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Examining mortality among formerly homeless adults enrolled in Housing First: An observatio...

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1 **Examining mortality among formerly homeless adults**
2 **enrolled in Housing First: an observational study**

3

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19

20 **Abstract**

21 **Background**

22 Adults who experience prolonged homelessness have mortality rates 3 to 4 times that
23 of the general population. Housing First (HF) is an evidence-based practice that
24 effectively ends chronic homelessness, yet there has been virtually no research on
25 premature mortality among HF enrollees. In the United States, this gap in the
26 literature exists despite research that has suggested chronically homeless adults
27 constitute an aging cohort, with nearly half aged 50 years old or older.

28 **Methods**

29 This observational study examined mortality among formerly homeless adults in an
30 HF program. We examined death rates and causes of death among HF participants
31 and assessed the timing and predictors of death among HF participants following
32 entry into housing. We also compared mortality rates between HF participants and (a)
33 members of the general population and (b) individuals experiencing homelessness.
34 We supplemented these analyses with a comparison of the causes of death and
35 characteristics of decedents in the HF program with a sample of adults identified as
36 homeless in the same city at the time of death through a formal review process.

37 **Results**

38 The majority of decedents in both groups were between the ages of 45 and 64 at their
39 time of death; the average age at death for HF participants was 57, compared to 53 for
40 individuals in the homeless sample. Among those in the HF group, 72% died from
41 natural causes, compared to 49% from the homeless group. This included 21% of HF
42 participants and 7% from the homeless group who died from cancer. Among
43 homeless adults, 40% died from an accident, which was significantly more than the
44 14% of HF participants who died from an accident. HIV or other infectious diseases

45 contributed to 13% of homeless deaths compared to only 2% of HF participants.
46 Hypothermia contributed to 6% of homeless deaths, which was not a cause of death
47 for HF participants.

48 **Conclusions**

49 Results suggest HF participants face excess mortality in comparison to members of
50 the general population and that mortality rates among HF participants are higher than
51 among those reported among members of the general homeless population in prior
52 studies. However, findings also suggest that causes of death may differ between HF
53 participants and their homeless counterparts. Specifically, chronic diseases appear to
54 be more prominent causes of death among HF participants, indicating the potential
55 need for integrating medical support and end-of-life care in HF.

56 **Keywords:**

57 Homelessness, Housing First, Health Disparities, Vulnerability Index, Death,
58 Permanent Supportive Housing

59 **Background**

60 Adults who experience prolonged homelessness have mortality rates 3 to 4 times that
61 of the general population [1–3], and communities including New York City [4] and
62 Philadelphia [5] have enacted surveillance systems to monitor and address mortality
63 in this population. Injuries, substance abuse, heart disease, liver disease, and ill-
64 defined conditions have been reported as accounting for the vast majority of deaths
65 among individuals experiencing homelessness [1, 3]. Housing can protect against
66 exposure to weather, infections, drugs, and violence experienced while living on the
67 streets. There is some evidence that exiting homelessness to housing is associated
68 with reduced risk of mortality [6], but whether access to housing affects health

69 disparities, including mortality rates of individuals who have experienced long-term
70 homelessness in particular, is unclear [7].

71 Housing First (HF) is an evidence-based practice that addresses homelessness
72 by offering immediate access to housing while providing ongoing community-based
73 support services [8]. HF has been adopted in multiple countries including the United
74 States [9], Canada [10], Europe [11], and Australia [12], and effectively ends
75 homelessness for people who have experienced a lifetime of cumulative adversity
76 [13] and carry a significant disease burden based on multiple risk categories [14]. To
77 date, however, there has been no research on premature mortality among formerly
78 homeless adults who have enrolled in HF. In the United States, this gap in the
79 literature exists despite research that suggests chronically homeless adults constitute
80 an aging cohort; nearly half are aged 50 years old or older [15].

81 To begin to address this gap, the present study explored mortality among
82 formerly homeless adults who moved into housing as part of an HF program in
83 Philadelphia, PA. We examined death rates and causes of death among HF
84 participants. We then compared HF participant mortality to two groups: members of
85 the general population and the homeless population. We also compared the causes of
86 death and characteristics of decedents in the HF program to a sample of adults
87 identified as homeless at the time of death through formal review process in
88 Philadelphia.

