Why We Know So Little about Prenatal Care Nationwide: An Assessment of Required Methodology

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Policymakers, advocates, providers, recipients, and health services researchers all would agree that too little is known about the nature and effects of specific components of prenatal care. In the process of designing a national, longitudinal study of pregnancy and childbirth, we surfaced some methodological dilemmas that help to explain why so little is known. This article explores two of the major problems: (1) selecting a valid scientific sample of pregnant women and (2) collecting data from providers and women. From this analysis, seven methodological questions, which should be investigated through empirical field studies, are identified. Those field studies are essential if future research into the content of prenatal care is to achieve an acceptable level of methodological rigor.

Virtually all pregnant women in the United States receive some prenatal care (Region IV Network for Data Management and Utilization 1986). This major modality of care involves many different types of providers, institutions, and agencies; it has been the recipient of substantial government support at many levels; and there is evidence that

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prenatal care favorably influences birth outcomes (Kessner, Singer, and Kalk 1973; Dott and Fort 1975; Placek 1976; Eisner et al. 1979; Greenberg 1983). Yet very little is known about the content of that care.

A need to understand the content of prenatal care has been expressed with increasing emphasis in recent years. The Institute of Medicine (1985) report on the prevention of low birthweight recommended that future research in the area focus on the effectiveness of selected components of such care. Within the federal government, both the Public Health Service and the Office of Technology Assessment have begun to review what is known about various components and to identify gaps in the knowledge base. Consensus conferences, sponsored by the Division of Maternal and Child Health (Department of Health and Human Services) and the March of Dimes Birth Defects Foundation in cooperation with the American Nurses Association (Curry 1987), have been held throughout the country as a way to benefit from the collective wisdom of providers in attempting to identify the most important components.

Why do we know so little about prenatal care? Professional organizations have developed, reviewed, and disseminated standards for prenatal care in the United States (AAP/ACOG 1984), but actual prenatal care delivery has never been routinely monitored. In addition, most published evaluations of its effectiveness (Kessner, Singer, and Kalk 1973; Dott and Fort 1975; Placek 1976; Eisner et al. 1979; Greenberg 1983) have used summary measures, such as number of visits, gestation at initiation of care, and so forth. This is partly because many of the studies have relied on data from birth certificates. While informative in many respects, birth certificates include only minimal entries about the timing and frequency of prenatal visits and no information about the content of care. Few studies have produced the detailed data on specific elements of prenatal care required to describe and analyze components. An exception is the Collaborative Perinatal Project (Niswander and Gordon 1972); however, that study—now more than 20 years old—covered a limited population, and its original purpose was not to assess prenatal care.

Another major problem with past studies, including the Collaborative Perinatal Project, is that their findings are not generalizable to the population at large. Many population-based studies of the effectiveness of prenatal care have been program evaluations (Sokol et al. 1980; Peoples and Siegel 1983; Peoples, Grimson, and Daughtry 1984; Strobino et al. 1986; Korenbrot 1984). Since most structured prenatal

programs have been organized to serve the poor, the generalizability of the results has been limited.

Evaluations of HMO prenatal care are also restricted to select populations (Quick, Greenlick, and Roghmann 1981; Showstack, Budetti, and Minkler 1984). Clinical approaches to assessing the effectiveness of specific interventions are limited, too, in that they usually involve the clients of only one hospital or a small number of hospitals.

Some experiments currently are underway to evaluate the effectiveness of new components and/or new models of prenatal care (Institute of Medicine 1985). However, components of prenatal care already integrated into clinical practice cannot be withheld to satisfy the requirements of experimental research. Consequently, further understanding of the extent to which those components influence birth outcome must depend on a study of prenatal practices across a variety of settings. The sample for such a study should be large enough to allow comparison between groups with selected components and those without, while controlling for potentially confounding influences with statistical techniques. The study should include women with a variety of demographic characteristics to maximize generalizability, and it should elicit information of sufficient detail to enable the researcher to characterize and analyze the prenatal care components under investigation.

