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Recruitment of Women in the National Children's Study Initial Vanguard Study

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The initial Vanguard Study of the National Children's Study was conducted during 2009–2010 in 7 locations in the United States. A goal was to evaluate the feasibility and yield of a household-based sampling design to recruit pregnant women. A multistage area probability sampling design was used to identify study locations (generally, counties) that were subsequently divided into smaller geographical units, termed segments. Between 7 and 18 segments were selected in each location, and dwelling units within segments were listed. A household-based recruitment process was implemented, which included enumeration of households to identify age-eligible women, pregnancy screening to identify pregnant women eligible for immediate enrollment and nonpregnant women for telephone follow-up, and administration of informed consent to eligible women. After a recruitment period of 17–20 months, 67,181 (89%) households were enumerated, which identified 34,172 (88%) age-eligible women to whom the pregnancy screener was administered. Among those who completed the screener, 2,285 women became eligible for enrollment, of whom 1,399 (61%) enrolled. Although response rates were fairly high at initial contact and among pregnant women, the overall yield was lower than anticipated. In particular, telephone follow-up of nonpregnant women was not a practicable strategy for prospective recruitment of newly pregnant women.

birth cohort; children; epidemiology; National Children's Study; population; recruitment; sampling

Abbreviations: DU, dwelling unit; EPSC, enumeration, pregnancy screening, and consent; NCS, National Children's Study; PPG, probability of pregnancy group; PSU, primary sampling unit.

The US National Children's Study (NCS) is a longitudinal study that will enroll and follow a national sample of 100,000 children from birth through age 21 years (1–7). The study plans to investigate over time whether environmental factors and interactions between genetic and environmental factors are associated with pregnancy outcomes, child health and development, and precursors of adult disease. Data collection will include in-person home and clinic visits during pregnancy, examination of infants at birth, and periodic contacts with families and children to age 21 years.

The NCS includes a pilot study (the Vanguard Study) to determine the feasibility, acceptability, and cost of the elements that will form the main study. It has begun several years prior to and will continue for the same duration as the NCS main study in order to pilot test the main study protocol (4, 8). A major focus of the initial phase of the NCS Vanguard Study was to assess the feasibility of using household-based recruitment to recruit a representative sample of children. A key objective was to assess factors that could occur early in pregnancy or around the time of conception, requiring prospective enrollment of women prior to conception and during early pregnancy. This paper reports on the recruitment and follow-up experiences of the NCS Vanguard Study in 7 study locations. Cost was not evaluated in this paper because it was not feasible to separate the specific costs of the pilot recruitment protocol from the overall cost of establishing the field operations to be used for the main study in the same locations. Much of the costs for infrastructure, staff, and training were related to developing longer-term capacity for field work, so it was not possible to determine the

costs for specific recruitment and enrollment activities. A related reason is that, initially, the study management system and budgeting were largely structured to report the effort of staff but not time they spent on specific tasks, yet the field contractors implemented extensive cross-training of staff across multiple tasks. The study management system of the NCS was modified for later pilots to record task-level effort by cross-trained staff. Field work in each location was implemented by an academic study center in coordination with a centralized data coordinating center under the guidance of the NCS program office.

METHODS

Multistage sampling

The sampling strategy was a household probability sample. The multistage cluster sample approach for the NCS has been described elsewhere (9). The first stage was the selection of primary sampling units (PSUs), which were counties or groups of geographically contiguous counties. The initial target was 100 PSUs, with a target of 1,000 births to be recruited over 4 years from each PSU to achieve the study population of 100,000 births. PSUs were sampled in a stratified random process to achieve representativeness of US births with respect to number of births, geographical regions, urban/rural characteristics, and demographic characteristics. A total of 110 PSUs in 105 counties or groups of counties in 43 states were selected.

Eight of these PSUs were randomly selected for the initial Vanguard Study—2 from each of the 4 census regions—resulting in a mix of metropolitan and nonmetropolitan counties. The Vanguard Study was implemented in the following 7 of the 8 PSUs: 1) Queens County, New York; 2) Montgomery County, Pennsylvania; 3) Waukesha County, Wisconsin; 4) Brookings County, South Dakota, and Yellow Medicine, Pipestone, and Lincoln counties, Minnesota; 5) Orange County, California; 6) Salt Lake County, Utah; and 7) Duplin County, North Carolina. Population and household characteristics of the 7 locations are shown in Table 1.

