The geography of adult homelessness in the US: Validation of state and county estimates

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ABSTRACT

This study models geographic variations in the US in lifetime occurrence of homelessness, length of homeless experience, and point-in-time estimates based on socioeconomic, demographic, and disability indicators, among 13,931 respondents in the National Comorbidity Replication and the National Latino Asian American surveys. It uses a small area estimation methodology to estimate county and state levels of homelessness. This study demonstrates high validity for the state estimates, but not for counties. Overall, the model generates a point-in-time estimate of adult homeless persons at 377,000, and an adult lifetime rate of 4.7% of the household adult population.

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1. Introduction

Two seemingly contradictory perspectives have infused debates on homelessness, its causes, and its policy remedies. On one hand, there are those who focus on the "literal homeless", on those who stay in shelters or live on the streets, and who are often characterized as having multiple and long-term disabilities such as poor physical and mental health, including substance abuse (Lamb and Lamb, 1990). These individuals are believed to require intensive services, including psychiatric hospitalization or out-patient commitment (Swartz et al., 2001). On the other hand, there is a much larger population of persons who are often characterized as being 'down on their luck', who have had only brief episodes of homelessness, frequently due to economic restructuring and displacement, and who primarily require concrete supports such as affordable housing and the like (Link et al., 1994). These people have sometimes been referred to as the 'precariously housed' (Rossi, 1989) and include a substantial population who are doubled up due to extreme financial emergencies. The impact of these disparate views of homelessness on definitions of homeless populations, resulting counts, and policy recommendations has become a classic case illustration of the reciprocal impacts of popular ideology, research, and policy on one another.

The purpose of this study is threefold. It involves the use of data from two national multistage probability surveys, specifically the National Comorbidity Study replication (Kessler et al., 2005) and the National Latino Asian American Study (Alegría et al., 2007), to (i) generate state and county estimates for the US of both the point-in-time "literally" homeless population and the larger at risk population consisting of those who have been homeless at some point in their adult lives, (ii) to validate these contrasting estimates through their comparison with two alternative national data sets from 1990 and 2005, and a final aim is to (iii) consider the implications of these findings for a third position on the above noted issue, namely: that while both perspectives contain important truths, our understanding of the literally homeless requires an understanding of a much larger population living on the social margin who have at some point been homeless, however briefly.

A considerable body of literature has clarified the role of larger social forces in the genesis of contemporary homelessness, including the impact of economic servicetization, diminishing social and family supports, and other forms of social capital (see Hudson, 1998; Vissing, 1996; Hwang and Dunn, 2005). This study instead develops a multivariate model that can be used for generating synthetic estimates of state and local rates of homelessness using small area estimation (SAE) techniques, as well as the testing of the resulting estimates through a systematic comparison with two independent studies.

Many of the methods of small area estimation have been pioneered in the United Kingdom, particularly through the work of Twigg et al. (2000) and more recently by Bajekal et al. (2004) on the behalf of that nation's Department of Health and its Healthy

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Lifestyles Project. Twigg and Moon (2002) conclude that small area estimation techniques can produce results that are competitive with those of direct local surveys (2002). Recent applications of SAE methods are exemplified by the work of Congdon (2008) and Earnest et al. (in press) in health and Congdon (2006) and Curtis et al. (2006) and Hudson (2009) in mental health. Such studies have demonstrated that small area estimation methods can effectively address the problem that even with survey sample sizes in the tens of thousands, there is often insufficient statistical power available due to small number of respondents in key subsamples, for inferences to be made to local areas using techniques of direct estimation.

2. Background

Since the early 1980s, there have been numerous attempts to estimate the size of the population of homeless persons, resulting in divergent estimates.[1] In 1982, the Community for Creative Non-Violence pegged the level at over 1% of the population (Snyder and Hombs, 1983), whereas in 1984, the Department of Housing and Urban Development estimated it at about .1%, or at the 250,000–350,000 level (US Congress, 1984). This latter figure was based on an integration of the results of four estimation methodologies. Several criticisms have been levied against this effort that include the sampling methods, lack of specificity in the requests for estimates, and an inappropriate use of local population figures to develop national figures. Each of these estimates have been widely discounted because of their methodological flaws, most commonly those involving an attempt to aggregate local guesstimates.

Most efforts to estimate rates of homelessness have been based on local surveys. Although the initial studies were small scale projects with shoe-string budgets, increasingly researchers have developed innovative techniques to estimate the rates of the 'hidden homeless'. These include not only snowball sampling methods (Beáta and Snijders, 2002), capture–recapture methods (Cowan, 1991), use of unduplicated management information system reports (Culhane et al., 2007), and the use of 'plants' to assess undercounts from conventional methods (Hopper et al., 2008). Some researchers have utilized decoy persons, or 'plants', who pose as homeless to determine the proportion of the homeless that are not counted through traditional street surveys. This was a method that was used to assess the undercount in the 1990 Census (see Hudson, 1998), as well as more recently by Hopper and his colleagues in New York, who found that between 29% and 41% failed to be included in this city's Census (Hopper et al., 2008). A recent study in Budapest, Hungary, has also demonstrated the promising use of the combination of snowball and capture–recapture methods in a major metropolitan area (Beáta and Snijders, 2002).

Estimates of the homeless population for the US in the 1990s have typically fallen in the 300,000–800,000 range. Two re-analyses of the 1984 HUD study placed the figure in the upper end of these figures. While the National Alliance to End Homelessness placed it at 735,000 (see Institute of Medicine, 1988), that same year HUD adjusted its estimate to 500,000–600,000 (Blau, 1992, p. 24). One estimate is that of Jencks' (1994) who used information from Burt and Cohen's (1988) research on the ratio of street to shelter homeless as well as the 1990 US Census count of homeless persons in shelters to estimate the total number at 324,000. In March of 1990, the US Census located 240,140 persons, or less

than a tenth of a percent (.096%) of the nation's population, who, most would agree, were homeless, with a fifth of a percent (49,734 or 21%) found to be living on the streets. There were major controversies regarding the S-Night counts, involving both inadequate definitions and methodologies, both of which were alleged to account for the many signs of a considerable undercount (NCH, 1991).