89 **Methods**

90 We used administrative records from the HF program to identify a cohort of 292
91 formerly homeless individuals who moved into a housing unit between September
92 2008, when the HF program first began operations, and October 2013. Individuals
93 who had been admitted to the HF program but had not yet moved into housing were

94 excluded from the study cohort, because these individuals could still be considered
95 homeless. In 2014, HF medical and continuous quality improvement staff members
96 reviewed and documented the events that preceded the death of all participants who
97 died during the first 6 years of the program's operation (2008–2013) for purposes of
98 program improvement. These data were used to ascertain the date and cause of death
99 among HF participants. Members of the study cohort were followed prospectively
100 from the initial date of their move to a housing unit until either their date of death or
101 October 31, 2013; this observation period was measured in person-years.

102 We conducted analyses to examine mortality among HF participants from
103 several perspectives. First, we calculated all-cause and cause-specific mortality rates,
104 expressed as deaths per 100,000 person-years of observation, for the entire study
105 cohort. Second, we used survival analysis methods to assess the risk and predictors of
106 death following HF participants' move to housing. We estimated hazard functions and
107 Kaplan-Meier survival curves to conduct descriptive analyses of the timing and
108 occurrence of death following move to housing and fitted a Cox proportional hazards
109 regression model to assess the relationship between HF participants' demographic
110 characteristics (gender, race and age) and risk of death following move to housing.

111 Third, we calculated all-cause mortality rates among HF participants stratified
112 by age and sex. We did not further stratify these age- and gender-specific mortality
113 rates by cause due to sparse data. We used mortality rate ratios to compare the age-
114 and sex-specific all-cause mortality rates among HF participants to members of the
115 general population in Philadelphia between 2008 and 2013. To calculate these rate
116 ratios, we divided the all-cause mortality rate among members of the study cohort by
117 the corresponding rates in the general population. These values were adjusted for race
118 using direct standardization, with the Philadelphia general population serving as the

119 standard population. We calculated 95% confidence intervals for these rate ratios
120 using established methods [16]. We obtained mortality data for the Philadelphia
121 general population (2008–2013) from the CDC Wide-ranging Online Data for
122 Epidemiologic Research compressed mortality files regarding underlying cause of
123 death [17].

124 Fourth, we compared mortality rates in our sample of HF participants to
125 mortality rates of individuals experiencing homelessness as reported in prior studies.
126 To achieve this, we identified published studies that provided mortality rates or
127 information from which such rates could be calculated. We only included studies that
128 were conducted in North America. We identified 10 studies [3, 6, 18–25] that met
129 these criteria. We excluded three studies: one study [24] because it only reported data
130 on homeless youths younger than 25; a second [18] because it grouped individuals
131 living in emergency shelters with those living in rooming houses and hotels; and a
132 third [25] because it only reported information for individuals experiencing
133 homelessness as part of a family with children. Following a previously employed
134 approach for comparing mortality rates among homeless individuals across several
135 studies [20, 23], we obtained or calculated age-specific all-cause mortality rates for
136 each identified study using age groupings that were as similar as possible (younger,
137 middle-aged, older). We then calculated mortality rate ratios by comparing the age-
138 specific all-cause mortality rates observed among HF participants in the present study
139 with those obtained or calculated from the identified studies. We calculated 95%
140 confidence intervals for these rate ratios when possible using published data. These
141 rates and rate ratios were not adjusted for race.

142 Finally, we compared the causes of death and characteristics of decedents in
143 the HF program with information on individuals identified as homeless at their time

144 of death in Philadelphia using data from a report by the City of Philadelphia's
145 Homeless Death Review Team [5]. Homeless status in the report is determined using
146 the U.S. Department of Housing and Urban Development's definition of
147 homelessness, which considers individuals to be homeless if they are residing in an
148 emergency shelter or in a place not meant for human habitation (i.e., unsheltered or
149 "street" homelessness). Although the report included sheltered and unsheltered
150 decedents, it did not provide specific information about the living situation of
151 decedents at the time of their death. The report, which identified 90 individuals who
152 died while homeless during a 2-year period (2009 and 2010) that overlaps with the
153 follow-up period for the HF participant cohort, provided demographic characteristics
154 from the medical examiner's office that included age, gender, and race. The medical
155 examiner also classified the manner of death as homicide, suicide, accidental, natural,
156 or undetermined. A natural manner of death includes infectious diseases,
157 cardiovascular or other chronic conditions, and cancers. The specific primary cause of
158 death was also noted and included: specific disease (e.g., infectious, circulatory,
159 respiratory), drug intoxication or alcoholism, injury (e.g., blunt force, gunshot
160 wound), cancer, hyper- or hypothermia, HIV, or other. To facilitate comparisons, the
161 demographic information and manner and cause of death among HF decedents were
162 reclassified using categories reported in the City of Philadelphia's report. The report
163 did not include information about the size of the overall homeless population in
164 Philadelphia during 2009 and 2010, nor are we aware of another publicly available
165 source that provides such information. As such, it was not possible to calculate
166 mortality rates for the Philadelphia homeless population using data from the report;
167 consequently, comparisons between the HF and homeless group were conducted
168 using chi-square and Fisher's exact tests. The small number of deaths that occurred