Significant methodological problems have frustrated efforts to conduct large-scale population-based studies. This article examines two of those problems: (1) selecting a valid scientific sample of pregnant women and (2) collecting data from providers and women. The result is identification of several methodological questions that must be answered through empirical investigation before productive studies of the content of prenatal care can be conducted.

SELECTING A SAMPLE OF PREGNANT WOMEN

To study prenatal practices, it is ultimately necessary to obtain data about the experiences of individual women. The women may be solicited directly or they may be sampled through providers.

SAMPLING WOMEN THROUGH PROVIDERS

If the provider entryway were to be used, one might approach providers of prenatal care or providers of related necessary services, such as laboratory tests. Laboratories present an interesting possibility since tests for venereal disease and rubella are recommended at the initial

prenatal workup (AAP/ACOG 1984). If the laboratories that perform these tests could be identified, it might be possible to select a sample of women, early in their pregnancies, with relative ease. Successful use of this approach, however, would require that all women who receive prenatal care be tested for these diseases and that the laboratories know which of their specimens are from pregnant women. Neither of these requirements prevails. Women can legally refuse the tests in 12 states (Alexander 1986) and not all laboratories request information on pregnancy status (Peoples-Sheps, Kalsbeek, and Siegel 1986). In addition, a design based on laboratory sampling would require complicated frame construction, because complete lists of laboratories are difficult to obtain. Finally, laboratories are likely to consider release of client names to be an unethical—if not illegal—practice. Complicated and expensive (and, perhaps, unsuccessful) steps would be necessary to obtain the release of names of eligible women.

The other provider option would involve locating women through their providers of prenatal care. In this case, the sampling protocol could start with selection of a sample of providers and identification of an appropriate study period, such as one year. Each provider would then be asked to identify eligible women. In addition to avoiding some of the logistical problems associated with the laboratory approach, this approach would involve providers from the outset—a potentially important added benefit, since these providers might be key actors in some aspects of data collection. A critical element in this approach, however, is locating a complete list of prenatal care providers.

Construction of a Sampling Frame

Prenatal care is delivered in at least ten types of service sites:

1. Private offices of physicians, osteopaths, nurse midwives, and chiropractors
2. Health maintenance organizations
3. University hospital clinics
4. Community hospital clinics
5. Public health departments
6. Community health centers
7. Migrant health centers
8. Indian Health Service settings
9. Military facilities
10. Schools.

The service sites, in turn, utilize different types of professionals and serve different groups of women (Institute of Medicine 1985; Klerman and Rockwood 1986; ASTHO Foundation 1985). Clearly, most women receive care from private physicians; yet a significant proportion of women do use other settings exclusively. Many of the women who go to alternative services are high-risk women with generally poorer outcomes. Thus, to obtain complete coverage and avoid bias in survey estimates, it is important that the sampling frame represent as many providers in as many of the settings as possible.

Basically, there are two ways to sample providers of care:

1. Sample from a list of institutions and practices in which care is provided (for example, hospital clinics, HMOs, private physicians' offices)
2. Sample from a list of individual professionals (for example, physicians, certified nurse midwives, osteopaths, nurse practitioners).

To provide guidance in assessing the feasibility of using either method, a number of pertinent professional organizations were queried regarding the availability and comprehensiveness of member lists and of the lists of organizations or individuals eligible for membership. This information is summarized in Table 1.

With regard to constructing a sampling frame of institutions and practices in which care is provided, a list of all hospitals in the United States is available through the American Hospital Association; furthermore, most states have a list of public health clinics available. Lists of private service delivery sites, however, are not as easy to obtain. To obtain a list of doctor's offices, one would be most likely to use the supplemented list of physicians available from the American Medical Association—but physicians in solo and group private practice would have to be identified. A list of well-established group practices is available from the American Group Practice Association, but the coverage of total group practices is known to be incomplete. The amount of time involved in obtaining all of these lists and combining them to make a sampling frame would be substantial, and the coverage of such a frame would probably be less than optimal.

