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Notes Regarding the 2006 Survey of Active Duty Spouses

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Abstract

The Defense Manpower Data Center of the U.S. Department of Defense launched the 2006 Survey of Active Duty Spouses to assess attitudes of the spouses of U.S. active-duty military members. Severe problems existed with the sampling, weight adjustments, and estimation (including variance-estimation) procedures. Stratification of the sample without proper consideration of the survey objectives made it impossible to achieve reportable information for many desired population subgroups. Excessive stratification caused many of the sampling strata to have very small numbers of respondents, both expected and actual. Consequently, nonresponse bias was probably enormous across many of the strata. Absurd weight adjustments likely contributed toward rendering many survey estimates unreliable. To make the survey estimates seem more precise, sampling strata were collapsed together to form new "variance strata" for variance estimation. Caution is advised in using results from this and other Defense Manpower Data Center surveys.

Keywords

Defense Manpower Data Center, nonresponse bias, sample selection, weight adjustment, variance estimation

The Defense Manpower Data Center (DMDC) collects, maintains, and analyzes personnel data within the U.S. Department of Defense (DOD). In 1985, 1992, and 1999, the DMDC fielded spouse questionnaires (in conjunction with surveys of active-duty service members) to study a variety of issues, such as the impact of separation and deployment on the family and how military couples deal with military life.[1] The DMDC's 2006 Survey of Active Duty Spouses (2006 ADSS) sought to address topics such as the costs of relocating, spouse employment, financial status, child care, marriage support, well-being, military commitment, and satisfaction.[2] The survey's

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purpose possessed importance not only in terms of assessing the impact of the extended deployments on soldiers' family lives but also as a means of gauging future staffing and recruitment needs.

The statistical methods that the DMDC followed for the 2006 ADSS were quite poor; accordingly, results derived from the 2006 ADSS are of negligible value. Briefly, some of the problems with the sampling procedures were the following:

- Stratification of the sample without proper consideration of the survey objectives rendered impossible the attainment of reportable information for many desired population groups
- When problems were observed in the sampling, no efforts were made to restratify to correct the problems—instead, the decision was made to accept the fact that some of the wanted information would be unattainable
- Extreme overstratification caused many of the sampling strata to have very small numbers of respondents, both expected and actual

As anticipated, survey response rates were quite low, most notably in strata that comprised spouses of lower-ranking service members; hence, response bias is probably high enough to raise concerns about the value of the data. The response rates of the husbands of low-ranking female service members were particularly abysmal, and any inferences concerning the husbands of female service members should be regarded with especial skepticism.

In an effort to correct survey estimates for response bias, weight adjustments occurred in three stages: a logistic regression model to adjust for unknown eligibility, a logistic regression model to adjust for survey completion among eligible respondents, and finally a poststratification adjustment to force specific survey estimates to match certain known population totals. Briefly, problems with the weight adjustments were as follows:

- The logistic regression models contained an extremely large number of explanatory variables (plus two-way crossings), which led to irrational weight adjustments. Most weights were adjusted very little (or not at all), while a few weights received enormous adjustments (sometimes more than one hundredfold)
- No efforts were undertaken either to examine or to mitigate the effects of excessively variable weight adjustments, which can cause severely warped estimates
- The poststratification cells (used in the final poststratification adjustment to the weights) were inconsistent with the survey objectives
- The poststratification adjustment demonstrated that many survey estimates following the second logistic regression model adjustment were off by quite a lot (as much as 42 percent)

Finally, sampling strata were collapsed together to form new "variance strata" for variance estimation, which effected a downward bias in the variance estimates to make the survey results appear more precise and accurate than they actually were. The variance estimates that resulted from the creation of the "variance strata" were inappropriate because the variance estimates did not reflect the actual sampling design. The margins of error presented with the 2006 ADSS survey results grossly misrepresented the actual uncertainty associated with the estimates.

The DMDC ought to undertake efforts to make survey methods more transparent, military families more aware of the importance of participating in surveys, and survey results more accessible to the public. Moreover, the Inter-University Seminar on Armed Forces and Society has been asked to critically review DMDC surveys and results to ensure the validity of conclusions. The present article should be helpful to that end.

