

Survey of Physician Practice Behaviors Related to Diabetes Mellitus in the U.S.

I. Design and Methods

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OBJECTIVE— To conduct a survey among a representative sample of primary care physicians in the U.S. to assess practice behaviors, treatment goals, and beliefs related to management of diabetes mellitus and prevention of its complications.

RESEARCH DESIGN AND METHODS— A mail survey with telephone follow-up was conducted among 3481 primary care physicians in active practice in the continental U.S. A stratified probability sample was selected using the files of the American Medical Association and American Osteopathic Association. Four specialties were selected to be included in the study: family physician, general practitioner, internist, and pediatrician. Two versions of a questionnaire were constructed: one for pediatricians containing questions about IDDM only and one for the other three specialties containing questions about both IDDM and NIDDM. Physicians who were not actively engaged in practice or did not see patients with diabetes were excluded.

RESULTS— Completed questionnaires were received from 1502 of 3481 sampled physicians. Based on various assumptions of eligibility among nonresponders, an overall response rate to the survey was estimated to be between 65.7 and 86.5%. Discrepancies between specialty identifications as noted on the American Medical Association/American Osteopathic Association files and as self-designated were noted.

CONCLUSIONS— This report describes the methodology used in the design and conduct of the survey, and data are provided to document the technical success of survey execution. This report provides the methodological basis for a series of separate reports on demographic characteristics of the physicians, their practices and their patients, and on specific attitudes, beliefs, and practice behaviors of primary care physicians in the U.S. with regard to diabetes mellitus.

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NIDDK, NATIONAL INSTITUTE OF DIABETES, AND DIGESTIVE AND KIDNEY DISEASES; NIH, NATIONAL INSTITUTES OF HEALTH; AMA, AMERICAN MEDICAL ASSOCIATION; AOA, AMERICAN OSTEOPATHIC ASSOCIATION; FP, FAMILY PHYSICIAN; GP, GENERAL PRACTITIONER; IM, INTERNIST; PD, PEDIATRICIAN; IDDM, INSULIN-DEPENDENT DIABETES MELLITUS; NIDDM, NON-INSULIN-DEPENDENT DIABETES MELLITUS; DCCT, DIABETES CONTROL AND COMPLICATIONS TRIAL; CI, CONFIDENCE INTERVAL; CDC, CENTERS FOR DISEASE CONTROL.

Over the last decade, numerous studies have focused on the practice patterns and attitudes among selected physician specialty groups regarding diabetes care (1–6). These studies, however, were not national in scope. Some limited data from national health surveys on the use of health care resources relevant to diabetes management are also available (7,8). In 1989, the NIDDK undertook a more comprehensive survey of a national random sample of primary care physicians with two purposes in mind. First, the NIDDK, along with other federal agencies, national voluntary and professional organizations, and the academic medical community have identified the need to improve the translation of research advances into clinical practice. Effectively targeting such activities will require an accurate and wide-ranging assessment of current knowledge, attitudes, and practice behaviors of physicians who provide diabetes care. A second purpose was to gather baseline data for future evaluations of health care changes. The DCCT is comparing the efficacy of a conventional approach to diabetes management with intensive management on the subsequent development or progression of microvascular and neurological complications in IDDM. Information obtained from this survey will be used to plan dissemination activities related to recommended health care practices after the conclusion of the trial.

This survey has generated an amount of data that cannot be effectively presented in a single report. Therefore, this report describes the design and implementation of the survey. Analysis of the demographic characteristics of these physicians, their practice settings and patient populations, and their attitudes and practice behaviors will be the subject of several separate reports.

RESEARCH DESIGN AND METHODS

Sample selection

A stratified probability sample of 3481 primary care physicians engaged in ac-

tive practice in the continental U.S. was selected. Four specialties were included in the study: family physician, general practitioner, internist, and pediatrician. Physicians identified as endocrinologist or pediatric endocrinologist were not included because the intent of this survey was to focus on primary care providers. The AMA file of active physicians was merged with the AOA file to form the sampling frame. Although doctors of osteopathic medicine were included in the sample, sufficient numbers were not obtained to allow separate estimates for this group. The merged file was stratified by specialty and geographic region before sample selection. A sample size goal of 400 completed interviews in each of the four specialty groups was deemed adequate to detect 5% differences between specialties at the 95% CI. A total of 3481 physicians was selected; GPs and IMs were slightly oversampled based on predicted higher rates of ineligibility and nonresponse in these specialties. Name, address, date of graduation from medical school, age, and, in some cases, telephone numbers for the sampled physicians were obtained from the associations' records. The sample sizes were IM, 921; PD, 835; GP, 911; FP, 814.