169 among HF participants during the same time frame as the City of Philadelphia's
170 report (i.e., 2009 and 2010) precluded a comparison of deaths between the same
171 groups during the same time period. Instead, we opted to compare HF deaths
172 observed during the entire study period (i.e., 2008–2013) with those identified in the
173 report. Study protocols were found to be exempt by the HF program's institutional
174 review board.

175 **Results**

176 Table 1 presents the characteristics of the 292 individuals in the overall HF participant
177 cohort and decedents. The mean age at move to housing was 51.3, and roughly 80%
178 of the study cohort was between the ages of 45 and 74 at move to housing. The study
179 cohort was predominantly male (70%) and African American (68%). The median
180 duration of follow-up was 3.2 years, resulting in 1,045 person-years of observation.
181 Forty-one deaths occurred during the study period, with a mean age at death of 57.2
182 years. The majority of decedents were male (78%) and African American (59%).

183 As shown in Table 2, the crude mortality rate for the study cohort was 3,916.1
184 deaths per 100,000 person-years. Disease of the circulatory system was the leading
185 cause of death, accounting for 29.3% of deaths in the study cohort. Cancer accounted
186 for 22% of deaths, whereas drugs or alcohol caused approximately 10% of deaths.
187 Kidney and respiratory disease caused about 5% of deaths each, with diabetes, HIV,
188 injury, and liver disease each accounting for about 2% of deaths.

189 Figure 1 presents the estimated hazard function for death following HF
190 participants' move to housing. The hazard for death was highest in the period directly
191 following participants' move to housing and then declined steeply and steadily
192 thereafter. Among decedents, the median time to death following move to housing
193 was 1.3 years, and 25% of deaths occurred within the first 6 months following entry

194 into housing. Kaplan-Meier 1-, 3-, and 5-year survival rates among all members of the
195 HF participant cohort were 94.5% (95% CI 91.9%-97.2%), 88.3% (95% CI 84.6%-
196 92.3%), and 82.9% (95% CI 77.9%-88.2%), respectively. Only age was a significant
197 predictor in the Cox regression model, with those in the 65–74 age bracket having
198 almost a five-fold increase (HR 4.8, 95% CI 1.2-18.1) in the risk of death following
199 their initial move to housing.

200 Table 3 presents age, gender, and overall all-cause mortality rates and rate
201 ratios (RRs) comparing mortality rates in the HF participant cohort with those of the
202 general population of Philadelphia. The all-cause mortality rate among male HF
203 participants in the 45–64 age bracket was 4.7 times higher than in the general
204 population (RR 4.7, 95% CI 2.1-10.8). Estimates of the risk ratios for all other age
205 and gender subgroups exceeded 1, but none of these differences was statistically
206 significant. However, the all-cause mortality rates were higher for male HF
207 participants (RR 4.4, 95% CI 1.7-11.7) and all HF participants (RR 4.6, 95% CI 1.6-
208 13.2) relative to the Philadelphia general population.

209 Additional file 1 presents the results of comparisons of mortality rates
210 observed among HF participants in the current study and the corresponding mortality
211 rates for members of the homeless population in several North American cities
212 reported in previously published studies. Point estimates of the mortality risk ratios
213 show that mortality rates among HF participants in the present study were generally
214 higher than those documented in prior studies for homeless individuals in similar age
215 brackets. For most age and gender subgroups, these risk ratios suggest that mortality
216 rates among HF participants in the present study were between 1.2 and 3 times higher
217 than those among their homeless counterparts. However, in cases in which it was
218 possible to conduct tests of statistical significance, the only significant difference in

219 mortality rates was found in a comparison of middle-aged male HF participants, who
220 had a increased risk of mortality (RR 2.2, 95% CI 1.5-3.2) relative to homeless men in
221 the same age bracket from a study using data from New York City [6].