The second sampling stage was the selection of geographical segments within the PSUs. Segments were based on aggregations of contiguous census blocks with "measure of size" based on the estimated annual births during the enrollment period. Between 7 and 18 segments were defined for each PSU, which together would yield 250 births per year per PSU. The study centers consulted with local health agencies and community representatives to get input on potential segment boundaries, so the segments would reflect coherent neighborhood groupings to the extent possible to facilitate community outreach.

Community outreach and engagement

Prior to initiating field activities, each study center developed and implemented a community outreach and engagement plan and established a community advisory board composed of community leaders, social and health services organizations, and residents. Outreach activities included meetings with public officials, presentations or information booths at community events, and the engagement of news media to raise awareness about the study. Initially, the study protocol did not allow for paid advertising but, over time, some study centers were allowed to use paid media, billboards, and the internet for outreach. The study centers had to keep segment locations confidential to avoid potential disclosure risks to study participants. Therefore, outreach materials, presentations, and media interviews could not identify the segments.

Enumeration and screening of potential participants

Standard listing methods (10) were used to define the sampling frame for each segment. Addresses of all dwelling units (DUs) within the segment boundaries were listed by staff members walking or driving through the segments. Various methods were piloted to increase the efficiency of this task. Results of this strategy have been compared with other approaches for DU identification (11).

After a letter introducing the study was mailed to each address, field staff approached each DU in person to enumerate residents. Multiple strategies were used to gain access to restricted communities, such as gated communities or locked apartment buildings, by gaining the trust and permission of "gatekeepers" such as apartment managers or homeowners' boards. Each female resident aged 18–49 years, identified during enumeration, was approached then or later and asked to complete a pregnancy screening questionnaire in person. Pregnant girls younger than 18 years were also screened in study centers where this was permitted under local laws and by institutional review board standards. The pregnancy screening assessed current pregnancy status. If the woman was not pregnant, she was asked about sexual activity, use and type of birth control, and medical conditions or past procedures resulting in infertility. Of the women who could become pregnant, responses to the screening questionnaire were used to classify women according to their probabilities of becoming pregnant. The classification scheme was complex but, generally, the high probability of pregnancy group (PPG) was defined as women who had been trying to become pregnant for less than 5 months, as well as women who reported having sex with a male within the past 3 months and who were not doing anything to prevent pregnancy or were using only withdrawal or "natural family planning" methods to prevent pregnancy. Women were classified into the low PPG if they were 45–49 years of age or if they were younger and reported not having sex with a male in the past 3 months, or if they reported having sex with a male but the partner had a vasectomy, or if the woman used a highly effective form of contraception. Other women were classified into the moderate PPG. Women were also asked if they had heard of the NCS before the in-person contact. Respondents were asked to provide contact information including phone numbers for 2 nonhousehold contacts.

The household enumeration and pregnancy screening questionnaires were implemented by trained staff members using computer-assisted interview software on tablet computers. For sensitive questions about sexual activity and birth control, the interview mode was changed to self-administration (i.e., audio computer-assisted self-interviewing). The interview

Table 1. Population and Household Characteristics[a] of the NCS—Initial 7 Vanguard Center Locations, January 2009–September 2010