Sampling

The population of inferential interest for the 2006 ADSS comprised the spouses of all married active-duty Army, Navy, Marine Corps, and Air Force members, up to and including pay grade O6,[3] who had at least six months of service on November 21, 2005 (which was the first day of the survey field period). Data for constructing the sampling frame were derived from the DMDC's March 2005 Active-Duty Master Edit File, March 2005 Family Database, March 2005 Active Duty Pay File, March 2005 Basic Allowance for Housing Population File, and June 2005 Defense Enrollment Eligibility Reporting System File.[4] A total of 720,364 records were identified as being associated with the target population (i.e., the active-duty member was married, was in pay grade O6 or lower, and had at least six months of active-duty service by November 21, 2005).[5]

A single-stage stratified sampling strategy was used. Eighty-five *reporting domains* (i.e., specific subpopulations for which prevalence estimates were desired) were identified for the 2006 ADSS.[6] The variables used to define the *sampling strata* (i.e., mutually exclusive and collectively exhaustive population subgroups from which individual sample members were to be selected) were (1) branch of service of the service member, (2) pay grade of the service member, (3) sex of the service member, (4) race/ethnicity of the service member, (5) region of service, and (6) family status of the service member.[7] A total of 21,445 individuals who had missing information for any of the stratum-defining variables were placed together in an "unknown" stratum. An initial candidate set of sampling strata was constructed by crossing all possible levels of the stratification variables. Then, candidate sampling strata were generally collapsed together until they contained, in most cases, at least approximately 200 population members. A total of 176 strata were constructed, with stratum populations ranging from 185 to 38,254.

The DMDC Sample Planning Tool was used to find the minimum sample size that would simultaneously satisfy precision constraints (i.e., maximum half-widths of 95

percent confidence intervals, aka margins of error) for survey estimates for the reporting domains.[8] Stratum-level expected eligibility rates, which ranged from .936 to .998 (based on the survey-eligibility rates observed during the 1999 Survey of Active Duty Members), and expected response rates, which ranged from .079 to .677 (based on the 1999 Survey of Spouses of Active Duty Members), were employed in determining the number of people (from each sampling stratum) to contact for the survey. No expected response or eligibility rates were entered for the "unknown" stratum. For design purposes, all prevalence estimates were set at .5 (which is the prevalence estimate associated with maximum variance).[9] Margins of error for population estimates associated with all reporting domains were initially constrained to be no more than .05. Then, the constraints on the margins of error were tweaked (usually relaxed for the more problematic reporting domains) until the sample size was close to 35,000. Most of the margins of error for the reporting domains ended up being constrained to .05, while fifteen were left unconstrained. Margins of error ranged from .01 (for the entire population) to .286 (for Pacific Islanders). For American Indians, Asians, Pacific Islanders, Multiracial people, Navy Warrant Officers, and Marine Warrant Officers, the margins of error were greater than .05.

For sample surveys, a common objective of stratification is to divide the population into subpopulations that are as homogeneous as possible internally (i.e., that vary as little as possible from one another within the stratum) and that are heterogeneous from one stratum to the next; in principle, a precise estimate for any stratum can be obtained from a small sample within the stratum (because of the homogeneity of the stratum's population), and the stratum-level estimates can be combined for a precise estimate for the whole population.[10] An advantage of stratified sampling is especially evident when analyses are desired for certain small subgroups of the population: these small subgroups can be placed in their own strata and can be sampled at a higher rate than other members of the population to ensure a sufficient number of completed surveys within these small subgroups for analysis without oversampling other groups of people. The goals of the 2006 ADSS included reporting survey information for groups that represented small subsets of the population and stratifying the population with these reporting domains in mind. The alternative would have been a much larger sample that would have included large numbers of people who just happened to be in the same sampling strata. For example, there were only 1,573 Pacific Islanders and 3,561 multiracial people in the population. For stratification, these people were lumped together with the far more numerous American Indians, Asians, blacks, and Hispanics across seventy-eight strata. Using the present strategy, it would have been impossible to increase the representation of Pacific Islanders and multiracial people in the survey without also dramatically increasing the number of blacks and Hispanics in the sample. The overall sample size was required to be in the vicinity of 35,000. Thus, a decision was made to remove precision constraints for the smaller minority groups. If the Pacific Islanders and multiracial people had been placed into their own strata, then one could have been assured of having a sufficient sample of Pacific Islanders and multiracial people without necessarily oversampling other minorities.