Due to undercount problems reported for the 1990 S-Night Census (NCH, 1991), the Census Bureau did not attempt a general count of homeless persons in the 2000 Census, but rather restricted its efforts to enumerating those in shelters as well as group quarters, excluding those living on the streets. The 2000 Census produced a somewhat more modest count of 170,706 homeless in emergency shelters, compared with the 178,638 found in 1990 (U.S. Bureau of Census, 2001).

One other study in the 1990s, conducted by one of this study's authors (Hudson, 1998), involved a secondary analysis of the Census Bureau's S-Night counts. It consisted of the development and testing of a structural equation model of variations in rates of homelessness among the 3141 US counties. The final model reported adjusts for systematic error or undercounting as modeled by the rate of enumerators per 10,000 population canvassed and includes other predictors such as McKinney funding, economic conditions, and urbanization, accounted for over 80% of variation in the rates (p. 299), and resulted in a national estimate of 482,000 homeless adults and children. Comparisons with local and national estimates at the time showed a moderate level of validity. Nonetheless, this was a rough estimate that was not able to capitalize on subsequent developments in the methodologies of synthetic regression estimation. At about the same time that Hudson reported his model estimates for 1990 and 1995, the Urban Institute conducted the National Survey of Homeless Assistance Providers and Clients in 1996. This involved an aggregation of counts provided by service providers from across the country that resulted in an estimate of between 444,000 and 842,000, although Burt suggested that the actual number was probably in the high end of this range (Urban Institute, 2000).

One line of research that is pertinent to the current study involves the use of a telephone survey of the general population. The purpose of such surveys is not to interview currently homeless persons, but to determine the proportion of housed persons who have been homeless at some point in their lives. The best known of such studies was that conducted by Link et al. (1994), who conducted randomly selected telephone interviews with 1507 persons in the general population. They found that although 14% reported being homeless, 7.4% were found to be literally homeless at some point or another. There have been several more recent such telephone interviews. Tompsett et al. (2006) conducted telephone surveys in 1993–1994 ($n=360$) and 2001 ($n=435$) and found that 8.1% and 6.2% of the population had experienced homelessness at some point in their lives, although the difference was not statistically significant. A more recent multi-national study that used techniques of random digit dialing (RDD) and an adapted version of Link's instrument, found a lifetime prevalence of homelessness in the US ($n=435$) of 6.2%, with rates ranging from 2.4% in Germany to 7.7% in the UK. The advantage of such surveys is that they provide a broader understanding of the population of individuals who are at the risk of homelessness, despite the uncertainty about the findings. Bias upwards can be expected due to participation on the part of only interested respondents, and bias downwards will result from the fact that such surveys fail to tap the proportion of the homeless who never rehoused, due to their chronicity, incarceration, or death.

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[1] The initial part of this background section has been adapted from Hudson (1998).

The most recent national effort to enumerate the homeless was undertaken by the National Alliance to End Homelessness in 2005 (2007). This study was an attempt to replicate their earlier study, and to take advantage of a growing trend to develop homeless information systems in the 463 areas throughout the nation that have been designated as Continua of Care (CoCs) as part of the McKinney–Vento Homeless Act. This study is essentially an aggregation of reported rates from each of these CoCs. It generated a 2005 adjusted count of 744,313 homeless adults and children, after adjustments for outliers, one that was within the range of the earlier study (444,000–842,000). The reliability and extent of unduplication of this data is similarly unknown. Nonetheless, the effort appears to have some face validity, given its general agreement with most of the other efforts to estimate the number of literally homeless persons throughout the US.

Most of the results of the major research efforts fall within the 400,000–800,000 range for point-in-time estimates of the literally homeless, and 6–8% range for the lifetime homeless estimate (both adults and children). The current study tests estimates of adult (18+) homelessness and investigates the possibility that the point-in-time and lifetime rates are essentially compatible, as well as examines their agreement with some of the previous studies reviewed here. It tests hypotheses about the possibility that variations in lifetime reported rates of homelessness can be systematically modeled, based on unfavorable socioeconomic conditions and personal disabilities, to predict rates of homelessness as measured through independent data collection efforts.

3. Methodology

3.1. Overview

This study aims to estimate state and county levels of adult homelessness through the computation of point-in-time and lifetime population rates. This is done by applying small area estimation methodologies (see Heady et al., 2003; Schaible, 1996) to the analysis of data collected as part of the US National Comorbidity Study Replication [NCS-R] (Kessler and Merikangas, 2004) and the National Latino Asian American Study [NLAAS] (Alegría et al., 2007), which collectively constitute a nationally representative probability sample of 13,931 respondents. It does this specifically through use of a small area methodology developed by the UK's Office of National Statistics (Heady et al., 2003). This initially involves the estimation of a predictive model of variations in the occurrence of both adult lifetime homelessness and total length of homelessness on the individual level. This first stage of the project, which uses both logistic regression (for lifetime homelessness) and multiple regression (for length of homelessness), also uses much of the methodology recently applied in a model that estimates rates of serious mental illness (Hudson, 2009). In the second stage, the coefficients derived from the two foregoing models are applied to parallel set of predictors on the area level, with data obtained through the 2000 Census, and coded using the same categories as used to estimate the individual-level model, to compute area-level estimates for 48 US states and counties. The results of these two parallel models are then used to compute point-in-time estimates of adult homelessness for each county and state. Estimation of point-in-time counts permits validation of the model used in this study, since there have been other national studies that have generated detailed point-in-time estimates for various localities, but none for the lifetime rates. Thus, in the third stage, the resulting estimates for the two levels of aggregation (state and county) are validated through their correlation with and regression on independent point-in-time rates of homelessness reported by two studies conducted using separate 1990 and 2005 data sets. This study restricts itself to the adult homeless population not only because of the data sets used here did not survey children, but also because of the very different methodological issues involved with this population (Vissing, 2007).