A sampling frame of individual professionals would present similar problems. It could be constructed from lists of all provider types: physicians, certified nurse midwives, osteopaths, chiropractors, nurse practitioners, physician assistants, and lay midwives. Use of this approach should provide extremely high coverage of the population of

Table 1: Selected Characteristics of Professional Organizations with Members Involved in the Delivery of Prenatal Care

Name of Association	*Membership*	*Size*	*Coverage*	*Information Available on Management of Pregnant Women*
American Medical Association (AMA)	Physicians*	Maintains data on all MDs in United States, including nonmembers	99 percent coverage of all MDs in United States	Indirectly; primary and secondary specialties listed
American College of OB/GYN (ACOG)	Board-certified obstetricians and gynecologists	25,000	94 percent coverage of OB/GYNs	Yes
American Hospital Association (AHA)	Hospitals and hospital administrators	6,100 hospitals; 40,000 personal members	99 percent coverage of all hospitals in United States, including nonmembers	Can get list of hospitals with OB/GYN facilities
American Group Practice Organization	Established group practices (e.g., the Mayo Clinic)	300 group practices representing 17,000 physicians	2 percent coverage of group practices	Yes
American Osteopathic Association	Graduates of osteopathic colleges who are eligible for licensure	16,734	74 percent coverage of eligibles	Specialty and type of practice information available
Nurses of the American College of OB/GYN (NACOG)	Nurse practitioners, registered nurses, some nurse midwives, obstetrical nurses, neonatal nurses	20,000	16 percent of potential members	Yes; about 30 percent of membership working with pregnant women

Midwives Association of North America	People interested in midwifery; about 40 percent of members certified	800	Not available; believed to be low	All members providing care to pregnant women
American Academy of Family Physicians (AAFP)	Family physicians	58,000, including students and residents	Not available	Yes; approximately 43 percent
American College of Nurse Midwives	Certified nurse midwives	2,500	67 percent coverage of nurse midwives	Majority do manage pregnant women
American College of General Practice	General practitioners	Not available	Not available	No (membership list not in machine-readable form)
American College of Osteopathic OB/GYNs	Osteopathic obstetricians and gynecologists	225	95 percent coverage; information not considered current	No (list not in machine-readable form)

Source: Telephone interviews with representatives of each organization (1985–1986).

*The AMA list includes its membership plus other physicians discovered through other professional associations, board and licensure agencies, and medical schools.

pregnant women. However, as Table 1 suggests, construction of this frame would also become complicated.

In order to construct the sampling frame, several lists of the different professionals would have to be combined, and the overlap among the lists would need to be assessed. Some of the lists would also be difficult to obtain; for example, although an organization for lay midwives does exist (Midwives Association of North America), a membership list is not available even for research purposes.

These problems suggest that if one list of professionals could yield acceptable coverage of pregnant women, then selecting the sample of women from that list alone might be preferable to the multiple-frame approach. The American Medical Association (AMA) produces and regularly updates a list of physicians. As shown in Table 1, the list, which is believed to be virtually complete, includes physician specialty so that physicians who are most likely to provide care to pregnant women can be identified. The AMA list also includes information about type of practice and the amount of time spent on patient care. These variables could be used to produce proxy measures of size for improving the statistical efficiency of the process of sampling women. Sampling physicians with probabilities proportional to size and then choosing women within selected physicians' practices with probabilities inversely related to size would help to control the variance of the number of women chosen from each doctor's clientele, and thereby the variance of survey estimates. Although a more direct measure of size would be better, these proxy measures are much easier to obtain than any measures of size that could be estimated from the other sources of provider information.