Characteristic	NCS Vanguard Center Locations							
	Orange County, California, %	Queens County, New York, %	Duplin County, North Carolina, %	Montgomery County, Pennsylvania, %	Salt Lake County, Utah, %	Waukesha County, Wisconsin, %	South Dakota/ Minnesota PSU[b], %	United States, %
Total population	3,026,786[c]	2,306,712[c]	52,858[c]	782,339[c]	1,034,989[c]	383,154[c]	54,639[c]	307,006,556[c]
Females 15–50 years of age	25.8	26.3	23.6	24.4	26.1	23.7	24.8	25.1
Birth rate (of females 15–50 years of age)	5.5	4.9	4.8	5.0	7.3	4.7	5.5	5.6
Race/ethnicity								
White (non-Hispanic)	45.3	30.2	52.4	81.3	74.8	91.1	94.7	64.9
Black (non-Hispanic)	1.6	17.6	25.6	8.4	1.5	1.6	0.5	12.1
Asian (non-Hispanic)	16.3	21.9	0.2	5.4	3.2	2.6	1.2	4.3
Other race (non-Hispanic)	2.6	3.4	1.3	1.3	3.9	1.0	2.0	2.9
Hispanic (any race)	34.2	26.9	20.5	3.6	16.6	3.7	1.6	15.8
Socioeconomic characteristics								
Unemployed (of persons in labor force ≥16 years of age)	9.4	9.9	6.7	6.9	7.8	6.3	3.7	9.8
Below poverty level	10.7	12.6	23.6	5.4	10.3	4.8	14.7	14.3
Without health insurance	17.8	16.8	NA	6.3	15.9	4.3	NA	15.1
High school education or less (of women ≥25 years of age)	36.8	49.9	59.3	35.8	36.3	33.9	42.4	44.2
Households	975,967[c]	792,664[c]	17,902[c]	299,213[c]	336,350[c]	151,203[c]	22,645[c]	113,616,229[c]
Do not speak English well	11.9	14.8	10.9	1.9	4.1	0.8	0.6	4.7
Household mobility								
Nonmover	84.4	90.7	83.2	88.3	84.1	89.3	79.3	84.6
Moved in last year (same county)	11.0	5.7	10.1	5.2	10.2	6.0	10.0	9.4
Moved in last year (different county)	3.8	2.8	5.9	5.8	4.8	4.7	10.4	5.5

Abbreviations: NA, not available; NCS, National Children's Study; PSU, primary sampling unit.

[a] Data are from the US Census Bureau's 2009 American Community Survey. For small counties, multiyear data are presented.

[b] This PSU consists of the following 4 counties: Brookings, South Dakota; Yellow Medicine, Minnesota; Pipestone, Minnesota; and Lincoln, Minnesota.

[c] Value represents number.

instruments were available in English and Spanish, and staff members fluent in Spanish were usually available to administer the questionnaires. If a respondent could not respond in English or Spanish, interpreters were used, if available. Data from the interview were uploaded directly from the tablets to the coordinating center databases via a secure connection.

The enumeration and pregnancy screening questionnaires were administered to household residents after a verbal informed consent. These respondents were not considered to be enrolled participants in the NCS Vanguard Study. No incentives were provided to respondents except for token nonmonetary incentives offered as part of a pilot study at 1 center.

Consent for study enrollment

Pregnancy screener responses were used to determine whether each woman was eligible for immediate enrollment in the study or for future follow-up pregnancy screening. The eligibility criteria for enrollment in the study were that a woman 1) resided in a sampled segment at the time of the birth and 2) was between the ages of 18 and 49 years and pregnant or likely to become pregnant (i.e., was determined by pregnancy screener responses to be in the high PPG). However, because of delays in implementing some study components, the eligibility criteria were restricted during

the first several months of recruitment, so only women who were at less than 20 weeks of pregnancy at enumeration were approached for consent. Nonpregnant women whose initial pregnancy screener responses categorized them as in the high PPG were invited to consent for the study beginning in January 2010, but prior to that date, they were not eligible for enrollment.

The informed consent process for eligible women took place during in-person visits. The consent process could be initiated following the pregnancy screener during the same visit, but in most cases, a follow-up visit was scheduled for enrollment. Women eligible for enrollment were informed that the intention was to follow children through age 21 years, and that participation entailed a series of study visits during and after pregnancy. The consent process took approximately 30 minutes.

Call center follow-up

The study plan called for enrollment of all new eligible pregnancies to women residing in study segments over a 4-year period. Following household enumeration and initial pregnancy screening of age-eligible women, new pregnancies were to be ascertained by self-report and follow-up telephone calls. Women whose pregnancy screener responses indicated that they were unable to become pregnant, out of the age range of 18–49 years, or planning to move out of the study area within the next 6 months were excluded from follow-up. All other women who completed the pregnancy screener were considered potentially eligible and received periodic follow-up telephone calls for rescreening. The frequency of telephone contacts depended on the probability of becoming pregnant as indicated by responses to the pregnancy screener. Women in the high PPG received follow-up calls at 1 month, 2 months, and 4 months after initial screening; women in the moderate PPG received calls at 3-month intervals; and women in the low PPG received calls at 6-month intervals. Initially, local study centers conducted the calls to women in the high PPG, whereas the national coordinating center conducted the calls to women in the moderate and low PPGs. After approximately 1 year, calls to women in the moderate and low PPGs were transitioned to the local call centers. The protocol was for the call centers to make up to 10 contact attempts on different days and times. Attempts were made to locate women who were not reached by contacting the alternate contact persons from information provided on the pregnancy screening questionnaire. Some study centers developed additional strategies to trace and contact the nonpregnant women, including sending letters or email or making follow-up home visits.