3.2. Variables

Three sources of data are employed in this study: (i) individual-level data downloaded from the publicly accessible version of two of the component studies of the Collaborative Psychiatric Epidemiological Studies [CPES], specifically, the NCS-R and NLAAS; (ii) Census data obtained from the 2000 Decennial Census from the STF3 long-form; and (iii) several data items used for validation that were computed from the reported results of two earlier studies. The primary variables are listed in Table 1 and elaborated in Appendix A.

Table 1
Demographic profile of the combined NCS-R and NLAAS samples.

	n	Percentage	95% CI	
			Lower (%)	Upper (%)
Age				
Missing	2099	20.3		
18–29	2411	23.3	21.4	25.4
30–49	1966	19.0	17.6	20.6
50–64	2153	20.8	19.0	22.7
65 and over	1712	16.6	14.8	18.5
Gender				
Male	4895	47.3	45.7	49.0
Female	5446	52.7	51.0	54.3
Race				
White	7314	70.7	67.4	73.9
Black	1157	11.2	9.4	13.2
Asian	446	4.3	3.6	5.2
Hispanic	1211	11.7	10.0	13.6
All Other	214	2.1	1.6	2.6
Education				
Missing	9	1		
11 Years and less	1859	18.0	16.5	19.6
12 Years/HS grad.	3217	31.1	29.1	33.2
1–3 Years college	2847	27.5	26.1	29.0
Bachelor's degree	1355	13.1	12.1	14.2
Some graduate work or more	1053	10.2	8.8	11.7
Household Income				
100,000 and Over	1737	16.8	14.8	18.9
60,000–100,000	2273	22.0	20.5	23.5
35,000–60,000	2333	22.6	21.2	24.0
15,000–35,000	2163	20.9	19.3	22.6
Under $15,000 per year	1835	17.7	15.9	19.7
Region				
Northeast	1968	19.0	14.1	25.2
Midwest	2380	23.0	19.8	26.6
South	3539	34.2	30.7	38.0
West	2454	23.7	20.2	27.7
Serious mental illness				
No	9773	94.5	94.0	95.0
Yes	526	5.1	4.7	5.6
Missing	42	.4		
Study				
NCS-R	8974	86.8	84.7	88.6
NLAAS	1367	13.2	11.4	15.3

Notes: All counts and percentages above are weighted, based on complex sampling design of the NCS-R and NLAAS. Total unweighted *n*=13,931 (NCS-R=9282; NLAAS=4649). All *n*'s are rounded.

3.3. Sampling

The data of this project were obtained from the two surveys included as part of the National Institute of Mental Health's Collaborative Psychiatric Epidemiology Surveys project (CPES), maintained by the Inter-University Consortium for Political and Social Research. These are the National Comorbidity Survey Replication (NCS-R), conducted in 2001 and 2002 ($n=9282$, unweighted) and the National Latino Asian American Survey (NLAAS) ($n=4649$, unweighted), conducted between May 2002 and November 2003. These parallel studies are national multi-stage probability household surveys of adults (18+) covering the contiguous 48 states using in-person interviews with standardized instruments, which are described in detail elsewhere. These surveys had response rates of 80.4% and 75.7%. The weighting factor used corrections for unequal probabilities of selection based on disproportionate over sampling of selected racial and ethnic minorities, as well as non-response, specifically for the combined NCS-R and NLAAS sample. Sample data were analyzed using the Complex Sampling module in SPSS 16.1, which takes into account not only the correct combined weighting factor for the two studies, but also the stratification and clustering used in the computation of standard errors.

3.4. Modeling procedures

Two models were initially estimated: one for adult lifetime homelessness and the other for the duration of adult lifetime homelessness (in months). The first was developed through the use of logistic regression as implemented in the SPSS Complex Samples module, using the Bernoulli distribution and logit link function. The dichotomous dependent variable, 'Ever Homeless', was coded 1 if present and 0 if absent, and regressed on the predictors consisting of the demographic and socioeconomic variables previously outlined. In virtually all cases, the reference category for indicator comparisons was defined as that category hypothesized to be at highest risk, such as those with a high school education or with less than $15,000 annual income. This was then recalculated with non-significant predictors deleted. Diagnostic statistical indices examined included standard goodness-of-fit measures, residuals, a receiver operator curve (ROC) analysis, and a classification table.

Similarly, total reported time homeless as an adult was analyzed with the general linear model, also included as a part of the SPSS Complex Samples module. But this was done using only the 491 respondents who reported being homeless, and only after converting all data into a common scale (months) and checking for normality. Because this data was highly skewed, an exponential transformation (proportion adult life **.2) was identified and used to normalize the data. Standard diagnostic measures were also examined for the model estimated. The final model was recomputed with non-significant effects deleted, for example, region of the country.

3.5. Estimation of rates

Estimation of the synthetic rates consisted of three sub-stages: (i) parallel data sets were prepared for both the 48 states and their associated 3109 counties, consisting of population versions of the same predictor variables and the same categories that were used in the initial individual-level modeling. For instance, five household income categories were used in the initial modeling (<$15,000, $15,000–35,000, $35,000–60,000, $60,000–100,000, and $100,000+), so five variables were calculated from the Census counts with the proportion (from 0 to 1) of adults, 18+, and in the household population in each of the same five income ranges. (ii) Syntax programs, using SPSS 16.1, were then prepared to apply the regression weights for each of the two models to the corresponding proportions in the zip code data set, and to calculate the estimates for each of the states and counties of interest. For the Ever Homeless logistic model, the resulting logit values for each of the areas were then converted into odds ratios and finally into probability rates. These rates constituted the estimated risk of having ever been homeless, which were then used to estimate the proportion of the adult area population that had ever been homeless. In the case of the general linear regression of length of homelessness, a similar procedure was used, and the resulting estimates were then transformed back to the original metric (proportion adult life homeless **5). (iii) Finally, the figures for the probability of prior homelessness and proportion of lifetime homelessness were multiplied to produce an overall risk of point-in-time homelessness (0–1.0), which was applied to the adult household population to produce a point-in-time estimate of homelessness for the area. The resulting estimate represents a generalized mean of the point-in-time counts for a wide range of years, rather than merely the point of data collection. These were also expressed as rates per 10,000 adult population.

