent chest pain: which patients should be investigated and which tests should be used? *Lancet* 1985; 2:1143-6.
24. Katon W. Panic disorder: epidemiology, diagnosis, and treatment in primary care. *J Clin Psychiatry* 1986; 47:21-30.
25. Fam AG, Smythe HA. Musculoskeletal chest wall pain. *Can Med Assoc J* 1985; 133:379-89.
26. Yunus M, Masi AT, Calabro JJ, Miller KA, Feigenbaum SL. Primary fibromyalgia (fibrositis): clinical study of 50 patients with matched normal controls. *Semin Arthritis Rheum* 1981; 11:151-71.
27. Wilke WS, Mackenzie AH. Proposed pathogenesis of fibrositis. *Cleve Clin Q* 1985; 52:147-54.
28. Rotes-Querol J. The syndromes of psychogenic rheumatism. *Clin Rheumatol Dis* 1979; 5:797-805.
29. Bass MJ, Buck C, Turner L, Dickie G, Pratt G, Robinson HC. The physician's actions and the outcome of illness in family practice. *J Fam Pract* 1986; 23:43-7.
30. Green LA, Wood M, Becker L, et al. The Ambulatory Sentinel Practice Network: purpose, methods, and policies. *J Fam Pract* 1984; 18:275-80.
31. Iverson DC, Calonge BN, Miller RS, Niebauer LJ, Reed FM. The development and management of a primary care research network, 1978-87. *Fam Med* 1988; 20:177-81.
32. Green LA. The weekly return as a practical instrument for data collection in office based research. *Fam Med* 1988; 20:182-4.
33. Green LA, Calonge BA, Fryer GE, Reed FM. Age/sex registries in primary care research. *Fam Med* 1988; 20:185-8.
34. Freeman WL, Green LA, Becker LA. Pelvic inflammatory disease in primary care. *Fam Med* 1988; 20:192-6.
35. Spontaneous abortion in primary care: a report from ASPN. *J Am Board Fam Pract* 1988; 1:15-23.