High-Risk for Mortality Criteria and Rough Sleepers: 10-year study of high-risk unsheltered adults from Boston

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Objectives

- Unsheltered or rough sleeper population is a sub-group of elusive yet highly visible homeless people who eschew homeless shelters and sleep on the streets
- "High-risk for mortality criteria" developed at Boston Health Care for the Homeless Program (BHCHP) to predict mortality were applied to an unsheltered cohort that was divided into 2 groups: high-risk (HR) and non-high-risk (NHR)
- Vulnerability Index (VI) and its iterations were effective community-organizing tools that catalyzed interest in unsheltered population and other homeless sub-populations resulting in thousands of people receiving supportive housing throughout the U.S. and were based on BHCHP's high-risk for mortality criteria
- Mortality and survival analysis for the HR and NHR groups were examined to determine if the HR group had worse outcomes than the NHR group
- Purpose of study was not to test the validity and reliability of the VI or any of its iterations; but rather to investigate whether BHCHP's high-risk for mortality criteria predicted a higher rate of mortality and lower probability for survival for unsheltered individuals

Methods

- 10-year prospective study with 445 unique unsheltered individuals
- Inclusion criteria: ≥18 years old, sleeping rough during year 2000, followed by BHCHP's Street Team
- Records were matched to Massachusetts Dept. of Public Health (MDPH) death occurrence files to confirm deaths
- Data sources: BHCHP street encounter database & electronic medical records, MDPH Death Occurrence files, National Death Index records, CDC Wide-ranging Online Data for Epidemiologic Research (WONDER) data, and mortality data for the general homeless cohort
- Survival analysis of HR vs. NHR groups was conducted
- Standardized mortality ratios (SMRs) using indirect standardization were calculated for HR and NHR groups using 2 comparison groups: Massachusetts (MA) population and an adult homeless cohort*

Results

Box 1: High-Risk for Mortality Criteria

≥18 years old and sleeping rough for ≥6 consecutive months, PLUS ≥1 of following 7 criteria:

1) Tri-morbidity (multiple medical illnesses co-occurring with mental illness and active substance use disorder);
2) ≥1 hospital admission or BHCHP respite admission anytime during previous year due to major medical problem(s);
3) ≥3 visits to the ED in previous 3 months;
4) ≥60 years old;
5) HIV or AIDS;
6) Cirrhosis, end stage liver disease, or renal failure; and/or
7) Previous history of frostbite, hypothermia, or immersion foot

Table 1: Characteristics of Unsheltered Cohort from 2000-2009

	Cohort N = 445	High-Risk[a] N = 119	Non-High-Risk N = 326	Decedents N = 134	Boston 2000 Census ≥18 years old N = 472,582[b]	MA[c] 2000 Census ≥18 years old N = 4,849,033[d]
Characteristic	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Age (years)						
18-44	248 (55.7)	57 (47.9)	191 (58.6)	56 (41.8)	306,658 (64.9)	2,569,111 (53.0)
45-64	176 (39.6)	57 (47.9)	119 (36.5)	65 (48.5)	104,588 (22.1)	1,419,760 (29.3)
≥65	21 (4.7)	5 (4.2)	16 (4.9)	13 (9.7)	61,336 (13.0)	860,162 (17.7)
Race/Ethnicity						
White	299 (67.2)	91 (76.5)	208 (63.8)	108 (80.6)	283,109 (59.9)	4,180,644 (86.1)
Black	94 (21.1)	16 (13.4)	78 (23.9)	15 (11.2)	102,491 (21.7)	236,027 (4.9)
[e]Other/Unknown	52 (11.7)	12 (10.1)	40 (12.3)	11 (8.2)	86,982 (18.4)	432,362 (8.9)
Gender[f]						
Men	322 (72.4)	91 (76.5)	231 (70.9)	116 (86.6)	224,078 (47.4)	2,289,671 (47.2)
Women	123 (27.6)	28 (23.5)	95 (29.1)	18 (13.4)	248,504 (52.6)	2,559,362 (52.8)
Risk-Level						
High-Risk	119 (26.7)			52 (38.8)		
Non-High-Risk	326 (73.3)			82 (61.2)		

[a]Individuals were considered High-Risk if they met criteria in Box 1
[b]Number reflects data on individuals ≥18 years old from Boston for the year 2000 from US Census Bureau: http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml
[c]MA refers to Massachusetts
[d]Number reflects data on individuals ≥18 years old from Massachusetts for the year 2000 from US Census Bureau: http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml
[e]Other Race/Ethnicity category contains individuals who reported their race/ethnicity to be American Indian, Hispanic, Asian, or race/ethnicity was unknown
[f]No missing data for Gender

Table 2: All-Cause Mortality and Cause-Specific Age-Standardized Mortality Ratios for Unsheltered Cohort, 2000-2009 by Risk-Level Compared to the Massachusetts Population, 2000-2009 and to an Adult Homeless Cohort from Boston, MA, 2003-2008[a]