Within each sampling stratum, persons were selected with equal probability via simple random sampling without replacement.[11] The total sample size was 36,055, for an overall sampling rate of 8.6 percent and an expected 12,519 eligible respondents. Stratum-level sample sizes ranged from 13 to 1,714, stratum-level sampling rates ranged from 2.1 percent to 28.2 percent, and the expected number of eligible respondents ranged from 3 to 528 per stratum. Design effects provided by the DMDC Sample Planning Tool indicated substantial room for improvement.[12] When it was observed that very small numbers of participants were anticipated from many of the strata, that several of the reporting domains would have too few respondents to provide reportable survey information, and that the design effects were high, no efforts were made to restratify to correct the problems. Instead, the decision was made to accept the fact that some of the desired information would be unattainable.

Survey Fielding and Response

The 2006 ADSS was administered by both Web and paper-and-pencil questionnaires.[13] The survey administration process began in November 2005, with the mailing of notification letters to eligible sample members.[14] The original field period was November 7, 2005, through February 9, 2006, and up to three additional postal communications were mailed to sample members throughout this field period; sample members with a valid email address on record could have received an email notification plus up to eight email reminders during the November to February field period.[15] The survey field was reopened from May 1 through June 1, 2006, to communicate with 3,091 sample members originally misclassified as ineligible; during this period, a postal notification and one postal reminder were sent, and sample members with a valid email address received an email notification and up to four email reminders.[16]

The overall response rate was 30.9 percent. Stratum-level response rates ranged from 1.8 percent to 61.9 percent. Twenty-four of the sampling strata had response rates that were less than 10.0 percent. As response rates decrease, the potential for a biased sample increases, which means that the obtained responses fail to be representative of the larger population. Low response rates do not necessarily guarantee bias,[17] but they certainly indicate an elevated potential for bias.[18] When several strata have only one or two respondents, it becomes increasingly difficult either to argue or to imagine that a survey is unaffected by response bias. Response bias can reduce a probability sample to what essentially becomes a convenience sample. Consequently, the results become much less reliable and the conclusions much weaker.

The willing participation of sample members is crucial to the success of any survey. The low response rates obtained for the 2006 ADSS suggest that the majority of people contacted for the survey (in many of the strata) may not have regarded the survey as a fruitful use of their time. In particular, the response rates of the husbands of low-ranking female service members were especially low, and any inferences concerning the husbands of female service members should be regarded with caution. Pressing people to participate in surveys can lead to negative attitudes toward the survey and a

deterioration of the survey climate.[19] One hundred seven of the sample members classified as nonrespondents specifically requested that their names be removed from lists for future surveys.[20] Moreover, when sampled persons perceive that the survey sponsor possesses a particular point of view on a survey topic, that viewpoint can affect decisions on whether or not to participate in a survey, which can lead to response bias.[21] DMDC survey results tend not to be widely shared, and the Office of the Under Secretary of Defense for Personnel and Readiness typically uses DMDC survey results as the Office of the Under Secretary of Defense for Personnel and Readiness deems fit.

Weight Adjustments

The analysis of survey data from complex sample designs generally requires the use of weights to improve the precision of estimates by compensating for variable probabilities of selection and adjusting for varying response rates.[22]

All members of the 2006 ADSS sample received a base weight (also called a *sampling* weight), which was the same for all sample members within a sampling stratum. The base weight was the ratio of the stratum population size to the number of people (within the stratum) who were selected for the survey. The 2006 ADSS included three subsequent weight adjustments. The first adjustment employed a logistic regression model to adjust for unknown eligibility status. For each sample member whose eligibility status became known after the launch of the survey, the base weight was multiplied by the inverse of the expected probability of the eligibility status becoming known—as determined from the logistic regression model. The weights of sample members whose eligibility status remained unknown were set to zero. The second adjustment employed a similar logistic regression model to adjust for survey completion status among eligible respondents. For each eligible respondent who completed at least one-half of the questionnaire, the eligibility status adjusted weight (from the prior weighting step) was multiplied by the inverse of the expected probability (as determined from the logistic regression model) that the eligible respondent completed at least one-half of the questionnaire. The weights of eligible respondents who completed less than one-half of the questionnaire were set to zero. Table 1 summarizes the base weights and the first two weight adjustments. The final adjustment was a post-stratification adjustment to force final weighted totals to match certain known population counts from the list frame from which the sample had been selected. Table 2 summarizes the final weights.