Potential Bias

Is it possible to select a reasonable probability sample of pregnant women if sampling is through physicians alone? First, it must be acknowledged that the small proportion of women who do not receive prenatal care—4.1 percent for teenagers up through age 17 and 1.5 percent for women 18 years or older in 1984 (Region IV Network 1986)—would have no chance of being sampled under any type of sampling through providers. Women who do not receive care tend to be low income and high risk, which means that this segment of the population would in all likelihood be underrepresented in the sample. In addition, the effects of receiving no prenatal care could not be assessed. Special efforts would be required to avoid this lack of coverage.

Table 2: First Prenatal Visit by Visit Setting and Type of Provider

	Type of Provider				
Setting	*GP*	*OB/GYN*	*Unknown/ Other MD*	*Non-MD*	*Total*
Physician's office	19	33	3	5	60 (81%)
Other	1	1	5	7	14 (19%)
Total	20 (27%)	34 (46%)	8 (11%)	12 (16%)	74 (100%)

Source: 1980 National Medical Care Utilization and Expenditure Survey (N = 74 pregnant women in the survey).

Among women who do receive prenatal care, the majority probably see a physician at some point in the prenatal period, and even when they do not see a physician, they are likely to be seen in a service delivery site in which physician supervision is available. For example, among pregnant women in the 1980 National Medical Care Utilization and Expenditures Survey for whom information throughout the prenatal period was available, all saw a physician at least once during pregnancy (NMCUES 1980). As shown in Table 2, 84 percent of women saw a physician on the first visit.

This highly select group of women from the NMCUES sample, obviously small, does not include any of the unknown proportion of women who receive care exclusively from nurse midwives and nurse practitioners throughout pregnancy. The exact proportion of women in this group probably varies from state to state, but it includes women who receive services from nurse midwifery private practices as well as some low-risk women who are served in the public sector. Assuring study coverage of this small but important subgroup of women would require special effort in a sample chosen from a physician-only frame. This effort would involve identifying this subgroup of pregnant women by linking nonphysician providers to the physicians who provide backup services and standing orders for them. If this could be accomplished, appropriate coverage should result.

To operationalize this approach, any physicians selected would have to be questioned about the nonphysician providers for whom they serve as a backup, consultant, or supervisor. This may not be as clear-cut as it appears. For example, a physician may only occasionally be on call as a backup for a given nonphysician provider. The physician may neglect to mention this provider's name when asked for whom (s)he serves as a supervisor. A questionnaire would have to be carefully

devised to extract all of the information of interest. And this approach could require a second level of provider recruitment, depending on how formally the physician works with the nonphysician provider.

Since a woman often sees several providers during pregnancy, another source of bias may exist during analysis. In general, if a woman can be selected through any provider she sees, her chances of inclusion in a provider sample are directly related to the number of prenatal care providers she visits during the period of enrollment for the study. Producing valid estimates under these circumstances requires the use of weighting factors which properly account for this "multiplicity" (Sirken 1970). This is done by determining the number of providers through which each woman in the sample could have been chosen during the enrollment period.

The problem of multiple chances of selection can be circumvented by uniquely linking each woman to a particular provider. For example, otherwise eligible women can be selected only through their first visit to a physician during the enrollment period, if the physician-only approach to provider sampling is used. It is possible, of course, to modify this approach to include nurse midwives and nurse practitioners. However, while the unique linkage of women to providers under this approach avoids the problem of multiplicity, it also makes the criteria for inclusion more restrictive and the study therefore more costly. Another important implication is that more of the information obtained with this method may be retrospective, since some women may not see the particular type of provider (for example, a physician) until fairly late in pregnancy (for instance, women receiving prenatal care from public programs). As a result, measurement bias could be added to the coverage problem already noted with this approach.

