

## RESULTS OF RANDOM DIGIT DIALING SURVEY METHODS IN A RURAL STATE

Takamaru Ashikaga, Carolyn J. Greene, Michael R. Young and Brian V. MacPherson  
University of Vermont

### INTRODUCTION

The Biometry Facility of the University of Vermont has been the only active survey research unit within the state of Vermont over the last fifteen years. Vermont is a small rural state of 9609 square miles in the northeast portion of the U.S. which appears to have a very stable population (Table 1). The state has a population of 511,456 residents distributed over 14 counties representing differing degrees of rurality (Table 2). Indeed, many areas of state are very inaccessible especially during the winter season. Previous survey efforts utilized area probability sampling procedures (1,2). However, due to increases in overall survey costs due to increases in travel expenses, the feasibility of phone surveys as an alternative method was examined.

Previous work has indicated that a two-stage cluster sampling procedure could potentially be of great utility in increasing yields over conventional random digit dialing methods (3-5). This study was undertaken to examine the potential increased yields that could be obtained by this method in the rural state of Vermont.

### METHODS

Primary sampling units (PSU) representing clusters of size 25 were generated using the technique of Waksberg in five geographic subregions of Vermont. These PSU's were classified as a good PSU if the first telephone number in the sequence was a functional Vermont residential number. It was considered a bad PSU otherwise. The proportion of good PSU's to the number of PSU's examined represents the primary-stage yield. Given that a PSU was considered as good, the remaining telephone numbers which comprised the PSU were examined. The total number of functional Vermont residential numbers to the total number examined gives rise to a total effort yield.

Conditional yields were also calculated. Given that a PSU was considered good, the yield of usable numbers was calculated excluding the initial number. A similar conditional yield was calculated for PSU's that were considered bad.

### RESULTS

Table 3 presents the primary stage yields for each of the five geographic subunits of Vermont. The values range from a low of 6.7% for Orleans County to a high of 17.7% for Caledonia County. The total effort yields are also presented in Table 3. Table 4 presents the conditional yields from both good and bad PSU's. The good PSU's have a higher secondary yield compared to the bad PSU's as expected. Table 5 presents the disposition of those numbers resulting from

the good PSU's only.

### DISCUSSION

The PSU yields for each of the five regions appears to be rather low with some indication that it might be related to the degree of rurality of a particular region. Total yields do not appear to be as strongly related to rurality. However, the absolute yields do appear to represent a good increase over the PSU yields. The degree to which the two-stage procedure reflected an increase in efficiency over simple random digit dialing methods is given in Figure 1. It appears tempting to suggest that increased rurality is directly related to increased efficiency.

### REFERENCES

1. Health Care - An International Study. (R. Kohn and K.L. White, Eds.) Oxford University Press, London, 1976.
2. Worden, JK, Waller, JA, Ashikaga, T and Sweeney, RR: Respiratory Disease in Vermont: A Population Survey for Planning a Public Education Program. Preventive Medicine 9: 120-134, 1980.
3. Waksberg, J: Sampling Methods for Random Digit Dialing. Journal of the American Statistical Association 73: 40-46, 1978.
4. Cummings, KM: Random Digit Dialing: A Sampling Technique for Telephone Surveys. Public Opinion Quarterly 43: 233-244, 1979.
5. Groves, RM: An Empirical Comparison of Two Telephone Sample Designs. Journal of Marketing Research 15: 622-631, 1978.

TABLE 1 - Distribution of Population by Size of Place for  
Vermont's 255 Minor Civil Divisions, 1940 to 1980

Distribution of the Population in Places											
Census Year	Under 1,000		1,000-1,999		2,000-4,999		5,000-9,999		Over 10,000		Total Pop.
	% Total Pop.	# Places	% Total Pop.	# Places	% Total Pop.	# Places	% Total Pop.	# Places	% Total Pop.	# Places	
1940	20.7	159	26.3	65	18.9	20	12.4	6	21.7	5	359,231
1950	19.6	161	25.1	63	17.0	18	15.6	8	22.7	5	377,747
1960	18.3	163	25.1	62	13.2	14	20.6	11	22.8	5	389,881
1970	16.0	154	23.7	63	17.1	21	14.9	9	28.3	8	444,732
1980	13.8	134	22.1	69	20.7	31	17.6	13	25.8	8	511,456