The SAS LOGISTIC procedure was used to develop the logistic regression models for the first two adjustments.[23] First, all single and two-way crossings of several categorical variables, including the six stratification variables mentioned above, plus the educational attainment of the service member and whether the service member was stationed on or off base were entered as explanatory variables into the logistic regression model. The logistic regression model was weighted by the base weight. Then, "nonsignificant" variables and two-way crossings were removed, until the p value associated with all remaining single and two-way crossings of explanatory variables

Table 1. Summary of Base Weights and First Two Weight Adjustments for the 2006 Survey of Active Duty Spouses

		First weight adjustment			Second weight adjustment		
	Base weight	Unknown eligibility predicted probability	Unknown eligibility adjustment factor	Unknown eligibility adjusted weight	Survey completion predicted probability	Survey completion adjustment factor	Survey completion adjusted weight
n (nonzero)	36,054.00	34,372.00	12,515.00	12,515.00	11,857.00	11,138.00	11,138.00
M	19.98	0.36	2.77	55.10	0.94	1.07	48.45
Mdn	19.01	0.10	1.00	24.51	0.95	1.05	24.51
Min	3.55	0.00003	1.00	3.56	0.12	1.00	3.66
Max	47.48	1.00	131.98	3,724.81	1.00	8.30	2,070.56
SD	12.52	0.42	5.28	110.76	0.06	0.12	100.40
Skewness	0.50	0.81	6.00	7.50	–3.59	29.01	5.82
Sum	720,349.67			689,626.61			539,663.08

Table 2. Summary of All Final Weights, Final Weights for Eligible Participants, and Final Weights for Known Ineligibles for the 2006 Survey of Active Duty Spouses

	All final weights	Eligible participants	Known ineligibles
n (nonzero)	11,796.00	11,138.00	658.00
M	58.16	48.39	223.56
Mdn	24.81	23.89	174.23
Min	3.44	3.44	4.77
Max	3,353.22	1,943.87	3,353.22
SD	116.99	99.59	220.32
Skewness	6.49	5.67	6.37
Sum	686,060.32	538,956.98	147,103.34

was less than .05. The SAS LOGISTIC procedure was designed to perform logistic regression analysis for data from a simple random sample *only*, and the approach used here is not valid for data that come from other sample designs, including complex samples.[24] The SAS LOGISTIC procedure treats the value of the WEIGHT variable as the sample frequency of the observation;[25] in other words, the SAS LOGISTIC procedure proceeded as if it were dealing with a sample of 686,194 (which was the record-eligible population size) rather than a sample of 34,372. Thus, any *p* values or other diagnostic measures associated with the model were meaningless.

The final model for the first weight adjustment had a total of 172 model parameters. The unknown eligibility probability predicted from the logistic regression model ranged from .00003 to 1 for the 34,372 frame-eligible sample members (Table 1). The unknown eligibility adjustment factor, which was the inverse of the unknown eligibility

predicted probability, ranged from 1 to 131.98 for the 12,515 sample members whose eligibility status became known. The unknown eligibility adjusted weights (which represented the product of the base weight and the unknown eligibility adjustment factor for the 12,515 whose eligibility status became known) ranged from 3.56 to 3,724.81. The unknown eligibility adjusted weights for the 21,857 sample members whose eligibility for the survey remained unknown were set to zero. The median unknown eligibility adjustment factor—for sample members whose eligibility status became known—was 1.00 (Table 1), which was also the minimum value and most common value. This means that most of the weights (for sample members whose eligibility status became known) were not adjusted at all in this step. Some weights were adjusted dramatically (i.e., increased by a factor of more than 100). With this adjustment, there were apparently some rather spectacular shifts in some of the weights. Because the model used to adjust the weights was quite complex, pinpointing and explaining the shifts are impossible.

The second weight adjustment involved redistributing the unknown eligibility adjusted weights, from eligible survey respondents who completed less than one-half of the questionnaire to eligible survey respondents who completed at least one-half of the questionnaire. Similar procedures described above for the first weight adjustment were followed again. A logistic regression model, weighted by the unknown eligibility adjusted weight that derived from the first weight adjustment, was used to estimate the probability that an eligible respondent completed at least one-half of the survey. Again, the SAS LOGISTIC procedure not having been designed to analyze data from complex samples meant that any diagnostic measures associated with the model were meaningless. The probability of survey completion predicted from the logistic regression model ranged from .12 to 1 (Table 1). The survey completion adjustment factor, which was the inverse of the survey completion predicted probability, ranged from 1 to 8.30. For the 11,138 eligible respondents who completed at least one-half of the survey, the survey completion adjusted weight was the product of the unknown eligibility adjusted weight and the survey completion adjustment factor. The survey completion adjusted weights ranged from 3.66 to 2,070.56. Again, because the model used to adjust the weights was enormously complicated, explaining adjustments in the weights is impossible. The survey completion adjustment factor was highly skewed (Table 1), meaning that most of the weights were adjusted very little (if at all), while a small number received a rather sizeable adjustment. The maximum adjustment factor for the second weight adjustment (8.30) was not nearly as extreme as for the first weight adjustment (131.98). However, the skewness of the second weight adjustment factor was nearly five times greater (29.0 compared to 6.0). For the 719 eligible respondents who completed less than one-half of the survey questionnaire, the survey completion adjusted weight was set to zero.