Timeline

The initial Vanguard Study launched field operations in 2 study locations (i.e., Duplin, North Carolina, and Queens, New York) in January 2009. Field work began in the remaining 5 study locations in April–May 2009. Most study locations used a phased approach, with enumeration, pregnancy

Table 2. Response Rates for Enumeration, Screening, and Informed Consent, National Children's Study—Initial 7 Vanguard Centers, January 2009–September 2010

Study Step	Eligible Case	No. of Potential Eligible Cases	No. of Final Eligible Cases	No. Complete[a]	Response Rate[b], %	Range Among 7 Vanguard Centers, %
Enumeration	Dwelling unit /household	83,870	75,396	67,181	89	74–96
Screening	Women aged 18–49 years or who are pregnant	34,837	34,172	30,062	88	80–93
Consent	Women who are pregnant or have high pregnancy probability[c]	2,436	2,285	1,399	61	47–76
By when became eligible	Initial household contact	744	729	488	67[d]	49–78
	Follow-up	1,692	1,556	911	59[d]	45–73
By pregnancy status	Pregnant	1,575	1,496	970	65[e]	51–80
	High pregnancy probability	861	789	429	54[e]	41–68

[a] For enumeration, "complete" means a household member responded to the enumeration questionnaire. For screening, "complete" means the woman completed the pregnancy screening questionnaire. For consent, "complete" means the woman consented to enroll in the National Children's Study.

[b] Proportion responding (i.e., proportion of final eligible cases that are complete).

[c] During the first 6 months of recruitment, only women who were in the first 20 weeks of pregnancy were approached for consent to the study. Then, the informed consent process began for all pregnant women, and in January 2010, it began for women in the high probability of pregnancy group.

[d] Response rates between women from "initial household contact" and "follow-up" differed significantly ($P < 0.001$) on the basis of the χ^2 test with an α level of 0.05.

[e] Response rates (i.e., consent to enter study) between pregnant women and women with "high probability of pregnancy" differed significantly ($P < 0.0001$) on the basis of the χ^2 test with an α level of 0.05.