In summary, sampling women through providers, while feasible in some respects, presents some difficult problems. The practicality of sampling laboratories is low, because coverage and identification of pregnant women vary by state and a list of laboratories is cumbersome to construct and incomplete. Sampling the providers of prenatal care is somewhat more promising although it, too, presents significant technical and operational hurdles. The fact that no central list exists either of institutions and practices in which care is delivered or of individual professionals who deliver care makes it necessary to construct a list from the rosters of various professional organizations—an approach likely to result in overlaps and some important gaps. The only single list that might constitute a useful frame is that of the AMA. Sampling only physicians, however, presents potentially troublesome measure-

ment and coverage problems, since many recipients of public prenatal care see a physician only late in pregnancy or not at all.

SAMPLING WOMEN DIRECTLY BY TELEPHONE

The other approach to sampling for the study of prenatal care is through direct contact with pregnant women themselves. This could be accomplished through a general population screening by telephone; the sample of women would be selected by identifying all eligible pregnant women in selected households. This approach has some major advantages over the provider approach. Women would be solicited into the study directly by the researchers, who probably would be more highly motivated toward the recruitment effort than would the often busy providers. As a result, response to solicitation probably would be higher.

A second important benefit of this approach is that it might mitigate any repercussions arising from liability concerns. That is, if sampling were through providers, all women in their practices who began prenatal care within a selected time frame would be the subjects of choice. In a climate in which malpractice suits are not uncommon, this approach could be perceived as threatening to providers. If pregnant women were sampled directly, however, a given provider might have only one or two patients in the study. In addition to minimizing potential liability concerns, having so few patients in the study would ease any individual provider burden associated with the data collection.

While the direct approach has some compelling advantages, it does also have one critical disadvantage. This approach could be extremely expensive: between four and five million women become pregnant in the 80 million U.S. households each year. A rough idea of the inefficiency of screening by telephone can be shown for a six-month enrollment period in which women during the first two trimesters of pregnancy are selected. When one assumes that an average of five call attempts is required to achieve an acceptable screening rate and that women are not aware that they are pregnant until the start of the second month, then it is estimated that an average of 384–480 telephone call attempts is needed to identify each eligible woman for the study. For enrolling women during the first trimester, this average increases to 960–1,200 phone call attempts, and it increases still further when one considers that not all women screened through this mechanism will agree to participate in the study.

Screening efficiency can be improved somewhat by network sampling, in which the concept of multiplicity is used to advantage by

identifying eligible women through a well-defined circle of close friends and relatives. However, the extent to which the ratio of calls to eligible women could be improved would be directly related to the size of the network and to the extent of knowledge held by those within the networks about the pregnancy status of the eligible women.

In addition to the expense of a general telephone screening, coverage itself would also be of concern. Because some people do not have telephones, a reasonable level of coverage of pregnant women cannot be assured. Those most likely to be missed would be part of the same group causing concern about the provider approach—poor young women in rural areas and therefore at greater risk of adverse pregnancy outcomes (Groves and Kahn 1979). To improve coverage, some type of supplemental recruitment would be necessary (for example, through area sampling of nontelephone households). Any supplemental strategy would complicate the sampling design and further inflate the cost of the study.

With complete sample coverage of pregnancies unlikely to be an attainable goal under any of the sampling frames explored to date, suitable measures of the effect of this undercoverage on survey estimates must be examined. One measure is the percentage of eligible pregnancies identified through the frame. The numerator of this coverage rate could be estimated from survey data, while the denominator might be obtained by adding counts of live births and fetal deaths from the vital records system.

COLLECTING DATA FROM PROVIDERS AND WOMEN

Just as there are many potential pitfalls and far-reaching implications in each approach to sample selection, the options for collecting data harbor their own share of significant hazards. As shown in Table 3, studies of the content of prenatal care might include a number of types of data. The relative emphasis and corresponding extent of detail given to each type would depend on the purpose of the study. Regardless of purpose, however, it is likely that pregnant women would be appropriate sources for some items while providers would be more appropriate for others. Some items might be collected with equal reliability and validity from both sources. Table 3 also suggests the more appropriate source for each type of data item.