222 Table 4 presents the comparison between the 41 HF participants who died
223 during the first 6 years of the program's operation and the homeless decedents
224 identified by the City of Philadelphia's Homeless Death Review Team during an
225 overlapping 2-year time period. The majority of decedents in both the HF and
226 homeless groups were between the ages of 45 and 64 at their time of death, although
227 there were proportionally more decedents younger than 45 in the homeless group.
228 Among those in the HF group, 78% died from natural causes, compared to 49% in the
229 homeless group. This included 22% of HF participants as opposed to 7% in the
230 homeless group who died from cancer. Among homeless adults, 40% died from an
231 accident, which was significantly more than the 12% of HF participants who died
232 from an accident. An infectious disease other than HIV caused more than 1 in 10
233 homeless deaths and hypothermia caused an additional 6% of deaths; neither of these
234 factors contributed to the death of HF participants.

235 **Discussion**

236 This study is the first to our knowledge to examine mortality among formerly
237 homeless participants in an HF program. Overall, the results from this study are
238 consistent with prior research on early mortality among populations that have
239 experienced long-term homelessness [1, 22, 20] and suggest that adverse health
240 outcomes associated with homelessness persist even after individuals obtain housing.
241 Importantly, we found that risk of death among HF participants residing in housing
242 was highest during the period immediately following their initial entry into housing.
243 On one hand, this may reflect particularly heightened vulnerability and poor health in

244 a certain segment of individuals who die shortly after entering housing. On the other
245 hand, this finding may indicate that the period of transition into housing is one of
246 elevated risk, during which it is of great importance to help individuals access needed
247 health care and other services that may help prevent potentially avoidable deaths.

248 Comparisons of mortality rates among members of the HF study cohort with
249 previously reported mortality rates in the homeless population in several North
250 American cities also provide some evidence that formerly homeless HF participants
251 have excess mortality in comparison to the more general homeless population. This
252 finding is not entirely unexpected because individuals experiencing chronic
253 homelessness, who have been shown to have more complex health and behavioral
254 health problems than their homeless peers who are not chronically homeless [26], are
255 the target population for HF programs. Put differently, HF program participants are
256 typically members of the homeless population who have the highest risk of mortality.
257 Future studies should contrast the mortality rates of HF participants with members of
258 the homeless population who experience chronic homelessness. This would provide a
259 better sense of the impact of HF on housing mortality, but such a comparison was not
260 possible with available data. Thus, a more rigorous assessment of the impact of HF on
261 mortality is an important goal for future research.

262 Findings from this study with respect to the causes of death among HF
263 participants are also noteworthy. Circulatory system disease was the leading cause of
264 death among members of the HF study cohort, accounting for almost 30% of deaths,
265 followed by cancer, which accounted for 22% of deaths in the study cohort. These
266 two causes combined with kidney disease, respiratory disease, diabetes, HIV, and
267 liver disease to account for 78% of deaths in the HF study cohort. In contrast, drug-
268 and alcohol-related causes and injury accounted for only 12% of deaths. As a point of

269 comparison, a recent study found drug overdose to be the leading cause of death
270 among homeless adults in Boston [21], accounting for 17% of deaths, with cancer and
271 heart disease each accounting for about 16% of deaths. Furthermore, the comparison
272 of HF decedents with those identified by the Philadelphia Homeless Death Review
273 Team shows that drug, alcohol, injury, and accident were more prominent causes of
274 death in the latter group. Similarly, comparisons of the manner of death indicate that a
275 much greater proportion of deaths among homeless decedents in Philadelphia were
276 due to accident or homicide relative to members in the HF cohort. Taken together,
277 these findings suggest that HF participants and their currently homeless counterparts
278 may face different mortality-related risks.