The logistic regression models used to adjust the weights for the 2006 ADSS illustrate that problems can result from overspecification of a logistic regression model. The first logistic regression model indicated that the majority of the people who did respond (as to their eligibility for the survey) would have been expected to respond

with 100 percent certainty. None of the sampling strata had anything close to a 100 percent response rate. This suggests that grossly overspecifying a logistic regression model can cause severely biased estimates. Otherwise, if the results were credible, then it should be possible to use the model to identify selection strata where the expected response rates would be 100 percent.

Peduzzi et al. concluded that a logistic regression model should have at least ten events per explanatory variable (where an "event" is the least likely of a binary outcome) to avoid problems associated with overestimated and underestimated variances—when a logistic regression model had fewer than ten events per explanatory variable, the regression coefficients were biased in both positive and negative directions, the large sample variance estimates from the logistic model both overestimated and underestimated the sample variance of the regression coefficients, the confidence limits about the estimated values did not have proper coverage, and paradoxical associations (i.e., significance in the wrong direction) increased.[26] The first logistic regression model (used to adjust weights in the 2006 ADSS) had 72.8 events per model parameter, and the second, which was based on 719 events, had 4.1 events per model parameter. If having too few events per model parameter causes problems with variances, confidence intervals, and significance tests, then one might also suspect that the regression equation is doing a poor job of predicting the probability of responding to the survey. Furthermore, having a large number of discrete explanatory variables (plus two-way crossings of discrete explanatory variables) in a logistic regression model has the effect of subdividing the sample into a very large number of small discrete subcategories. Events may end up being isolated in very small subcategories, which may lead to irrational weight adjustments. If logistic regression models are to be used in weight adjustment, then it would be advisable to try to use more reasoned logistic regression models.

Some of the unknown eligibility adjustment factors (which derived from the first logistic regression model) were quite high—the maximum was 131.98 (Table 1). Many of the sampling strata did have very low response rates (as low as 1.8 percent). While increasing the weights of respondents from such strata by a couple of orders of magnitude might superficially seem reasonable, nonresponse bias from such strata is probably quite high. Moreover, if weight adjustments cause a few survey respondents to have very large weights compared to the rest of the sample, then the survey results can become quite dependent on the responses provided by the few respondents with the largest weights. Cox and Cohen presented a method for truncating and redistributing (through ratio adjustments) excessively large weights.[27] For the 2006 ADSS, no efforts were undertaken either to examine or to mitigate the effects of excessively large weights.

The poststratification for the 2006 ADSS (which represented the final weight adjustment) forced survey estimates to match list-frame population totals by branch of service, educational attainment of the service member, and six categories of occupational PERSTEMPO group (a variable created by the DMDC to represent the average number of days per month deployed away from home by occupational group). Some of the poststratification adjustments were rather large: survey estimates for the

poststratification cells (prior to the poststratification adjustment) were off by as much as 42 percent. It is likely that survey estimates for parameters other than the poststratification cells were also off by quite a bit. The poststratification used in the 2006 ADSS may have made some survey estimates more accurate and others less accurate. Confidence interval half-widths for the 2006 ADSS were generally targeted to be .05 or lower. Based on the poststratification adjustments, it is difficult to believe that all of the published survey estimates are as accurate and precise as presented.

In general, adjusting weights is a gross attempt to correct nonresponse bias and is typically used for unit nonresponse rather than item nonresponse. Much more sophisticated methods tend to be employed when item nonresponse is recognized as a major problem.[28] Nonresponse bias associated with item nonresponse was not addressed for the 2006 ADSS.