Table 3: Types of Data of Potential Interest in Studies of Prenatal Care by Source

Type of Data	*Source*	
	Providers	*Women*
Gynecologic risks predating pregnancy	X	X
Obstetric risks predating pregnancy	X	X
Medical risks predating pregnancy	X	X
Family medical history	X	X
Behavioral risk factors preceding and during current pregnancy		X
Demographic risk factors	X	X
Psychosocial risk factors (e.g., stress, work)		X
Complications of present pregnancy*	X	X
Diagnostic tests and procedures*	X	X
Complete physical examination and system review	X	
Routine measurements (e.g., weight, blood pressure)	X	
Obstetrical assessment at each visit	X	
Medications prescribed/taken*	X	X
Other treatments*	X	X
Advice		X
Referrals (e.g., to smoking modification program)	X	X
Setting, providers, characteristics of care*	X	X
Cost of care/payment plan*	X	X
Pregnancy outcome: mother and fetus	X	X

*Providers and pregnant women may have different knowledge within this category.

COLLECTION OF DATA FROM PROVIDERS

Selected characteristics of three approaches to collecting data from providers are shown in Table 4. The first characteristic, "type and degree of disruption," refers to the chance that an instrument will interfere with the normal flow of day-to-day activities in a provider's practice. The "likelihood of generating detailed data" is considered important because detailed data are required for a suitable response to many of the major questions regarding prenatal care and practices. The third characteristic is "likelihood of becoming an intervention." A purpose of the study would be to describe the practice of prenatal care as it is normally provided. If an instrument were to influence the practice of prenatal care by suggesting how care should be delivered, it would become an intervention rather than a tool for observation. The resulting descriptive information would be biased and those data, in turn, would bias the estimates of relationships between prenatal care activities and dependent variables.

The first data collection option is a detailed medical record patterned on the records that were used successfully by the Collaborative

Table 4: Selected Characteristics of Instruments for Collecting Data from Providers

Instrument	*Type and Degree of Disruption*	*Likelihood of Generating Detailed Data*	*Likelihood of Becoming an Intervention*
Prospective detailed medical record that could be used as the prenatal record	Provider would record on this multicopy form at each visit. To use it as the prenatal record, the provider would have to change his or her record-keeping system. Highly disruptive and not likely to be well received.	Very high. It could be structured to include every data item of interest.	Very high. Level of detail could encourage activities not ordinarily practiced by a provider.
Prospective entry-to-care form supplemented by brief encounter forms at each visit	Provider, or his or her designee, would record on these instruments in addition to the medical record. Highly disruptive, although information could be abstracted from the medical record to data collection forms by nonprovider personnel.	Same as above.	Same as above.
Retrospective abstracting form completed from information in the medical record after termination of pregnancy	Much less than prospective medical record; disruption would ultimately depend on whether provider was responsible for abstracting.	Unknown.	Low.

Perinatal Project (Sever et al. 1983). For that study, each of 12 hospitals participated in development of the data collection form–medical record, and each of them had hundreds of patients in the study. For a study based on a random sample of either providers or women, this approach is much less feasible. The number of providers who would be requested to make changes in their record systems would be much larger, and each of them would have a relatively small number of patients in the study. Since changing a medical record system is a major undertaking, this approach could become a serious disincentive to provider participation.

To avoid requesting providers to change medical records, the second option is considered, involving prospective data collection on forms other than the official medical record. Depending on the person completing the forms, this approach could be highly disruptive of day-to-day activities since it would require duplicative work.

The important benefit of both of these prospective approaches is that they would allow researchers a great deal of control over the data to be collected so that, in principle, the study could yield high-quality, detailed information. By virtue of this characteristic, however, both approaches also carry a strong probability of influence on the practice of prenatal care.