279 Elevated rates of accidental deaths, homicide, and deaths from infectious
280 diseases in the homeless group may reflect the fact that homelessness increases
281 exposure to risks and unmet service needs, which supports the notion that HF may
282 serve as a protective factor against some causes of death. Nonetheless, HF participants
283 were more likely to die of natural causes, potentially reflecting underlying differences
284 in the disease burden of these two groups, which could be explained by a growing
285 practice in the United States known as *vulnerability indexing* wherein homeless
286 individuals identified as having medical conditions placing them at the highest risk of
287 death receive priority for placement in permanent housing programs [27]. This
288 practice, which was implemented in Philadelphia starting in 2011, suggests that HF
289 participants are more vulnerable to death than those who remain on the streets, in
290 which case any evidence supporting the notion that HF serves as a protective factor is
291 understated.

292 The high number of deaths in the HF group resulting from chronic diseases
293 also suggests that HF providers may need to reorient their supportive service delivery

294 models, which have traditionally focused on housing stability and behavioral health
295 interventions, to increasingly focus on chronic disease management and end-of-life
296 care [28, 29]. This may entail additional staff training on integrated care models [30,
297 31] to address client needs. Growing interest in the use of newly available Medicaid
298 funds via the Affordable Care Act to offer supportive services in permanent
299 supportive housing programs could present an important opportunity for HF programs
300 to develop new service models [32]. It may also be important to provide increased
301 support to help staff members handle the emotional impact of client deaths at a time
302 when HF may have provided renewed hopes of recovery from chronic homelessness.
303 Interventions designed for health care professionals who encounter patient deaths may
304 be useful models [33].

305 This is the first study to consider premature mortality among formerly
306 homeless adults who have enrolled in Housing First, an approach that has been
307 adopted as the official policy of the United States to address chronic homelessness [9]
308 and is being implemented in multiple countries [10–12]. The use of death reviews
309 conducted by medical professionals for both homeless adults and HF participants in
310 the same city during the same time period is a strength of the study. The small sample
311 size of the HF participant cohort represents a limitation of the study, particularly
312 regarding comparisons of mortality rates among HF participants with those among
313 members of the general population. Lack of more detailed information about the
314 health conditions of HF participants at enrollment and other characteristics that may
315 be related to mortality risk is also a serious limitation in the present study.
316 Interpretation of the results of the comparison between HF decedents and those
317 identified in Philadelphia Homeless Death Review study warrants caution for several
318 reasons. First, because only three deaths occurred among HF participants during the

319 time period covered in the Philadelphia Homeless Death Review report, it was
320 necessary to compare HF decedents identified during a 6-year period with homeless
321 decedents identified during a 2-year period. Moreover, because data on the size and
322 characteristics of the overall Philadelphia homeless population during the time period
323 were not covered by the report, it was not possible to calculate mortality rates in the
324 homeless population during this time period and compare them to those observed
325 among HF participants. Finally, the absence of information about whether homeless
326 decedents identified in the death review report were eligible for or offered HF
327 services represents a clear limitation.

328 **Conclusions**

329 HF may decrease mortality rates for adults who have experienced chronic
330 homelessness by reducing exposure to risks while homeless that contribute to higher
331 rates of deaths caused by accidents, homicide, and infectious diseases. This idea is
332 further supported when considering that individuals who are most medically
333 vulnerable are often prioritized for HF, which may also account for higher rates of HF
334 participant deaths due to natural causes. Integrating medical support and end-of-life
335 care in HF support services is needed, as is support for staff members who are
336 working to promote recovery among highly vulnerable individuals.

337 **Competing interests**

338 The authors declare that they have no competing interests.

339

340 **Authors' contributions**

341 BFH originally drafted the article with input from TB, who conducted the analysis.
342 BS collected data on Housing First enrollee deaths and provided feedback on the
343 article. All authors approved the final article.

344

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348

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445 Figures

446 **Figure 1 – Hazard function for death following move to housing among**
 447 **Housing First participants**

448

449 Tables

450 **Table 1 – Characteristics of all Housing First participants in study cohort (N =**
 451 **292) and decedents (N = 41)**

	Overall	Decedents
	<i>n</i> (%)	<i>n</i> (%)
Gender		
Female	84 (28.8)	9 (22.0)
Male	207 (70.9)	32 (78.0)
Unknown	1 (0.3)	0 (0.0)
Age ^a		
19–44	58 (19.9)	4 (9.8)
45–64	213 (72.9)	32 (78.0)
65–74	21 (7.2)	5 (12.2)
Race		
Black	197 (67.5)	24 (58.5)
White	78 (26.7)	17 (41.5)
Other	17 (5.8)	0 (0.0)

452 ^aFigures in this row reflect *M* (range) at time of move to housing for the overall
 453 sample and at time of death for decedents.