Questionnaire design

With assistance of experts in diabetes treatment and in questionnaire design, an instrument was developed to assess the following physician characteristics:

- Current practice behaviors related to the management of diabetes, including methods of insulin delivery, patient monitoring of glycemia, patient education, and dietary recommendations;
- Current knowledge regarding management of diabetes;
- Attitudes of physicians about the clinical management of diabetes.

Two versions of the questionnaire were prepared: one for pediatricians, containing 33 questions only about IDDM, and one for the other three specialties, con-

taining 37 questions about IDDM and NIDDM (9). A brief screening questionnaire was presented first to determine the responder's eligibility for the survey (see criteria for eligibility, *vide infra*). The questionnaire was pretested by three IMs, three FPs, and three PDs, all of whom have practices in the state of Maryland; and it was modified as indicated. The average time required to complete the final questionnaire was 25 min.

Data collection

Questionnaires were sent by mail with telephone follow-up to a subsample of nonresponders during the second half of 1989. A check for \$25 was enclosed as an incentive to encourage participation. All nonresponders to an initial mailing were sent a second copy of the questionnaire. During September and October, a subsample of ~50% of the physicians not responding after the second mailing was contacted by telephone for the purpose of ascertaining eligibility and administering the questionnaire by telephone to those found to be eligible.

Eligibility and response criteria

Each surveyed physician was classified on the basis of his or her response to the survey as a responder or nonresponder. Responders were further classified as those who completed the entire questionnaire (found to be eligible in the screening portion of the questionnaire) and those found to be ineligible on the basis of screening questionnaire responses. Physicians were classified as ineligible for the survey from their responses to the screening questionnaire for the following reasons:

- Self-reported practice specialty was not GP, PD, IM, or FP;
- Identified themselves as resident physicians;
- Treated no IDDM patients and <10 NIDDM patients;
- Presently spent <50% of their time in direct patient consultation or care;
- Did not speak English.

Physicians were classified as nonresponders for the purposes of weighting and calculating response rates if they did not complete the screening questionnaire for either of the following reasons:

- Refused to participate;
- Unavailable during the interview period.

A questionnaire was deemed complete if the physician was eligible to respond and answered the questions. Item nonresponse was minimal; therefore, no adjustments were performed.

Calculation of eligibility and response rates

Eligibility rates were calculated as the percentage of eligible responders from among all those completing at least the initial eligibility screening section of the survey. These rates were calculated separately for mail and phone responders. A major determinant of survey effectiveness is the response rate. This rate is defined as the fraction of completed questionnaires from among all survey subjects who met the eligibility criteria. The determination of the denominator for this equation (total eligible subjects) is not, however, straightforward. The eligibility of those subjects who did not respond at all (nonresponders) can only be estimated on the basis of various sets of assumptions. The most pessimistic assumption is that all nonresponders would be eligible if they had participated. The most optimistic assumption is that none of the nonresponders would be eligible if they had participated. The assumption adopted for this analysis lies between these two extremes and sets the presumed eligibility rate of nonresponders to the measured eligibility rates found among subjects who did participate in the survey (10).

Calculation of weights and variances

Because the sampled physicians were selected with unequal probabilities and ad-

Table 1—Response status of sample physicians by specialty

	TOTAL (%)	FP (%)	GP (%)	IM (%)	PD (%)
RESPONDERS	65.7	59.6	62.4	60.9	80.5
COMPLETES	43.2	47.9	38.1	45.6	41.3
INELIGIBLES	22.5	11.7	24.3	15.3	39.2
OTHER SPECIALTIES/RESIDENT PHYSICIAN	5.1	3.4	4.7	7.5	4.7
INSUFFICIENT DIABETES PATIENTS	9.2	2.1	4.6	2.4	28.6
<50% PATIENT CARE	8.0	6.2	14.5	5.5	5.9
NON-ENGLISH SPEAKING	0.1	0.0	0.4	0.0	0.0
NONRESPONDERS	34.3	40.4	37.6	39.1	19.5
REFUSAL	11.1	11.3	16.2	10.2	6.4
NO CONTACT	23.2	29.1	21.4	28.9	13.1
TOTAL	100	100	100	100	100
n	3,481	814	911	921	835

adjustments were made for nonresponse by specialty and age within specialty, weights were used in the calculation of population estimates (11, see APPENDIX for definitions and formulae). Variances were calculated for selected estimates and CIs constructed. The 95% CIs are $\pm 3\%$ for totals and $\pm 4-6\%$ for the various subgroups.

RESULTS

Response and eligibility rates

Table 1 summarizes the final response status for the entire sample of 3481 physicians. The eligibility rate derived from the responses to the screening questionnaire was 65.6% (43.2%/65.7%).