Retrospective studies are unlikely to disrupt day-to-day activities or to alter prenatal care practices. A retrospective approach to the collection of prenatal data from providers has been used successfully in the periodic National Natality Surveys (NNS) and, in 1980, in the National Fetal Mortality Survey (NFMS) (Placek 1984). Since the scope of the studies is broad, however, they have not attempted to gather data of sufficient detail to characterize prenatal practices.

A critical question regarding a retrospective approach is whether detailed data can be obtained from existing medical records. The answer to the question is unknown; but during the past decade, detailed systematic maternity and newborn records have become widely available commercially, and many medical centers have developed similar forms of their own (Institute of Medicine 1985; Institute of Medicine and National Research Council 1982). Professional interest as well as concerns regarding liability and peer pressure may have encouraged the use of these more comprehensive forms to the point that detailed retrospective data on pregnant women may in fact be widely available.

If detailed data could be abstracted from most maternity records after termination of pregnancy, the retrospective approach to collecting data from providers would be clearly preferable to both prospective

approaches. The extent and quality of data could be improved further by the abstracting methods selected for the study—that is, abstracting by trained study personnel would be preferable to abstracting by staff in the provider's setting.

In theory, it might be possible to collect provider-generated information from third party payers as a secondary source. While reliance on third-party sources would avoid several of the problems just identified, it would present other, more substantial difficulties. First, several third party payer files (Blue Cross and Blue Shield, commercial carriers, Medicaid) would have to be obtained to achieve adequate coverage of the pregnant population. Second, third party payer data systems tend to be limited to claims-paid information, which would yield only a small fraction of the types of data required to understand the content and effects of prenatal care. Finally, third-party coverage of pregnant women is not complete; about 20 percent of persons age 18–24 have no health insurance of any kind (Institute of Medicine 1985).

COLLECTION OF DATA FROM PREGNANT WOMEN

As shown in Table 3, any study of prenatal care practices would require some data that would be most appropriately collected from pregnant women themselves. The amount and specific types of information, of course, would depend on the purposes of a given study. Table 5 shows selected characteristics of the two major approaches to collecting data about pregnancies and prenatal care from pregnant women. The characteristics of interest here are the same as those shown in Table 4 for providers except that the last criterion has been changed to "likelihood of influencing prenatal behavior."

The first option is a prospective diary that would be maintained throughout pregnancy by women in the study. Although it is not often used, diary-keeping is an attractive method for data collection. It is administered easily and is therefore economical. In addition, the use of diaries instead of retrospective questionnaires (either self-administered or obtained by interview) has produced more accurate information, in some cases, because the method is much less susceptible to recall bias (Poikolainen and Karkkainen 1983; Carp and Carp 1981).

Despite the improved accuracy, however, there are some inherent problems with diary use for data collection. The most notable is the selection bias introduced by the demands put on the study participants. The participants must be motivated to keep the log, must understand how to use it, must remember to use it, and must be literate. Poor and

Table 5: Selected Characteristics of Instruments for Collecting Data from Women

Instrument	*Type and Degree of Disruption*	*Likelihood of Generating Detailed Data*	*Likelihood of Influencing Prenatal Behavior*
Prospective maternal diary	Women would record prenatal events, behaviors, environmental influences, and some characteristics of prenatal care as they occur. Instrument would be disruptive but might be well received if perceived as beneficial.	High. Diary would be constructed to elicit all data of interest as events occur.	Moderate. Data requested may prompt behaviors that would not have occurred without the diary.
Retrospective questionnaire	Moderate. The required time commitment would vary by the number of questionnaires.	Low. Would be subject to recall bias. (Could affect quality more than quantity of data.)	Low. However, retrospective questionnaires administered during pregnancy could influence subsequent behavior.

undereducated individuals are more likely to refuse to use a diary or to use it inappropriately (Carp and Carp 1981).