454 **Table 2 – Cause of death among Housing First decedents and crude mortality**
 455 **rates**

Cause of death	Number of deaths	% of deaths	Crude mortality rate per 100,000 person years
All causes	41	100.0	3,916.1
Circulatory system disease	12	29.3	1,146.2
Cancer	9	22.0	859.6
Other	8	19.5	764.1
Drugs or alcohol	4	9.8	382.1
Kidney disease	2	4.9	191.0
Respiratory disease	2	4.9	191.0
Diabetes	1	2.4	95.5
HIV	1	2.4	95.5

Injury	1	2.4	95.5
Liver disease	1	2.4	95.5

456

457 **Table 3 – Mortality rates and rate ratios comparing Housing First participants**
 458 **and the general population in Philadelphia**

	Deaths	Person-Years of Observation	CR ^a	Race-Adjusted RR ^b	95% CI
Men					
25–44	2	114	1,754.4	8.1	0.2, 334.7
45–64	26	554	4,693.1	4.7	2.1, 10.8
65–74	4	56	7,142.9	2.3	0.6, 9.2
All men ^c	32	725	4,413.8	4.4	1.7, 11.7
Women					
25–44	1	76	1,315.8	23.1	0, 10,988.9
45–64	5	195	2,564.1	2.8	0.7, 11.2
65–74	3	49	6,122.4	2.1	0.5, 9.8
All women ^c	9	320	2,812.5	4.8	0.6, 39.1
Total ^c	41	1045	3,923.4	4.6	1.6, 13.2

459 Abbreviations: CR, crude rate; CI, confidence interval; RR, rate ratio

460 ^aDeaths per 100,000 person-years of observation

461 ^bMortality rate ratios calculated by dividing the race-adjusted mortality rates for the
 462 Housing First participant cohort by corresponding mortality rates in the Philadelphia
 463 general population. Race-adjusted mortality rates were calculated using direct
 464 standardization with the Philadelphia general population during the study period
 465 (2003–2013) used as the standard population

466 ^cMortality rate ratios also adjusted for age using direct standardization with the
 467 Philadelphia general population during the study period used as the standard
 468 population

469 **Table 4 – Comparison between decedents in a Housing First program in**
 470 **Philadelphia (2008–2013) and individuals identified as homeless at time of**
 471 **death in Philadelphia (2009–2010)**

	Housing First <i>n</i> (%)	Homeless <i>n</i> (%)	<i>p</i>
Gender			.630
Male	32 (78.0)	75 (83.3)	
Female	9 (22.0)	15 (16.7)	
Age			.088

< 25	0 (0.0)	3 (3.3)	
25–34	1 (2.4)	5 (5.6)	
35–44	2 (4.9)	9 (10.0)	
45–54	10 (24.4)	34 (37.8)	
55–64	21 (51.2)	22 (24.4)	
65–74	7 (17.1)	14 (15.6)	
75+	0 (0.0)	3 (3.3)	
Manner of death			< .001
Accident	5 (12.2)	36 (40.0)	
Homicide	1 (2.4)	8 (8.9)	
Suicide	0 (0.0)	2 (2.2)	
Natural	32 (78.0)	44 (48.9)	
Other or unknown	3 (7.3)	0 (0.0)	
Cause of death			< .001
Drug or alcohol	4 (9.8)	23 (25.6)	
Circulatory system disease	12 (29.3)	21 (23.3)	
Injury	1 (2.4)	13 (14.4)	
HIV and infectious disease	1 (2.4)	12 (13.3)	
Cancer	9 (22.0)	6 (6.7)	
Hypothermia	0 (0.0)	5 (5.6)	
Respiratory disease	2 (4.9)	3 (3.3)	
Fire	0 (0.0)	3 (3.3)	
Diabetes	1 (2.4)	0 (0.0)	
Other	11 (26.8)	4 (4.4)	