	High-Risk[b]			Non-High-Risk		
Underlying Cause of Death[c,*]	N=52 (%)	SMR[d] (95% CI)[e] HR[f] vs. MA[g]	SMR (95% CI) HR vs. Adult Homeless	N=82 (%)	SMR (95% CI) NHR[h] vs. MA	SMR (95% CI) NHR vs. Adult Homeless
All-Cause						
Risk-Level	52 (100)	15.5 (11.7, 20.2)	4.0 (3.0, 5.2)	82 (100)	7.9 (6.3, 9.8)	2.2 (1.8, 2.8)
Men	45 (86.5)	15.0 (11.1, 19.9)	4.2 (3.1, 5.6)	71 (86.6)	7.4 (5.8, 9.2)	2.4 (1.9, 3.0)
Women	7 (13.5)	9.5 (4.2, 18.8)	3.0 (1.2, 5.7)	11 (13.4)	5.4 (2.9, 9.5)	1.6 (0.9, 2.8)[†]
Natural Causes						
Chronic Liver Disease	11 (21.2)	86.0 (45.0, 150.0)	11.7 (6.2, 20.4)	*		
Cancer	9 (17.3)	8.1 (4.0, 15.0)	4.5 (2.2, 8.2)	12 (14.6)	3.7 (2.0, 6.3)	2.2 (1.2, 3.7)
Heart Disease	7 (13.5)	10.4 (4.5, 20.5)	3.5 (1.5, 7.0)	11 (13.4)	5.2 (2.7, 9.0)	2.0 (1.0, 3.4)[†]
Substance Use Disorder	5 (9.6)	104.2 (38.1, 231.0)	4.9 (1.8, 10.9)	11 (13.4)	83.5 (43.8, 144.8)	4.0 (2.0, 6.8)
HIV/AIDS	5 (9.6)	122.3 (44.8, 271.1)	6.5 (2.4, 14.4)	5 (6.1)	43.1 (15.8, 95.5)	2.3 (0.8, 5.1)[†]
External Causes						
Injuries, non-poisoning[i]	6 (11.5)	44.0 (17.8, 91.6)	8.4 (3.4, 17.5)	13 (15.9)	30.0 (16.7, 50.0)	6.7 (3.7, 11.1)
Drug Overdose (poisoning)	*			7 (8.5)	16.2 (7.1, 32.1)	1.1 (0.5, 2.1)[†]
Substance Use Causes						
Substance Use	17 (32.7)	75.2 (45.2, 117.9)	4.1 (2.5, 6.5)	22 (26.8)	32.9 (21.1, 48.9)	1.9 (1.2, 2.8)
Alcohol	16 (30.8)	212.5 (125.8, 337.7)		14 (17.1)	71.1 (40.5, 116.4)	
Opioid	*			8 (9.8)	18.4 (8.5, 34.9)	

[a]General Homeless Cohort from Boston, MA, 2003-2008 used for comparison from Baggett, TP et al. *Mortality Among Homeless Adults in Boston: Shifts in Causes of Death Over a 15-Year Period.* JAMA 2013 Feb; 173 (3): 189-195
[b]Individuals were High-Risk if they criteria in Box 1
[c]No unknown Causes of Death
[d]SMR refers to Standardized Mortality Ratio and were calculated for deaths ≥5
[e]CI refers to Confidence Interval
[f]HR refers to High-Risk
[g]MA refers to Massachusetts
[h]NHP refers to Non-High-Risk
[i]Injuries, non-poisoning category contains Transportation Accidents codes V01-V99, Other External Causes of Accidental Injuries codes W00-X59 except for X40-X49 which represent accidental poisonings by noxious substances, and Events of Undetermined Intent codes Y20-Y34 except for codes Y10-Y19 which represent poisonings of undetermined intent. Methodology in collapsing ICD-10 categories based on similar methodology in Health of Boston 2014-2015 Report from the Boston Public Health Commission: http://www.bphc.org/healthdata/health-of-boston-report/Documents/HOB-2014-2015/FullReport_HOB_2014-2015.pdf
[*]Causes of death <5 were suppressed; these were: diseases of digestive system, Influenza and Pneumonia, Chronic Lower Respiratory Disease, Infection (Sepsis, Viral Hepatitis), Anoxic Brain Injury, Cerebrovascular Disease, Renal Failure, Central Nervous System Disease, Mental Disorder, Ill-Defined Conditions, Suicide, Homicide
[†]SMR not significant at p-value <0.05 level; all SMRs without symbol were significant at p-value <0.05

Conclusions

- Key findings:
  - Survival analysis showed that the HR group had lower probability of survival than NHR group
  - Cox Proportional Hazard Model showed the HR group had a 2 times greater rate of death compared to the NHR group
  - Compared to MA population, the HR group a 15 times higher rate of death and a 4 four higher rate of death than an adult homeless cohort
  - NHR had about half the rate of death of the HR group when compared to MA population and adult homeless cohort
- High-risk for mortality criteria did confer information about vulnerability but not necessarily about a need for housing
- Mortality rates for both HR and NHR groups were high compared to non-homeless and homeless populations, but all mortality rates for HR group about twice as high than NHR
- Causes of death for each group were common causes of death seen in general population such as cancer and heart disease but also seen were a disproportionate number of deaths directly attributable to substance use disorders
- Outcomes seen despite direct access to health insurance and health care service delivery from BHCHP's Street Team

Future Work

- Future work should address:
  - Contribution of chronicity of homelessness and/or living unsheltered to mortality and vulnerability
  - Which components of HR criteria contributed to the increased mortality for those who were characterized as HR
  - Better understanding of what the social determinants of health are for the unsheltered population to inform future policies and interventions to improve disparities
  - What is needed beyond direct access to health insurance and a comprehensive patient-centered medical and behavioral health service delivery model to reduce morbidity and mortality for the unsheltered population

References

*Baggett TP et al. Mortality among homeless adults in Boston: shifts in causes of death over a 15-year period. JAMA Intern Med. 2013;173(3):189-95. doi: 10.1001/jamainternmed.2013.1604. PubMed PMID: 23318302; PMCID: PMC3713619.