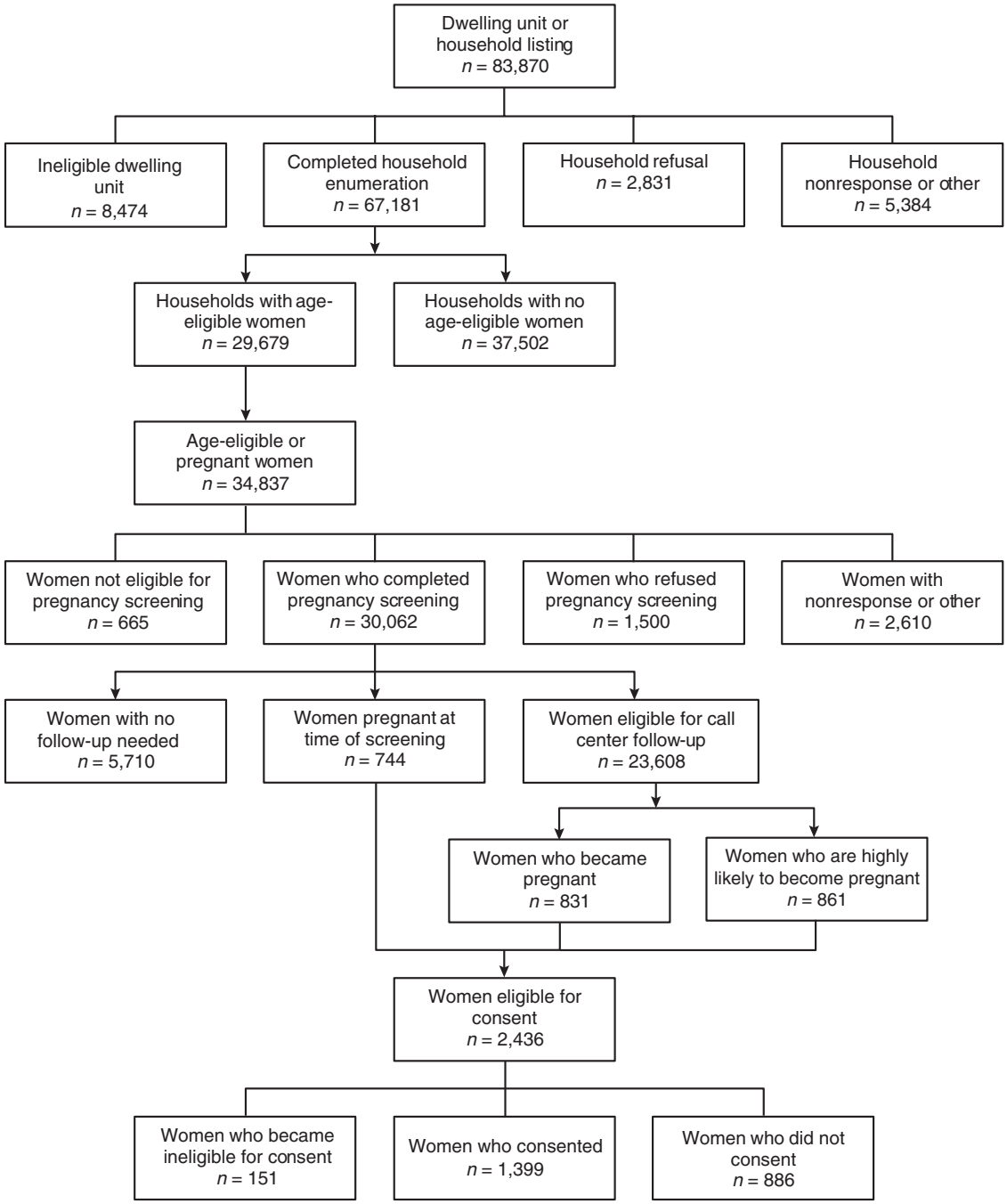

Figure 1. Initial Vanguard Study recruitment process in the National Children's Study, January 2009–September 2010.

screening, and consent (EPSC) activities beginning in a few segments at a time. EPSC activities for the last segments began as late as November 2009. We report on recruitment through September 2010, when the initial Vanguard Study recruitment ended and transitioned to a subsequent phase of the Vanguard Study called the Alternate Recruitment Strategies Substudy.

Data analysis

Response rates to EPSC events were computed for each event as the number of respondents completing the interview or event divided by the number of respondents eligible for that event (12). Because the first 2 event phases identified respondents who were eligible for the next event, and because

Table 3. Outcomes of Call Center Follow-up of Potentially Eligible Women, National Children's Study—Initial 7 Vanguard Centers, January 2009–September 2010

Outcome	Total No.	Total %	Initial PPG Status[a]							
			High PPG		Moderate PPG		Low PPG		Holding/Other[b]	
			No.	%	No.	%	No.	%	No.	%
Women eligible for follow-up	23,608	100	2,297	100	6,183	100	14,534	100	594	100
Call center follow-up outcome										
Not locatable	5,685	24	NS[c]	13	NS[c]	24	NS[c]	26	NS[c]	NS[c]
Nonresponse/other	6,026	26	NS[c]	26	NS[c]	26	NS[c]	25	NS[c]	NS[c]
Refusal	978	4	NS[c]	4	NS[c]	5	NS[c]	4	NS[c]	NS[c]
Still active[d]	10,919	46	1,293	56	2,815	46	6,548	45	263	44
Became eligible for enrollment[e] (percent of still active)										
Pregnant	831	8	359	28	238	8	205	3	29	11
Preconception[f]	861	8	336[b]	26	279	12	228	5	18	7
Total eligible for enrollment	1,692	16	695	54	517	20	433	8	47	18

Abbreviation: NS, number suppressed; PPG, probability of pregnancy group.