TABLE 2 - Rural and Urban Population in Vermont, 1980

County	Rural Population (in places under 2,500)			Urban Population (in places 2,500 and over)			Total Pop.	
	Total	% Rural	# of Comm.	Total	% Urban	# of Comm.	Total	Total Comm.
Addison	18,539	63.0	21	10,867	37.0	2	29,406	23
Bennington	7,999	24.0	13	25,346	76.0	4	33,345	17
Caledonia	10,333	40.0	14	15,475	60.0	3	25,808	17
Chittenden	6,147	5.3	6	109,387	94.7	12	115,534	18
Essex	6,313	100.0	19	0	0.0	0	6,313	19
Franklin	15,966	45.9	11	13,822	54.1	4	34,788	15
Grand Isle	4,613	100.0	5	0	0.0	0	4,613	5
Lamoille	6,747	40.2	3	10,020	59.8	7	16,767	10
Orange	18,050	79.4	16	4,689	20.6	1	22,739	17
Orleans	11,472	48.9	16	11,968	51.1	3	23,440	19
Rutland	20,175	34.6	21	38,172	65.4	7	58,347	28
Washington	17,338	33.1	15	35,055	66.9	5	52,393	20
Windham	19,509	52.8	21	17,424	47.2	2	36,933	23
Windsor	20,254	39.7	18	30,776	60.3	6	51,030	24
State	183,455	35.9	199	328,001	64.1	56	511,456	255

TABLE 3

Geographic Area	Primary Stage		Total Effort	
	#PSU Tried	#Yield (%)	#Tried	#Yield (%)
Caledonia	198	35 (17.7%)	847	385(45.5%)
Essex	296	21 ( 7.1%)	644	244(37.9%)
Franklin	145	16 (11.0%)	433	146(33.7%)
Orleans	120	8 ( 6.7%)	295	86(29.2%)
Others	200	25 (12.5%)	526	220(41.8%)

TABLE 4

Geographic Area	Conditional Given Good PSU		Conditional Given Bad PSU	
	#Tried	#Yield(%)	#Tried	#Yield(%)
Caledonia	649	350 (53.9%)	99	30(30.3%)
Essex	348	223 (64.1%)	81	19(23.5%)
Franklin	288	130 (45.1%)	242	87(36.0%)
Orleans	175	78 (44.6%)	548	227(41.4%)
Others	326	195 (59.8%)	78	42(53.8%)

TABLE 5 - Disposition of Sample Numbers by County and Sample Stage

	Caledonia		Essex	
	1st Stage	2nd Stage	1st Stage	2nd Stage
1. Working Number	42(21.2%)	388(59.8%)	46(15.5%)	223(64.1%)
A. Working Vt Number	35(17.7%)	350(53.9%)	21( 7.1%)	223(64.1%)
B. Eligible Household	13( 6.6%)	175(27.0%)	14( 4.7%)	115(33.0%)
C. Completed Interview	12( 6.1%)	144(22.2%)	12( 4.1%)	101(29.0%)
2. Nonworking Number	156(78.8%)	261(40.2%)	250(84.5%)	125(35.9%)
A. Not In Service	99(50.0%)	120(18.5%)	170(57.4%)	48(13.8%)
B. Fast Busy	47(23.7%)	11( 1.7%)	23( 7.8%)	1( 0.3%)
C. Busy	2( 1.0%)	14( 2.2%)	3( 1.0%)	12( 3.4%)
D. No Answer	8( 4.0%)	116(17.9%)	54(18.2%)	64(18.4%)
TOTALS	198	649	296	348

TABLE 5 continued

Franklin		Orleans		Others	
1st Stage	2nd Stage	1st Stage	2nd Stage	1st Stage	2nd Stage
18(12.4%)	151(52.4%)	13(10.8%)	86(49.1%)	33(16.5%)	219(67.2%)
16(11.0%)	130(45.1%)	8( 6.7%)	78(44.6%)	25(12.5%)	195(59.8%)
7( 4.8%)	66(22.9%)	5( 4.2%)	32(18.3%)	10( 5.0%)	135(41.4%)
6( 4.1%)	59(20.5%)	5( 4.2%)	26(14.9%)	10( 5.0%)	119(36.5%)
127(87.6%)	138(47.9%)	107(89.2%)	89(50.9%)	167(83.5%)	107(32.8%)
79(54.5%)	58(20.1%)	69(57.5%)	51(29.1%)	103(51.5%)	46(14.1%)
2( 1.4%)	0( 0.0%)	0( 0.0%)	0( 0.0%)	11( 5.5%)	0( 0.0%)
2( 1.4%)	6( 2.1%)	1( 0.8%)	2( 1.1%)	31(15.5%)	1( 0.3%)
44(30.3%)	74(25.7%)	37(30.8%)	36(20.6%)	21(10.5%)	60(18.4%)
145	288	120	175	200	326

FIGURE 1