3.6. Validation of model

Internal consistency was assessed through a comparison of the point-in-time counts and rates of homelessness estimated by the model with those directly calculated from the NCS-R data set. Although there is no 'gold standard' against which this model can be validated, it was possible to compare the model's projected rates with independent indicators, specifically those computed based on a regression model that was adjusted for the undercount in the 1990 S-Night US Census (Hudson, 1998), and a recent national study conducted by the National Alliance for Ending Homelessness (NAEH, 2007). For both the 1990 adjusted Census and 2005 NAEH data, adjustments in the proportion of children under 18 were subtracted, and non-surveyed jurisdictions, i.e. Alaska and Hawaii, were also dropped to assure comparability of the data sets. Overall means were examined, but the most important assessment of these relationships was conducted through computation of Pearson r correlations, both zero-order and first-order partial correlations controlling for population, paired T-tests, as well as linear regressions and their scatterplots.

4. Results

4.1. Homelessness

Almost 1 in 20 adults or 4.7% of the US household population are estimated, based on the NCS-R data, to have been homeless one or more times since the age of 18 (see Table 2). The total time, which these respondents have been homeless, ranges from 1 day to 45 years, with a median of 3.0 months and a mean of 9.4 months, which represents a mean of 4.7% of the respondents' adult lives. We can directly infer from this combined sample that at a given point-in-time there are 416,000 (95% CI: 319,000–513,000) or 19.9 per 10,000 (15.2–24.5) adults who are homeless. This assumes that the respondents have a reasonably accurate memory and are generally honest in their reporting.

Table 2
Levels of adult homelessness, computed from 2002 National Comorbidity Replication Survey.

Indicator	n	Measure	95% CI
Ever experienced homelessness as an adult? (%)	10,331	4.7%	4.1–5.3%
Reported lifetime length of homelessness			
Mean (months)	491	9.4	7.0–11.9
Median (months)	488	3.0	–
Percent of adult lifetime (%)	488	4.7%	3.5–5.9%
Point-in-time estimate—homeless persons per…			
10,000 adult population	10,331	19.9	15.2–24.5
For 48 states (1000s of persons)		416,000	319,000–513,000

Note: Data are weighted for complex sample design used in NCS-R study. Under the point-in-time estimate, only an estimate for the adult (18+) household population in the 48 states is reported, and this excludes Alaska and Hawaii, since the NCS-R only surveyed the 48 states. The point-in-time estimate represents an estimate of the average percent or count at any given point in time.

Table 3
Demographic profile of the sub-sample of previously homeless persons (n=482).

	n	Percentage	95% CI Lower (%)	Upper (%)
Age				
Missing	144	29.8	25.0	35.0
18–29	104	21.5	16.8	27.0
30-49	129	26.8	21.6	32.7
50-64	88	18.3	14.1	23.3
65 & Over	18	3.7	1.4	9.4
Gender				
Male	266	55.1	48.8	61.2
Female	217	44.9	38.8	51.2
Race				
White	287	59.5	51.4	67.1
Black	100	20.8	15.2	27.6
Asian	7	1.4	1.1	1.9
Hispanic	62	12.8	10.0	16.2
All Other	27	5.6	3.8	8.0
Education				
11 Years and less	153	31.7	27.5	36.3
12 Years/HS grad.	160	33.1	28.4	38.3
1–3 Years college	129	26.8	22.6	31.5
Bachelor's degree	23	4.8	2.7	8.4
Some graduate work or more	17	3.6	1.8	6.8
Household income				
100,000 and over	41	8.4	6.1	11.5
60,000–100,000	68	14.2	10.0	19.8
35,000–60,000	98	20.2	16.4	24.7
15,000–35,000	101	20.9	16.0	26.8
Under $15,000 per year	175	36.2	29.7	43.3
Region				
Northeast	96	20.0	12.7	29.9
Midwest	85	17.7	13.2	23.3
South	142	29.5	23.9	35.9
West	158	32.8	25.9	40.6
Serious mental illness				
No	379	78.9	73.5	83.5
Yes	101	21.1	16.5	26.5
Missing				
Study				
NCS-R	426	88.2		
NLAAS	57	11.8		

Notes: All counts and percentages above are weighted, based on complex sampling design of the NCS-R and NLAAS. Total unweighted n=495 (NCS-R=335; NLAAS=160). All n's are rounded.

4.2. Characteristics of the former homeless

Of the 10,341 respondents interviewed, 491 identified themselves as being homeless on one or more occasions. Whereas the mean age of the overall sample is 44.9, the ex-homeless are slightly younger, with a mean age of 40.6 (see Tables 1 and 3). Men are disproportionately represented, representing 61.2% of the ex-homeless group, compared with 49.0% for the general population. The racial groups that are over-represented are Blacks, at 20.8% of the ex-homeless, compared with 11.2% in the general population, and, "All other", at 5.6%, compared with 2.1% in the general population sample. The ex-homeless struggle with relatively low levels of education and income, with almost a third having less than a high school education. Their mean annual household income of $38,000 is dramatically less than $58,700 for the general population sample. Almost a third (32.8%) of these individuals were located in the West (Mountain and Pacific states), compared with less than a quarter (23.7%) of the larger population. About one in five, or 21.1% of the ex-homeless, has a serious mental illness, compared with 5.1% of the US household population.