[a] PPG was determined from responses to the initial pregnancy screener. Women in the high PPG received follow-up calls at 1, 2, and 4 months after initial screening. Women in the moderate PPG received follow-up calls at 3-month intervals. Women in the low PPG received follow-up calls at 6-month intervals.

[b] During the first 6 months of enumeration, women who were pregnant beyond 20 weeks were assigned to the holding group and scheduled to receive a follow-up call in 6 months. After 6 months of enumeration, women who recently gave birth or had a pregnancy loss were assigned to this group. A few women who had no PPG assignment are included in this group.

[c] Number suppressed to avoid identity disclosure risk.

[d] Women who were followed until they became eligible for enrollment in the study or until September 2010.

[e] Includes 43 pregnant, eligible women and 125 women in the preconception group who had no record of a call center contact.

[f] Preconception cohort eligibility screening and enrollment started in January 2010.

eligibility status could change because of pregnancy loss or a move outside the sampled segment in the time between events, only cases that were eligible at the time of subsequent event administration were considered "final eligible" and included in the response rate computation for that event. Final outcomes of call center contact processes were summarized. Demographic characteristics of the women who were eligible to enroll and who consented were summarized and tested for differences using Pearson's χ^2 tests.

RESULTS

The listing process identified 83,870 potential DUs among the sampled segments. Of these potential DUs, 75,396 were occupied and eligible for enumeration (Table 2, Figure 1). The number of DUs and geographical sizes varied inversely with the birth rates in the segments, with a range of approximately 7,200–16,000 DUs per location across the study locations. The physical sizes of segments in rural locations could be dozens of square miles, whereas in urban locations, a segment could consist of a few blocks or even a single high-rise apartment building.

Enumeration was completed on 67,181 (89%) of the 75,396 eligible DUs (Table 2). The median number of visit attempts to complete enumeration was 1, ranging from 1 to 3 across the study locations, although staff in some locations made up to 20 visit attempts before closing out DUs that could not be enumerated. The timing and pace of enumeration were adjusted to account for local conditions. For example, in a coastal city in Orange County, California, enumeration visits had to be extended over several months because seasonal residents could be away for several months. Enumeration visits in a rural farming location, such as in South Dakota/Minnesota, were more effective during winter months when household residents were more likely to be at the DU rather than working elsewhere on the property. Visits had to be repeated periodically on unoccupied DUs because new families could move into a DU.

Among the enumerated DUs, 44% had at least 1 woman who was potentially eligible for the pregnancy screener (Figure 1), resulting in the identification of 34,837 women who were pregnant or age eligible. Upon further determination that 665 of these women were not residents of the DUs or were outside of the eligible age range, the remaining women completed the pregnancy screening interview at an average rate of 88% (range, 80%–93% across study locations). This initial pregnancy screening identified 744 pregnant women who were eligible for enrollment in the study (Table 1) and another 594 pregnant women who were initially not eligible because of early eligibility criteria restrictions (i.e., "holding" group in Table 3). Together, 1,338 pregnancies were identified among 30,062 screened women. By the time of consent, 729 of the 744 eligible pregnant women remained eligible (15 women became ineligible because of pregnancy loss or because they moved out of the segments prior to the consent visits), and 488 (67%, range, 49%–78%) consented to

participate in the NCS (Table 2). Another 1,556 women became eligible for enrollment during follow-up; of these women, 911 (59%) consented (Table 2). Therefore, overall, 1,399 (61%) of the 2,285 women who were eligible for study either at the time of the initial screening or during follow-up consented to participate in the study. Consent rates were higher for pregnant women (67%) compared with women in the high PPG (59%) (Table 2). Response rates at all recruitment steps varied substantially across study locations.

Among the 23,608 screened women who were eligible for follow-up by the call centers, 62% were identified as being in the low PPG (Table 3). Of all women being followed by the call centers, one-quarter were lost to follow-up because they could not be located, another quarter became unreachable, and 4% refused participation in follow-up calls. Successful follow-up through September 2010 was completed for 10,919 women (46%). Women who were initially categorized into the high PPG were more likely to be successfully followed (56% vs. 45% for women in other PPGs, $P < 0.001$) (Table 3). Among the women followed by the call centers, 8% became pregnant during the approximately 1.5 years of follow-up, and another 8% became eligible for enrollment into a preconception cohort during the 8–9 months of follow-up (Table 3). More than half of the women with initial high-PPG status became eligible for enrollment (28% as pregnant eligible and 26% as preconception eligible), whereas only 20% and 8% of the women initially categorized in the moderate PPG or low PPG, respectively, became eligible (Table 3).