Variance Estimation

SUDAAN (Software for the Statistical Analysis of Correlated Data), which is a computer program designed to analyze data from surveys, was used to estimate standard errors for estimates from the 2006 ADSS.[29] SUDAAN uses Taylor series approximation to compute standard errors of the estimates, taking into account the stratification, including stratum-by-stratum finite population correction factors.[30] As mentioned above, many of the 176 sampling strata had very small numbers of eligible respondents. One stratum had only one eligible respondent, and 5 strata had only two eligible respondents. Of the strata, 50 (28.4 percent) had fewer than ten eligible respondents. If measured correctly, confidence intervals of estimates from the survey would have seemed unacceptably wide. With so few eligible respondents in many of the strata, it would have been necessary to take into consideration degrees of freedom to compute appropriate coverage factors, which is highly unusual for sample surveys.[31] To circumvent these difficulties, 84 new "variance strata" were created by combining sampling strata that had fewer than approximately thirty eligible respondents with similar strata. In all, 5 "variance strata" possessed thirteen to nineteen eligible respondents and were not further combined with other "variance strata." The intention was to create a downward bias in the variance estimates, so that confidence intervals of survey estimates would appear more acceptable and survey estimates would seem more precise than they really were.

Overall Conclusions

Because of shoddy statistical practices, results derived from the 2006 ADSS are not credible. In future surveys, the DMDC may wish to consider stratification schemes that concentrate on the survey objectives. If the DMDC observes that some strata have very few respondents anticipated or that there are difficulties involved in getting enough of a sample for certain reporting domains, then the DMDC ought to stop and restratify. Ending up with table cells for which information is nonreportable because

of small sample sizes and having to create new strata for standard-error estimation because the original sampling strata were inadequate are simply not desirable solutions. The DMDC ought to devote some thought to modifying its approach to weight adjustment—at the very least by using logistic regression models that are less complex and poststrata that are consistent with the survey objectives. Raking ratio estimation for weight adjustment is an alternative that is becoming increasingly popular.[32] Enhancing the accuracy of DMDC survey results, through improved and more reasoned weight adjustment methods, would be a great service to the decision makers who rely on information from DMDC surveys.

The DMDC may wish to consider developing ways of making military families more aware of the importance of participating in surveys. If the DMDC cannot increase response rates among people in strata typified by a low likelihood of participating in surveys, one option might be to limit surveys to strata where people are likely to participate. Admittedly, this would substitute one form of bias (coverage) for another (nonresponse). Another option might be to offer only sample results, and not population inferences, from strata with low response rates. Proper population inferences could be provided for strata that were less affected by nonresponse bias. However, offering sample results from strata with low response rates might seem to finesse rather than to solve the problem, and statistically unsophisticated readers might not notice the difference.

Finally, the DMDC ought to undertake efforts to publicize DMDC surveys to make the methods more transparent and the results more accessible to the public. The Office of the Under Secretary of Defense for Personnel Readiness makes decisions that affect millions of people, and topics covered by DMDC surveys would potentially be of high interest to a huge cross-section of the nation. Through the DMDC home page, one may presently find one's way to the Office of the Secretary of Defense and Joint Staff Freedom of Information Act Request Center, through which one would presumably be able to request DMDC survey results. However, the DMDC Web site does not even list surveys with which the DMDC has been involved. Making complete survey results available through its Web site would represent a step toward elevating the DMDC's visibility and significance and may tend to enhance people's level of trust and confidence in DMDC surveys.

Armed Forces & Society has published a number of articles that have used data from DMDC surveys.[33] DMDC statistical methods tend to vary little from survey to survey, and one should be particularly skeptical concerning results derived from DMDC surveys.