4.3. Regression models

In order to estimate state and local rates, the first stage in the modeling process involved estimating two models based on the demographic and socioeconomic predictors outlined earlier. The purpose is to understand and model variations in the numbers of those who have previously been homeless, and among these persons the variations in the length of homelessness. Table 4 summarizes the results of a logistic model of lifetime homelessness. This model largely reflects the initial findings based on the bivariate analyses, namely that the young and middle aged, males, blacks, and people of mixed racial identification, those with low levels of education and income, and those with serious mental illnesses are disproportionately represented among those who have experienced homelessness at some point in their adult lives. Those in the lowest educational and income groups are at about four times the risk of being homeless compared to those in the highest educational and income groups. Similarly, those with a serious mental illness are four times more likely to be homeless than those without such a history (OR=.25). Not only is each of these effects highly significant ($p < .0005$), but the model as a whole is similarly significant (Wald=125.29; df=23,89; $p=.000$). The overall rate of correct predictions from this model is a very substantial, .954. In contrast, the sensitivity of the model in correctly predicting those who have been homeless is low, at only .026. The range of possible trade-offs of the estimates of specificity and sensitivity are determined by the particular cutoff in the probability level that is set for individual-level predictions, and for this reason, this study also computed a Receiver Operating Curve (ROC) that permits examining the full range of possible predictive cutoffs, and the overall measure for the predictive accuracy of the model is assessed by the "area under the curve" (AUC) statistic that is

Table 4
Self-reported lifetime occurrence of homelessness, regressed on selected demographic predictors ($n = 10,336$).

Predictor	Logit	Wald	p	Exp
Intercept	−2.951	125.3	.000	.052
Age				
Missing	2.260			9.58
18–29	1.416			4.12
30–49	2.232			9.32
50–64	1.696			5.45
65 and Over [ref. category]	.000	534.7	.000	1.00
Gender				
Male	.494			1.64
Female [ref. category]	.000	11.2	.001	1.00
Race				
White	−.533			.59
Black	.001			1.00
Asian	−1.724			.18
Hispanic	−.989			.37
All other [ref. category]	.000	11.5	.000	1.00
Education				
Missing	−18.911			.00
11 Years and less	1.430			4.18
12 Years/HS grad	.906			2.47
1–3 Years college	.913			2.49
Bachelor's degree	.076			1.08
Some graduate work+ [ref. category]	.000	267.8	.000	1.00
Household income				
100,000 and Over	−1.345			.26
60,000–100,000	−1.169			.31
35,000–60,000	−.865			.42
15,000–35,000	−.729			.48
Under $15,000 per year [ref. category]	.000	7.3	.000	1.00
Region				
Northeast	−.396			.67
Midwest	−.682			.51
South	−.718			.49
West [ref. category]	.000	5.7	.001	1.00
Serious mental illness				
No	−4.07			.25
Yes [ref. category]	.000	54.2	.000	1.00

Notes: Model Wald = 125.287 (df = 23,89; p = .000); Nagelkerke = .166; Specificity = .999; Sensitivity = .026; Overall correct predictions = .954. ROC analysis AUC = .700.

.70, which is considered a moderately acceptable level (see Hosmer and Lemeshow, 2000).

The reported length of lifetime homelessness of the 479 respondents who have been homeless was regressed on the same predictors using the general linear model. After using backward elimination of non-significant effects, the final model confirmed that people of younger age, the male gender, those never been married, and those unemployed were likely to have had longer histories of prior homelessness, as would be expected based on numerous studies (see Table 5). This model, however, accounted for only a small proportion – about an eighth – of the variation in the lengths of prior homelessness ($R^2 = .127$). Nonetheless, it reveals a highly significant set of effects (Wald = 19.5; df = 3,55; p = .000).

4.4. Computation and testing of model predictions

Since the main purpose of this study is prediction and estimation, rather than explanation, it was necessary to use the regression weights from the foregoing models for the calculation of lifetime and point-in-time counts of homeless persons for states and counties. The equations for the estimated models were used to calculate both an overall probability (0–1) for each area, as well as probable length of homelessness, expressed as a proportion of the adult life span (0–1). The first, by itself, is a measure of the likely proportion of the local adult population that

Table 5
Self-reported lifetime length of homelessness, regressed on selected demographic predictors ($n = 479$).

Predictor	General linear regression of duration of homelessness		
	Beta	Wald	p
Intercept	40.167	1,553.8	.000
Age			
Missing	5.151		
18–29	11.647		
30–49	6.378		
50–64	1.415		
65 and Over (ref. category)	.000	5.7	.001
Gender			
Male	3.639		
Female (ref. category)	.000	4.5	.039
Marital status			
Married	−5.126		
Separated, wid., div.	−2.136		
Never married (ref. category)	.000	5.8	.005
Employment			
Missing	−12.067		
Employed	−1.152		
Unemployed	3.890		
Not in labor force (ref. category)	.000	19.5	.000

Notes: Model Wald = 19.5 (df = 3,55), p = .000; $R^2 = .127$. The above betas reflect the effects of an exponential transformations for normalization (power of $.5 \times 100$), which was removed prior to use of model in computing estimates for local areas.

Table 6
Validity coefficients and T-tests for model estimates of homeless populations, for US states and counties.

Areas	n	Correlation (r)	Probability
US states[a]			
2005 NAEH estimates (0-order)	48	.947	.000
Controlling for population	48	.755	.000
Paired T-test (t = −1.983; df = 47)	48	–	.053
1990 Adjusted Census Est. (0-order)	48	.873	.000
Controlling for population	48	.259	.079
Paired T-test (t = −.087; df = 47)	48	–	.931
Counties			
1990 Adjusted Census Est. (0-order)	3109	.906	.000
Controlling for population		.106	.000
Paired T-test (t = 5.992; df = 3108)	3109	–	.000

[a] Excludes Alaska and Hawaii, since NCS-R data is not representative of these states.

has ever been homeless. The product of the two represents the probable proportion of homeless adults at a given point-in-time, specifically at the point of data collection (2002), and progressively greater error as one moves away from this period of time. For example, if the risk measure of homelessness for a given county is .05, and the average proportion of the life span of the homeless adults spent homeless is .1, then the point-in-time estimate of adult homelessness for this county would be their product or .005 (50 in 10,000). These rates are then multiplied by the adult household population for each of the areas to generate actual estimated counts.