Among women eligible for consent, consent rates varied by race/ethnicity, age group, and urban/rural characteristics of the county (Table 4). Consent rates were similar for Hispanics, non-Hispanic African Americans, and non-Hispanic whites, whereas Asian women had the lowest consent rate of 44%. Women older than 35 years were less likely to consent (51%) than younger women. Consent rates were highest in small, rural counties (68%) and lowest in suburban counties (55%). Consent rates did not differ materially by marital status or language.

Despite community engagement processes and letters mailed to all listed addresses prior to enumeration, only 41% of women eligible for enrollment reported having heard of the NCS (Table 4). Awareness of the NCS was associated with a higher consent rate of 67%, compared with 57% for women who stated they had not previously heard of the NCS (Table 4).

Table 4. Consent Rates by Participant-Reported Race, Ethnicity, and Other Characteristics at Screening, NCS—Initial 7 Vanguard Centers, January 2009–September 2010

Characteristic	No. Eligible for Consent	No. Who Consented	Consent Rate, %	*P* Value[a]
All women	2,285	1,399	61	
Race and ethnicity				<0.001
Hispanic	411	261	64	
Non-Hispanic white	1,147	720	63	
Non-Hispanic African American	127	81	64	
Asian	126	56	44	
Other	217	148	68	
Unknown	257	133	52	
Age, years				<0.001
<26	715	462	65	
26–35	1,293	793	61	
36–49	252	128	51	
Unknown	25	16	64	
Marital status				0.45
Married	1,519	903	59	
Not married	608	374	62	
Unknown	158	122	77	
Primary language				0.19
English	1,834	1,092	60	
Non-English[b]	197	128	65	
Unknown	252	179	71	
County characteristic				<0.0001
Small/rural	693	469	68	
Medium/suburban	605	331	55	
Large/urban	986	599	61	
Awareness of NCS[c]				<0.0001
Have heard of NCS	928	626	67	
Only through advance mailing	292	193	66	
Through other sources[d]	636	433	68	
Have not heard of NCS	1,335	760	57	

Abbreviations: NCS, National Children's Study.

[a] χ^2 test (with an α level of 0.05) of difference between subgroups, with "unknown" category excluded.

[b] The majority of non-English screening interviews were conducted in Spanish. The numbers for "other language" are not shown because they are too small; the consent rate for these women was 44%.

[c] As reported at initial pregnancy screening. χ^2 test was performed on "heard of NCS" versus "not heard of NCS."

[d] Sources include family, friends, church, community leader/activities, health care provider, newspaper, TV, radio, billboard, and internet.

DISCUSSION

The initial Vanguard Study piloted an area-based household sampling for recruitment of women who were pregnant or preconception for the NCS. Response rates of 89% for enumeration of households and 88% for screening of potential participants were achieved. The consent rate of 61% among study-eligible women was lower than anticipated, in part because of early restrictions in eligibility criteria. However, the consent rate of 67% among eligible pregnant women is similar to consent rates for other long-term studies with relatively high respondent burdens (13, 14).

The yield of 1,399 pregnant women or women in the high PPG who consented during more than 1 year of recruitment

activities was lower than estimated. Several aspects of the recruitment process likely contributed to the lower enrollment than the initial target. First, the phased implementation of the EPSC field work and the initial restriction in eligibility criteria during the early phase of recruitment to enroll only those who were pregnant for less than 20 weeks allowed several missed opportunities for recruitment of potential participants. Second, enrollment in the study required completion of the following 3 events: enumeration of the household, pregnancy screening of age-eligible woman, and consent. Although response rates at each step were reasonably good, nonresponse accumulates over each step in a multistep process.