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Notes

1. Defense Manpower Data Center, "1999 Survey of Spouses of Active Duty Members: Statistical Methodology Report," report no. 2000-021 (Arlington, VA: Defense Manpower Data Center, 2001), 1-3.
2. Defense Manpower Data Center, "2006 Survey of Active Duty Spouses: Financial Well-Being and Spouse Employment," note no. 2008-005 (Arlington, VA: Defense Manpower Data Center, 2008), 1.
3. Pay grade O6 corresponds to the rank of Colonel in the Army, Marine Corps, and Air Force and to the rank of Captain in the Navy.
4. Defense Manpower Data Center, "2006 Survey of Active Duty Spouses: Administration, Datasets, and Codebook," report no. 2006-034 (Arlington, VA: Defense Manpower Data Center, 2007), 8.
5. Ibid., 8.
6. Ibid., 10-11, lists the variables used in defining the reporting domains.
7. Ibid., 9, lists the variables used in defining the sampling strata.
8. Jill A. Dever and Robert E. Mason, *DMDC Sample Planning Tool* (Research Triangle Park, NC: Research Triangle Institute, 2003).
9. Michael Sullivan III, *Statistics: Informed Decisions Using Data*, 2nd ed. (Upper Saddle River, NJ: Pearson Prentice Hall, 2007), 482.
10. William G. Cochran, *Sampling Techniques*, 3rd ed. (New York: John Wiley, 1977), 89-90.
11. Ibid., 18-20.
12. The *design effect* is the sampling variance for a statistic—as computed under the sample design—divided by the sampling variance that would have been obtained from a simple random sample of the same size. See Robert M. Groves, Floyd J. Fowler, Jr., Mick P. Couper, James M. Lepkowski, Eleanor Singer, and Roger Tourangeau, *Survey Methodology* (New York: John Wiley, 2004), 334.
13. Defense Manpower Data Center,*2006 Survey of Active Duty Spouses: Administration, Datasets, and Codebook*, appendices A and B.
14. Ibid., appendix C.
15. Ibid., appendix C.
16. Ibid., 8.
17. Robert M. Groves and Emilia Peycheva, "The Impact of Nonresponse Rates on Nonresponse Bias: A Meta-Analysis," *Public Opinion Quarterly* 72 (2008): 167-89.
18. Maurice C. Bryson, "The Literary Digest Poll: Making of an American Myth," *American Statistician* 30 (1977): 184-85.
19. Lars R. Bergman and Robert Brage, "Survey Experiences and Later Survey Attitudes, Intentions and Behaviour," *Journal of Official Statistics* 24 (2008): 99-113.
20. Defense Manpower Data Center, *2006 Survey of Active Duty Spouses: Administration, Datasets, and Codebook*, 13.
21. Groves and Peycheva, "Impact of Nonresponse Rates."
22. Brenda G. Cox and Steven B. Cohen, *Methodological Issues for Health Care Surveys* (New York: Marcel Dekker, 1985), 190.

23. SAS Institute, *SAS/STAT® 9.1 User's Guide: The LOGISTIC Procedure (Book Excerpt)* (Cary, NC: SAS Institute, 2008).
24. The New SAS SURVEYLOGISTIC procedure provides a valid method for performing logistic regression on data from complex survey designs. See Anthony B. An, "Performing Logistic Regression on Survey Data with the New SURVEYLOGISTIC Procedure," in *Proceedings of the Twenty-Seventh Annual SAS® Users Group International Conference* (Cary, NC: SAS Institute, 2002), paper 258-27.
25. SAS Institute, *SAS/STAT® 9.1 User's Guide*, 2328.
26. P. N. Peduzzi, J. Concato, E. Kemper, T. R. Holford, and A. R. Feinstein, "A Simulation Study of the Number of Events per Variable in Logistic Regression Analysis," *Journal of Clinical Epidemiology* 99 (1996): 1373-79.
27. Cox and Cohen, *Methodological Issues*, 204-5.
28. Donald B. Rubin, *Multiple Imputation for Nonresponse in Surveys* (New York: John Wiley, 1987).
29. Research Triangle Institute, *SUDAAN® User's Manual Release 8.0* (Research Triangle Park, NC: Research Triangle Institute, 2001).
30. Kirk M. Wolter, *Introduction to Variance Estimation*, 2nd ed. (New York: Springer, 2007), 226-34.
31. International Organization for Standardization, *Guide to the Expression of Uncertainty in Measurement Corrected and Reprinted 1995* (Geneva: International Organization for Standardization, 1995), 23.
32. Willard C. Losinger, "A Look at Raking for Weight Adjustment," *Stats* 33 (2002): 8-12.
33. Among them are Brenda L. Moore, "The Propensity of Junior Enlisted Personnel to Remain in Today's Army," *Armed Forces & Society* 28 (2002): 257-78; Kirby L. Bowling, Juanita M. Firestone, and Richard J. Harris, "Analyzing Questions That Cannot Be Asked of Respondents Who Cannot Respond," *Armed Forces & Society* 31 (2005): 411-37; and Juanita M. Firestone and Richard J. Harris, "Sexual Harassment in the U.S. Military Reserve Component: A Preliminary Analysis," *Armed Forces & Society* (forthcoming).

Bio

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