But estimates have limited value unless they can be validated. In this study, the estimated counts were examined for both their postdictive and predictive validity, as well as their face validity. Table 6 summarizes several statistical measures of the correlation and agreement of the predicted rates with those from two other studies, one based on regression-based corrections of the 1990 S-Night data, and the other the 1995 counts from the National Alliance for Ending Homelessness, based on aggregations of local service system counts. The zero-order correlations of the

a

b
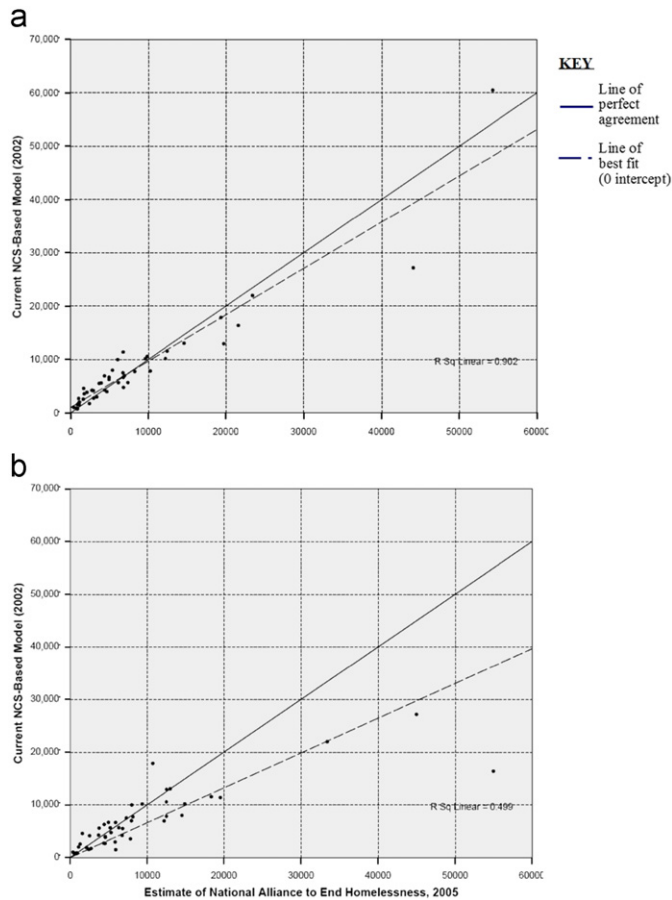
Fig. 1. Model estimates of homeless adults in 48 contiguous US states, regressed on 1990 and 2005 estimates. (a) Regressed on estimates derived from regression-based adjustments to 1990 S-Night Census data (Hudson 1998). (b) Estimates for 2005 regressed on counts compiled by the National Coalition to End Homelessness (January 2007). *Note*: the 1990 and 2005 data were adjusted to assure comparability, i.e. children under 18 were subtracted, and only 48 contiguous states are included, excluding Alaska, Hawaii, and Washington DC. In second scattergram, California is not represented to assure comparable scales in two figures. It was, however, included in calculation of lines of best fit and other statistics.

estimated counts of the two studies are very high, for both counties and states, ranging from .87 to .95. These are plotted in Fig. 1 and they indicate that only a few of the largest states, such as California and New York, contributed a disproportionate amount of the error. Despite the strong correlation, the predicted rates were slightly lower than the 1990 figures, and more so with the 2005 counts, as indicated by the differing slopes of the lines of perfect agreement and of best fit.

Another test of the model projections involves the statistical control for population since population is a component of the estimated counts, and since the high correlation between population sizes may inflate the resulting correlation of estimated counts. On the state level, control for population explains away only a small part of the correlation with the 2005 figures, as the partial correlation is still very substantial, i.e. .76. However, control for population explains away most of the apparent association with the 1990 counts on both the state and county levels.

Correlations, however high, only provide one view, primarily of the covariation in two measures, rather than their actual agreement. To assess level of agreement, paired T-tests were calculated between each set of estimates to determine if the two sets of paired counts are significantly different. Neither of the tests for differences between the state-level estimates and the 1990 ($t = -.087$; df$=47$; $p=.931$) and 2005 ($t = -1.983$; df$=47$; $p=.053$) validation studies were significantly different; however, the T-test with the 1990 county data revealed a very significant difference ($t=5.992$; df$=3108$; $p=.000$), indicating that there is little agreement with these earlier county rates.

Tables 7 and 8 present estimated counts for the largest and smallest states, as well as the largest counties. These reveal both striking levels of agreement, as well as some areas of disagreement between the three sets of rates and counts. Perhaps the most notable disagreement is that of California, with a 2005 rate of 41.2, compared with 17.9 for both the 1990 and the study estimates (for 2002). Similarly, several of the other 2005 estimates are decidedly greater than the others. In contrast, there are unexpected levels of agreement between most of the estimates in the smaller states. Whereas the total estimate of homeless adults for the 48 states generated from the model was 377,531, the 1990 estimates were almost the same, at 379,679, in

Table 7
Point-in-time estimates of adult homelessness in selected US states.

| State	1990 Validation estimates[a]		2005 Validation estimates[b]		2002 Model estimates	
	Rate/10,000	*n*	Rate/10,000	*n*	Rate/10,000	*n*
States with highest estimates (2002)						
California	17.9	53,157	41.2	148,851	17.9	60,486
New York	23.9	42,998	23.4	44,971	14.3	27,165
Texas	14.0	23,786	14.6	33,395	10.5	21,963
Pennsylvania	16.5	19,593	8.6	10,721	14.5	17,858
Florida	16.9	21,794	30.9	54,946	10.2	16,366
States with lowest estimates						
Wyoming	9.6	436	7.1	363	21.0	1039
South Dakota	12.7	881	11.4	887	11.4	860
Vermont	12.8	720	11.2	701	13.6	825
Delaware	12.1	805	10.3	866	10.3	810
North Dakota	14.7	936	8.4	538	11.5	738
48 states in total	15.4	379,679	19.4	571,222	13.5	377,531

[a] Based on multivariate adjustments of the 1990 S-Night US Census, reported in: Hudson, 1998. An Interdependency Model of Homelessness: The Dynamics of Social Disintegration. Lewiston, NY: Edwin Mellen. The under-18 population is subtracted as part of this current study. The 2002 estimates are modeled using data from the National Comorbidity Study Replication. The under-18 population is subtracted out to assure comparability with 2002 adult data.