Examination of the results by specialty discloses several interesting outcomes. A large percentage of pediatricians were ineligible (39.2%) due in large part to their reporting that they saw no IDDM patients (28.6%). Of the general practitioners sampled, ~15% were ineligible as a result of their maintaining less than full-time practices. Nonresponse among pediatricians was relatively low (19.5% of sample). Nonresponse because of refusal to participate was higher among GPs than other specialties (16.2%). Although we could not compare interview responses among responders and nonresponders, we did ex-

amine geographic and age characteristics for association with response status. No difference was noted in the percentage of response by region (northeast, southeast, midwest, west; data not shown), and a small difference was seen when comparing younger to older physicians (60% of those <46 yr of age and 67% among those ≥ 46 yr of age older, data not shown). This age dichotomy was entirely accounted for within the FP and GP subsamples (data not shown).

In Table 2, we report the response status of all surveyed physicians

categorized by survey phase. After completion of the mail survey phase, the eligibility rate among responders was 74.3%. Approximately 50% of the mail nonresponders were contacted by telephone, and it was possible to get responses from 46.9% of this cohort. Interestingly, the eligibility rate found among this latter group was only 19.6%. If one assumes that the eligibility of nonresponders is equal to the rate among telephone responders, then the overall response rate for the survey (total completed/total eligible) is 86.5%—from Table 1, $43.1\%/[43.1\% + (.196 \times 34.3\%)]$. Alternatively, if one assumes the eligibility rate of the nonresponders more closely mirrors the total responders' eligibility, then the overall response rate approaches the eligibility rate among responders (65.6%).

Prepayment incentive

Nearly all of those completing the questionnaire accepted payment of the \$2.5 incentive check (92%). Of those who did not complete the questionnaire, <10% took payment. No differences were found among specialty groups in cashing or returning the checks (data not shown).

Table 2—Responses to survey phases

	PERCENTAGE OF SAMPLE	ELIGIBILITY RATE: (COMPLETES/RESPONDERS)
MAIL SURVEY		
RESPONDERS	55.3	
COMPLETES	41.1	
ELIGIBLES	14.2	0.743
NONRESPONDERS	44.7	
TOTAL	100	
n	3,481	
FOLLOW-UP TELEPHONE SURVEY		
RESPONDERS	46.9	
COMPLETES	9.2	
INELIGIBLES	37.7	0.196
NONRESPONDERS	53.1	
TOTAL	100	
n	770	

Table 3—Specialty identification

SPECIALTY AS SHOWN ON AMA/AOA FILE	SPECIALTY AS IDENTIFIED BY PHYSICIAN				TOTAL
	FP	GP	IM	PD	
FP (n)	339	45	4	2	390
GP (n)	105	230	11	1	347
IM (n)	8	4	408	0	420
PD (n)	0	0	0	345	345
TOTAL	452	279	423	348	1,502

Specialty identification

The specialty identification from the combined AMA/AOA file for each physician was used to establish the sampling frame, select the samples, calculate the sample weights, and analyze the responder characteristics. However, the responders were asked to identify their specialty in the questionnaire. A comparison of specialty classification between the AMA/AOA file and physicians' self-identification is presented in Table 3. The difference of note is the substantial number (105) of self-identified FPs listed in the AMA/AOA file as GPs and the moderate number (45) with the opposite shift in classification. The self-reported specialty classification was used for all further analyses of physician characteristics.

CONCLUSIONS— Over the last decade, a broad expansion has occurred in the tools and techniques for the clinical management of diabetes. This has been accompanied by significant changes in recommended approaches to the care of patients with this disease. These newer approaches, developed by expert advisory committees, have been nationally promulgated by the ADA and CDC (12–15), and offer guidance to the diagnosis and management of patients with IDDM and NIDDM. However, there is a lack of information about the level of understanding and degree of utilization of the newer treatment methods among prac-

ticing physicians. Previous studies have focused on limited aspects of care or have been restricted to selected physician samples, patient populations, or geographic areas (1–6). Primary care practitioners were targeted for this survey because data from a national health survey of physicians visits indicate that 8 of 10 visits for diabetes are made to primary care physicians: one third of patients go to IMs, one fifth see GPs, and one fifth use FPs. Only 2.5% of visits for diabetes are made to physicians whose subspecialty is diabetes or endocrinology (8).