472

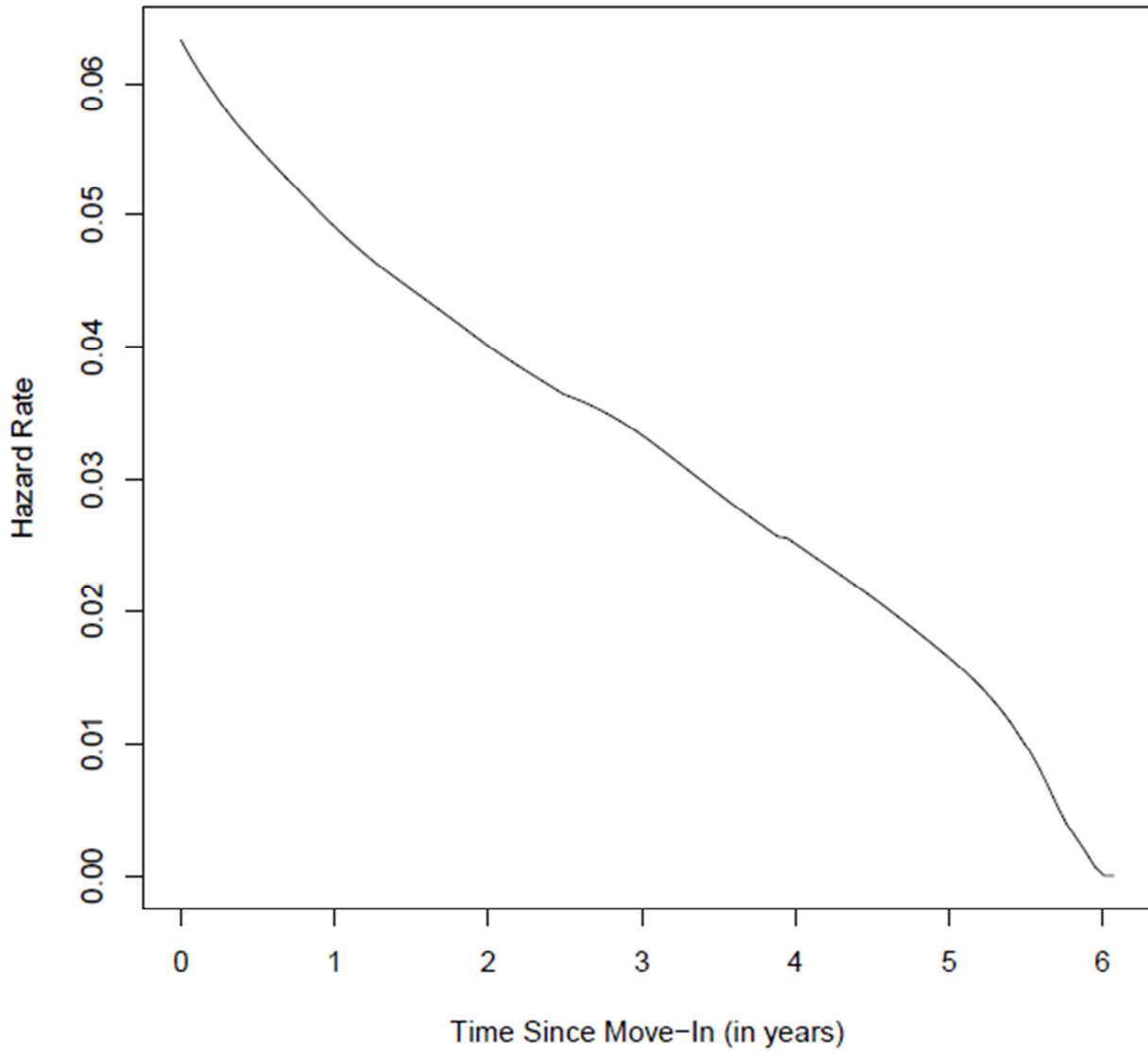
473 **Additional files**

474 **Additional file 1 – Mortality rates and rate ratios comparing Housing First**
475 **participants in study cohort and individuals experiencing homelessness**

476

477 This additional table is attached separately in Microsoft Word format and is titled
478 “Additional file 1.doc.”

1 Figure 1 - Hazard function for death following move-in to housing among HF participants



2

Additional files provided with this submission:

Additional file 1: Additional file 1.docx, 25K

<http://www.biomedcentral.com/imedia/2914248190054991/supp1.docx>

Additional file 2: STROBE_checklist_case-control_10.28.15.doc, 80K

<http://www.biomedcentral.com/imedia/1899923785193598/supp2.doc>