[b] Based on: National Alliance to End Homelessness (2007). These figures include the sum of the counts for both persons not in families for each state and the parental/caretaker portion of persons in families, imputed for each state based on: the reported number of homeless families counted and total persons in homeless families in each state, as well as a proportion (.53), which are estimated to be single parent families (based on Wood et al., 1990).

Table 8
Point-in-time estimates of adult homelessness in selected US counties.

Counties with highest 2002 estimates	1990 Validation estimates[a]		2002 Estimates	
	Rate/10,000	*n*	Rate/10,000	*n*
Los Angeles Co., CA	20.7	18,339	27.1	18,252
Cook County, IL	20.5	10,485	15.2	5967
Harris County, TX	16.2	4564	15.4	3674
Maricopa Co., AZ	17.6	3727	25.5	5636
Orange County, CA	18.8	4199	20.3	4154
San Diego Co., CA	27.9	4683	24.1	4869
Kings County, NY	18.0	6420	27.0	4803
Miami-Dade Co., FL	19.5	3487	14.7	2441
Queens County, NY	18.1	3811	17.9	3051
Dallas County, TX	15.0	3350	15.6	2457
48 states in total	15.4	379,679	13.5	377,531

[a] Based on multivariate adjustments of the 1990 S-Night US Census, reported in: XX1stauthor. Hudson, 1998. An Interdependency Model of Homelessness: the Dynamics of Social Disintegration. Lewiston, NY: Edwin Mellen. The under-18 population is subtracted as part of this current study. The 2002 estimates are modeled using data from the National Comorbidity Study Replication. The under-18 population is subtracted out to assure greater comparability with 2002 adult data.
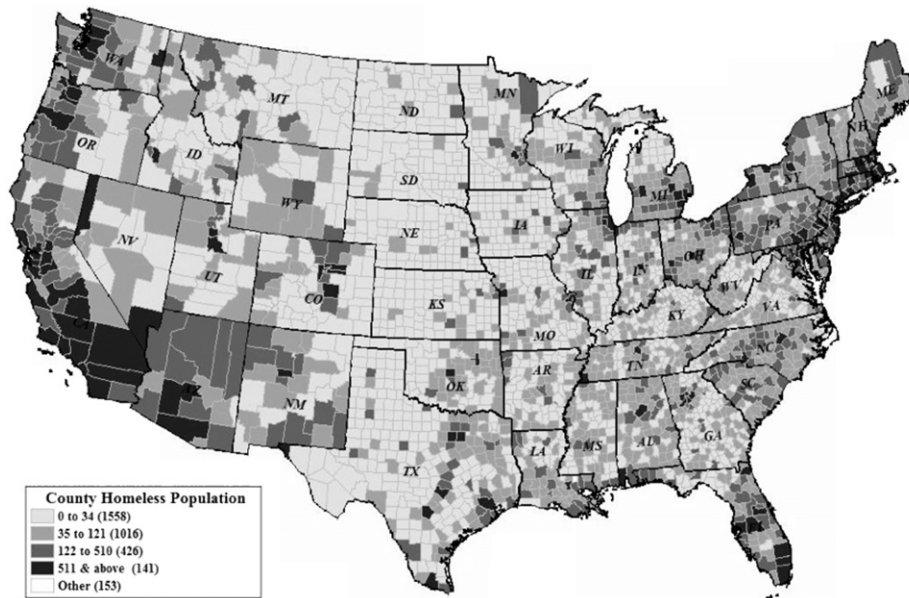
Fig. 2. Estimated number of homeless for US counties, 2002.

contrast to the 571,222 for the 2005 service system counts. The levels of agreement in the counts for most of the larger counties (Table 8) are much more than most would expect, with the exception of Cook County, IL, and Kings County, NY. Finally, the estimated counts of homeless persons for the range of US counties in the 48 states are mapped out in Fig. 2, which confirms the expected patterns of high levels of homelessness not only in urban areas and the northeast, but particularly in the Western US, and the lowest levels in the Plaines, particularly the North Central states such as the Dakotas, Nebraska, Iowa, Kansas, and Missouri.

5. Discussion

This study provides specific estimates of the substantial populations of homeless and ex-homeless adults in the US and in individual states. It demonstrates that the targeted point-in-time estimates of the 'literally homeless' and the estimates of the much larger numbers of people who have been homeless are largely consistent with one another. This study's point-in-time estimate of 377,531 homeless adults is virtually the same as an

estimate based on the 1990 Census, at 379,679, and about a third less than one generated in 2005, at 571,222. Similarly, this study's lifetime estimate of 4.7% of the adult household population who have been homeless is only moderately less than that derived from several much smaller and less rigorous telephone surveys that ranged from 6.2% to 8.1% (Link et al., 1994; Tompsett et al., 2006; Toro et al., 2007). However, the primary purpose of this study was not to estimate overall national rates, but to test the feasibility of estimating state and local rates based on systematic variations in the national data set of individuals surveyed in the NCPE studies. In this regard, the study succeeded only in estimating levels of homelessness for the states with a good to high level of validity, based on validations with the two other studies with available state data. The low level of reliability in the county estimates undoubtedly derives from several sources of error, such as limitations in client recall, insufficiently powerful predictors of length of homelessness, and client mobility, as well as limitations in the reliability of the validating studies.

Given the large size of the sample and the use of state-of-the-art interviewing and multistage probability sampling methods employed in its collection, the data used in this study has made it

an ideal candidate for statistical modeling of variations in risk of homelessness and in lifetime length of homelessness in the adult household population. The models estimated have confirmed that many of the demographic profiles of the adult homeless populations generated in past research that, for example, those who have been homeless are most likely to be young to middle aged, male, black, minimally educated, and with low incomes (see Hudson, 1998). Although close to four-fifths (78.9%) of the ex-homeless do not have a serious mental illness, the significant minority who do have such a condition highlights the diverse and continuing needs of adults who have been homeless. That about a fifth (21.1%) of the ex-homeless has a serious mental illness (SMI) – a figure similar to estimates among the currently homeless[2] – suggests that this group has succeeded in exiting homelessness at a similar rate as others. This interpretation is supported by the finding that those who are young (particularly in the 18–29 age group), male, never married, and unemployed, or not participating in the labor force, are most likely to have had the most prolonged experience of homelessness.