This study was designed to survey a nationally based random sample of primary care physicians with sufficient size to compare responses between physician groups (400 per group, 1600 total). We received 1502 completed questionnaires with GP and PD groups showing the fewest completed responses. However, this appears to be the result of proportionately greater rates of ineligibility among these groups. The inability to reach target response levels may compromise the ability to demonstrate small but statistically significant differences in specific questionnaire responses between groups. The overall response rate for the survey (defined as the percentage of completed questionnaires from among eligible subjects) can only be estimated because the eligibility status of nonresponders cannot be determined. Using alternate limiting assumptions of nonresponder eligibility, one can estimate that

the true response rate lies between 65.6 and 86.5%. The combination of mail and phone interview technique is not believed to have introduced any significant bias because <5% of the completed questionnaires were administered by phone (72 of 1502).

The use of a prepaid monetary incentive for optimizing participation was incorporated in the study design because data from controlled studies (16–18) indicated that the use of a prepaid monetary incentive could enhance the response rate. Although the design of the survey precludes evaluation of this question, we did observe that very few physicians who did not complete a questionnaire cashed the check, whereas >90% of those who completed the questionnaire accepted payment.

Specialty designations provided in the combined AMA/AOA file were used to select the sample. However, the physicians' self-identification of specialty sometimes differed, particularly among FPs and GPs. A substantial number of AMA/AOA-classified GPs called themselves FPs whereas a smaller number showed the reverse. This phenomenon may reflect current trends in the acquisition of board certification in family practice that have not been entered into the files of the AMA or AOA, or the changing connotations of FP/GP designations by the physician community that are not represented in the AMA/AOA files. Differences of this magnitude between listed and self-identified specialty were not seen in another NIH survey (National Survey of Coronary Heart Disease Risk Factors in Children) conducted in 1987, which used the AMA file as the sampling frame (unpublished observations).

This study was undertaken to provide a basis for the planning of educational interventions to improve diabetes care and a baseline for future evaluations of trends in diabetes care. This report documents the survey methodology and provides validating data on the technical success of survey execution.

Results of this survey related to attributes of the physicians and their patient populations, current practice behaviors as well as attitudes and beliefs regarding treatment goals and clinical management of diabetes will be presented in a series of separate reports.

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Parts of this survey were presented in abstract form at the 50th and 52nd annual meetings of the American Diabetes Association, Atlanta, Georgia, 16–19 June 1990, and San Antonio, Texas, 21–23 June 1992.

APPENDIX—ESTIMATION AND ANALYTIC PROCEDURES

Weighting procedures

Weights were used in the calculation of population estimates because the sample GPs, FPs, IMs, and PDs were selected by unequal probability sampling, and adjustments were made for physicians' nonresponse (10). Each sampled physician was assigned a base weight, which was the reciprocal of the probability that the physician was selected from the specialty stratum. The base weight was multiplied by a nonresponse adjustment factor to produce the final weight for a responding physician.

Base weight

The base weight for a physician was the result of dividing the number of physicians in the population of each specialty by the number sampled from the stratum. The base weight for all physicians selected from specialty stratum h is given by

$$BW_h = \frac{N_h}{n_h}$$

Where N_h = the number of physicians in the population in specialty stratum h , and n_h = the number of physicians in the sample in specialty stratum h .

The base weights for sampled physicians in the four specialty strata are GP, 24.1; PD, 29.7; FP, 46.6; and IM, 52.3.

Nonresponse adjustments

Nonresponse adjustments, used to compensate for nonresponse among eligible physicians, were computed separately for three nonresponse classes within each specialty. The nonresponse classes were formed by cross-classifications using specialty and three categories of age. The age categories were determined by specialty to construct cells with approximately an equal number of physicians. For nonresponse class i in specialty stratum h , the nonresponse adjustment factor F_{hi} is given by

$$F_{hi} = \frac{n_{hi}}{n'_{hi}}$$

Where n_{hi} = the number of eligible sampled physicians in nonresponse class i in specialty stratum h , and n'_{hi} = the number of responding sampled physicians in nonresponse class i in specialty stratum h . The nonresponse adjustment factors for the 12 nonresponse adjustment classes ranged from 1.19 to 1.88.

Final weights

The final weight for a responding physician in nonresponse class "i" in specialty stratum "h" is given by

$$FW_{hi} = BW_h (F_{hi})$$

Final weights ranged from 38 to 41 for GPs, 35 to 41 for PDs, 68 to 87 for FPs, and 83 to 97 for IMs.

Variance estimates

The formula used for estimating the variance of a proportion or percentage for a stratified random sample is:

$$\text{var}(p) = \sum_{h=1}^L \frac{N_h^2 \times p_h \times (1 - p_h)}{N^2 n_h}$$

The variances were summed first across nonresponse class within specialty and then across specialty. The SEs are the square roots of the variances described above. These SEs were used to provide 95% CIs.

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