The study identified several challenges in implementing EPSC. One challenge was the low awareness of the NCS among screened women despite community outreach and engagement efforts. Raising awareness about the study in the sampled communities was challenging because the segment locations had to be kept confidential to minimize the risk that the identities of study participants could become known to the public. This particularly affected highly populous locations because the sample segments were only a very small proportion of the location population and geographical area.

Another challenge was physically accessing some DUs to conduct the enumeration interviews. Several of the locations had restricted-access communities and barriers to the DUs including gated communities, locked high-rise apartments, fenced homes with guard dogs, and properties with "no trespassing" signs in rural areas (15). Mistrust is also a challenge in minority and immigrant communities (16).

Another challenge in culturally diverse locations is that family decision-making processes could differ substantially by race/ethnicity and culture. The study identified regional differences in culture that affected the EPSC process. For example, rather than refusing a request, some women may have preferred to avoid being asked by not answering the door. Such "passive refusal" is an aspect of Southern hospitality, as well as custom among some Asian and other immigrant communities. A related challenge is that some locations had a substantial proportion of newly immigrant or transient populations (15). It was difficult to engage these families in a study that could last for more than 20 years, when the families did not anticipate staying in the same location or even in the same county for more than a short period of time.

Lastly, identifying incident pregnancies through telephone follow-up proved not to be practicable; attempts to recontact women who were not pregnant, not engaged in the study, and not receiving incentives had very low success rates. After only 1–1.5 years of follow-up, the call centers combined had lost contact with more than half of the women, because the women had moved, their phone numbers were not valid, or they had lost interest. Women who were in the high PPG were less likely to be lost to follow-up, suggesting that they were more motivated to cooperate with the study. The more frequent contacts with women in the high PPG may have also contributed to the better success in maintaining contact.

Other factors may have contributed to the loss to follow-up among the nonpregnant women. The pregnancy screener contained sensitive questions that may have caused discomfort and discouraged participation among these women. The protocol was revised subsequently to reduce the number of sensitive questions asked during follow-up. Furthermore, these women were not formally enrolled in the study or given specific information about being recontacted periodically for up to 4 years, so they may not have understood the importance of maintaining contact with the study center staff. The loss to follow-up was particularly problematic in communities with higher household turnover.

Researchers in a variety of fields find that in-person contact results in higher response rates than other contact modes (12). The relatively high cooperation with in-person visits but low response rates to follow-up calls is consistent with the experiences of other studies. The feasibility of using additional strategies to maintain participant contact, such as e-mail and text messaging, as well as obtaining more extensive information on alternate contacts, is being evaluated in subsequent phases of the NCS Vanguard Study. Another factor for the NCS may be the motivation of pregnant women to participate, suggested by the higher consent rate for pregnant women compared with women in the high PPG eligible to consent. Possibly lower interest in the study among nonpregnant women poses a significant challenge for preconception enrollment.

With 7 study locations involved in the initial Vanguard Study, each with unique demographic characteristics but also with differences in processes such as community engagement, staffing, and timing of study roll-out, it was not possible to distinguish which factors contributed to between-center variation in recruitment success. When consent rates were evaluated according to characteristics of eligible women, differences were noted by race, age, and awareness of the NCS. Survey weights for the multistage sampling design can be used to adjust for differences in response and consent rates for developing population estimates; however, differences in consent rates could still cause selection bias if factors associated with consent differ among the sociodemographic groups. The NCS Vanguard Study has conducted and reported elsewhere qualitative research on factors that influence consent among individuals from different ethnic and cultural backgrounds (17). Themes related to the consent process identified in that study, such as perceived risks and benefits, as well as decision-making strategies, can be used in future research to enhance consent rates and possibly decrease the differences in consent rates observed in this study. As shown in Table 4, the consent rate was also influenced by whether the women had previously heard of the NCS. Subsequent recruitment pilot tests have implemented strategies to increase awareness of the NCS, which can be targeted to hard-to-reach populations and those in whom consent is difficult to obtain.

In conclusion, the initial NCS Vanguard Study piloted an area-based sampling method and EPSC protocol for household-based recruitment for a study with substantial participant burden. We found that cooperation rates were fairly high at initial contact and among pregnant women, but that telephone follow-up of nonpregnant women to ascertain incident pregnancies was not a practicable strategy by itself for ongoing recruitment of a representative sample over an extended study period.

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