These results highlight the importance of the provision of both mental health services and economic supports, especially a range of affordable housing options, assisted education, and continued inclusion of job training and placement services. Given the fact that there are at least 21 times the number of ex-homeless as there are literally homeless persons, the public can, thus, have confidence in the capacity of the currently homeless to obtain new homes when provided with sufficient supports.

The success of the small area estimation methodology used for estimating state homeless populations demonstrates a promising approach to ongoing estimation and research in this field. It permits the inexpensive use of data from existing national studies to estimate state needs, and potentially those of smaller areas. It also reinforces the need to more systematically and rigorously incorporate indicators of the homeless experience into mainstream household probability surveys on mental illness, housing, poverty, nutrition, and especially, the Census.

Further research is needed on the reliability and validity of the data sources used in this study, including those used to validate it. Nonetheless, this study does provide strong evidence that the measures, in aggregate, correlate and agree with data derived from alternative methodologies, such as population censuses, and homeless information systems. A critical limitation of the use of household data is that such a source cannot tap the proportion of homeless persons who fail to exit homelessness and become domiciled, sometimes due to either long-term institutionalization (e.g. jail, hospital, group home) or death. The fact that the estimates from this study are about a fifth less than the counts from the National Alliance to End Homelessness may reflect this phenomenon, as well as the possibility that the recall of the ex-homeless is compromised by a tendency to discount negative experiences. In contrast, the difficulty that service providers have in unduplicating service system counts and accessing the unserved also needs to be considered, as well as financial and political incentives that may impact on these kinds of data collection efforts. Given these sources of error, one might conclude that the true point-in-time adult rate would fall between these two estimates (between 377,000 and 571,000). In either case, these studies again confirm that a substantial population of persons suffers the multiple and debilitating effects of extreme poverty.

The profile developed in this study for both the currently homeless and the larger group of persons who periodically experience homelessness highlights the dynamic nature of the populations involved, their severe health problems, particularly psychiatric disabilities, and the many possibilities of both prevention and early intervention. It provides strong evidence that when provided with sufficient supports, most homeless adults – including the seriously mentally ill – are able to find new homes. At the same time that the data supports the often cited figure of 20–30% of currently homeless adults as having a serious mental illness, and thus requiring a range of services, it also highlights the severe economic problems, as evidenced by low levels of education, income, and employment experienced by a substantial majority of both currently and ex-homeless persons. This requires not only a variety of affordable housing, income support, and job development strategies, but a systematic implementation of a linked social development strategy in which services and supports are integrated with both mental health services, as well as carefully linked with existing and emergent economic opportunities.

Appendix A. Variables used in analyses

A.1. Dependent variables (individual level)

Responses to two questions that were asked in both the NCS-R and NLAAS surveys were used to compute both point-in-time and lifetime rates of homelessness: (i) ever been homeless?: "Since the age of 18, have you ever been homeless?" (Yes/No), and (ii) total duration of homelessness: "How long were you homeless altogether since the age of 18?"

A.2. Independent variables (individual level)

The individual-level data consists of items that were collected as a part of two parallel national probability samples of households in the 48 contiguous US states in 2001–2002, specifically, the NCS-R and NLAAS surveys. Although there is wealth of potential predictors in these two databases, and ones that have been identified by earlier studies, the methodology of this study required using only those predictors for which analogous predictors could be calculated from the US Census or related sources.

In addition, predictors were used from the NCS-R and NLAAS studies based on both theory and previous research (see Hudson, 1998). (i) Initial demographic predictors included age, gender, race, and region; (ii) socioeconomic indicators consisted of household income, education, occupation, and occupational status, poverty status, and employment; (iii) primary supports consisted of marital status and household size; and (iv) the indicator of personal disabilities used was the rate of serious mental illness, reported in Hudson (2009). The NCS-R and NLAAS versions of these variables were coded using the categories reported in Table 1, and similarly, these categories were used in the preparation of the Census Standard Tape File 3C (STF-3C) 2000 Census data.

A.3. Area level predictors

Variables paralleling the above were prepared primarily from the 2000 US STF-3C long form data. This was initially done using both the state-level aggregation for the national as a whole as

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[2] One meta-analytic review of the results of 9 studies that included approximately 1000 subjects of psychiatric hospitalization and psychopathology among the homeless found that over a quarter (26%) evidenced a personality disorder, about a sixth (16%) an affective condition, such as major depression, and a seventh (14%), schizophrenia. Twenty percent of the homeless in these studies had been previously psychiatrically hospitalized (Hudson, 1998).

well as for Massachusetts using the counts from the zip code level of aggregation. Whenever available, actual counts for the 18+ adult household population were used; however, in a few cases, the required cross-tabulations were not included in the Census. In these instances, it was necessary to apply the appropriate proportion of adults in the household population to relevant sub-categories to obtain estimates. National totals excluded Alaska, Hawaii, and the territories as these were not surveyed as part the NCS-R or NLAAS studies.

A.4. Validation data

Validation of the area-level estimates relied on data from two previous studies: (i) the first validation data set was taken from the lead author's prior study (1998) in which a structural equation model was used to estimate homeless rates in the nation's 3141 counties, based on the S-Night counts, as well as data on several predictors and sources of systematic error. For the purposes of this study, the proportion of these persons who were 18 or under was subtracted to produce a comparable adult count. In addition, only results from the 48 states of interest here were used. (ii) The second validation study used was conducted by the National Alliance to End Homelessness (2007), based on 2005 data reported by each of the nation's homeless service systems. These figures include the sum of the counts for both persons not in families for each state and the parental/caretaker portion of persons in families, imputed for each state based on: the reported number of homeless families counted and total persons in homeless families in each state, as well as a proportion (.53), which are estimated to be single parent families (based on Wood et al., 1990). Because of the incomparability of the county-level and CoC level data from the NAEH, this data could only be used to assess the validity of the state level estimates produced in this study.

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