While the prospective diary instrument would be preferable from the perspective of data quality and quantity among those who would use it, it might lead to other problems. For example, if the diary influenced prenatal behavior, it would introduce bias in a way similar to that of the prospective provider instruments. Bias could also result from selective use, a problem that might be most likely to occur among disadvantaged women. Systematic reminders could discourage attrition and encourage compliance with diaries (Poikolainen and Karkkainen 1983; Robbins and Tanck 1982).

These biases might also be minimized by use of retrospective questionnaires that could be administered either by mail or interview. But this solution to some of the problems with the diary method would introduce another major source of bias—recall. If the questionnaires were administered at a few selected points during pregnancy, they might be less susceptible to recall bias than a single questionnaire administered after delivery, but some bias would probably persist.

CONCLUSION

While many other related factors, such as incentives for providers and women, additional cost factors, and sample-size issues, require careful consideration as well, the preceding review of two very difficult methodological problems—selecting a valid scientific sample of pregnant women and collecting data from both providers and women—helps to explain why we know so little about prenatal care on a national basis. As investigators have begun to develop studies of prenatal care, this entangled set of methodological issues has emerged. Concurrently, the need to carry out field studies of selected methodological questions in order to proceed to answer larger questions about prenatal care has become apparent. Most often, however, the interest and the resources required to conduct the preliminary studies have not been available. Researchers are left with three choices: (1) to fall back on the measures and methods of the past, often making assumptions of unknown validity (for example, that detailed data cannot be collected retrospectively from providers); (2) to limit the study to local or other narrowly defined populations; or (3) to study something else. These limited choices have impeded major progress in the field.

We propose that a fourth option—to study alternative means of addressing the methodological problems—is preferable in the short run

Table 6: Research Questions for Studies of Methodology

1. To what extent would a sample of pregnant women selected through a sample of physicians be biased?
2. (a) How difficult would it be to construct nonoverlapping frames of
   1. Institutions and practices in which care is provided
      and
   2. Individual professionals?

   (b) What proportion of service delivery sites and professionals would be excluded from these frames?
3. What proportion of physicians who deliver prenatal care are involved in providing public services?
4. What proportion of disadvantaged women would be missed if a telephone sampling approach were used?
5. How much would the efficiency of a general telephone screening for pregnant women be improved if network sampling were used?
6. To what extent do existing maternity records include the detailed data required to study the content of prenatal care?
7. Is a diary a feasible data collection instrument for a broad cross section of pregnant women?

to the other three. This review of two major problems has produced seven research questions, listed in Table 6. Although formidable, these questions require empirical investigation before nationwide studies of prenatal care can be undertaken. Currently, we are designing field studies to examine these issues systematically.

To further inform the design and conduct of studies of prenatal care, the field studies should be undertaken under differing circumstances. For example, studies of the solicitation of pregnant women through physicians (question 1, Table 6) might produce results in geographic areas where liability claims are high that differ from results found in areas in which claims are low—even when the solicitation methods used in both areas are the same.

Field studies could also go beyond questions 6 and 7 in Table 6 in order to determine the most appropriate data sources for national studies with highly specific purposes. If the purpose of a study, for example, was to assess the content and effects of a prenatal behavior-change strategy (such as modification of cigarette smoking), it would be extremely useful to undertake a field study to determine the most accurate and least expensive source(s) of data (from among prenatal care providers, providers of the smoking intervention, or pregnant women, for example). A different type of study might be conducted to locate the best data source for research focused on prenatal laboratory

tests and their results. These studies would yield empirical support for an elaboration of Table 3, showing in detail the different types of information that could be collected from providers and pregnant women.

Ultimately, studies of the content of prenatal care nationwide will be carried out. The information those studies can produce is needed by researchers; advocates; federal, state, and local policymakers; and prenatal care providers and recipients. But, as the current state of knowledge bears witness, the answers to the big questions will be only as valid as the methods used to produce them.

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