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Sex Differences in Healthcare Utilization and Costs among Individuals with Elevated Blood Pressure: The LARK Study from Western Kenya

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Research article

Keywords: hypertension, sex differences, healthcare utilization, healthcare costs

Posted Date: November 18th, 2020

DOI: https://doi.org/10.21203/rs.3.rs-108685/v1

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Abstract

Background: Elevated blood pressure is the leading risk factor for global mortality. While it is known that there exist differences between men and women with respect to socioeconomic status, self-reported health, and healthcare utilization, there are few published studies from Africa. This study therefore aims to characterize differences in healthcare utilization and costs between men and women with elevated blood pressure in Kenya.

Methods: Data from 1447 participants enrolled in the LARK Hypertension study in western Kenya were analyzed. Latent class analysis based on nine dependent variables was performed to describe patterns of healthcare utilization and costs in the study population. Regression analysis was then performed to describe the relationship between different demographics and each outcome.

Results: Women in our study had higher rates of unemployment (28% vs 12%), were more likely to report lower monthly earnings (72% vs 51%), and had more outpatient visits (39% vs 28%) and pharmacy prescriptions (42% vs 30%). Three patterns of healthcare utilization were described: (1) individuals with low healthcare utilization, (2) individuals who utilized care but paid low out-of-pocket costs, and (3) individuals who utilized care but had higher out-of-pocket costs. Women and those with health insurance were more likely to be in the high-cost utilizer group. Women were also more likely to report lower quality-of-life and functional health status, including pain, mobility, self-care, and ability to perform usual activities.

Conclusions: Men and women with elevated blood pressure in Kenya have different health care utilization behaviors, cost and economic burdens, and health outcomes. Awareness of these sex differences can help inform targeted interventions in these populations.

Trial registration: ClinicalTrials.gov Identifier: NCT01844596, Date of registration: May 1, 2013.
https://clinicaltrials.gov/ct2/show/NCT01844596

Background

Elevated blood pressure is the leading global risk factor for mortality and the most common cardiovascular condition in the world.(1) Despite 80% of all cardiovascular-related deaths occurring in low- and middle-income countries, health care utilization in these populations remains low.(2, 3) Healthcare utilization is influenced by three groups of factors: “predisposing factors” which include age, sex, educational level, marital status, and trust level in healthcare influence; “enabling/inhibiting factors” such as medical insurance, wealth, and availability of medical care; and need for care.(4)

Emerging literature has supported sex differences in relation to many of these individual characteristics. For instance, the 2007–2016 NHANES survey of US civilian populations found higher awareness, treatment, and blood pressure control rates in women age less than 65 years with hypertension of all races,(5) despite general lower rates of employment and lower income compared to men of the same status.(6, 7) However, the differences in health care utilization between men and women with elevated blood pressure has not been characterized in African populations.

We therefore sought to describe the patterns and costs of health care utilization of men and women with elevated blood pressure in western Kenya along with characteristics that may affect these patterns. The LARK Hypertension study is a cluster randomized controlled trial that demonstrated that community health workers, equipped with behavioral communication strategies and smartphone decision-support tools, can increase linkage to hypertension care and yield modestly improved but not statistically significant blood pressure reduction among individuals with hypertension in rural Western Kenya.(8) We present here an analysis of baseline data from the trial, focusing on sex differences in self-reported patterns of health care utilization and costs in this population.

Methods

Study Setting and Participants

The LARK study was conducted within the infrastructure of the Academic Model Providing Access to Healthcare Partnership (AMPATH) in Kenya.(9, 10) It was conducted within two administrative divisions in rural western Kenya: Kosirai and Turbo. From April 2014 to December 2016, adult individuals who met the study inclusion criterion of elevated blood pressure (defined as systolic blood pressure (SBP) ≥ 140 mg/dL or diastolic blood pressure (DBP) ≥ 90 mg/dL) were invited and consented into the LARK study. Overall, the LARK study enrolled 1460 participants. Full data for the present analysis were available for 1447 participants. Detailed study procedures have previously been fully reported.(9)

Survey

The baseline questionnaire of the LARK study collected data about employment status, field of employment, and reason for unemployment when relevant (8). Monthly income was asked in 5,000 to 10,000 Kenyan shilling (KS) increments (roughly equivalent to $50 - $100 increments). Participants were asked whether they had health insurance, including the Kenyan National Health Insurance Fund (NHIF), and whether they had been told within the past 12 months that they had high blood pressure. Rates of health care utilization were determined by questions on numbers of admissions to a hospital (in-patient) over the past 12 months, and number of visits to an outpatient medical provider, herbalist, or spiritual provider over the past 3 months. Participants with any of the previous visits were asked for their out of pocket costs for the visit. Additionally, participants were asked about medications they were prescribed and associated cost. To approximate quality-of-life status, participants were asked about mobility, self-care, ability to perform usual activities, pain, and anxiety/depression. Participants were also asked to score their health status on a scale of 0-100, with 0 being “the worst health you can imagine” and 100 being “the best health you can imagine”.(11) All items in the questionnaire were ascertained by self-report. Sex (“male” or “female”) of each participant was recorded by the clinician in the clinical encounter form.

Data Analysis

Demographic, socioeconomic and health status variables and self-reported measures healthcare utilization over the past 3 or 12 months were summarized overall and separately for men and women. Categorical measures were expressed using counts, and percentages and continuous measures using median and interquartile range (IQR). Data were analyzed using R version 3.6.1.(12)

Health Utilization and Costs

Latent class regression analysis (LCA) was used to describe patterns of healthcare utilization and costs in our population.(13) A latent class distribution was assumed to describe the joint distribution of nine manifest (dependent) variables, each of which was binary: (1) whether they had been told they had high blood pressure in past 12 months (with the 27 observations with missing values omitted), (2) any hospital admission in the past 12 months, (3) any outpatient visit in the past 3 months, (4) any visit to a herbal medicine or spiritual healer in the past 3 months, (5) filled 1 or more prescription medications in the past 3 months, (6) total inpatient costs above 5,000 KS (~ 50 USD) in the past 12 months, (7) total outpatient costs above 200 KS (~ 2 USD) in the past 3 months, (8) total prescription costs above 200 KS (~ 2 USD) in past 3 months, and (9) total herbalist or spiritual healer costs above 200 KS (~ 2 USD) in past 3 months. Cut-offs for cost variables were based on the data including median cost values and burden based on income.

The patterns of health utilization and costs for each latent class were described and an informative label was assigned to each class, anticipating finding LCA groups pertaining to low, medium, and high health care use and costs. The probability of belonging in each latent class was captured for each participant. For descriptive summaries, participants were assigned to the class with the highest probability. As a sensitivity analysis and acknowledging low variability in the inpatient cost manifest variable, a second LCA model was constructed removing this manifest variable.

The latent class regression analysis allowed the dependent manifest variables to be modeled as a function of covariates. We allowed latent class membership probability to be dependent on sex, age group (< 50, 50–64, >=65), health insurance status, employment and income status as a 3-level variable (no job, monthly earnings < 5,000KS, and earnings > = 5,000KS), and community unit.(14) Observations with missing data (n = 108 (7.5%)) were omitted from this analysis. Using the largest latent class as the reference, we generated relative risk ratios of latent class membership for the other classes by sex, age, insurance, and employment/income status. LCA models were fit using the poLCA R package.(14) The Akaike information criterion (AIC) was used for model selection.(12)

Utilization and Self-Reported Health

Self-reported health outcomes were summarized by latent class assignment. To examine our primary hypothesis that there were sex differences in health status, utilization and costs, we regressed the self-reported health measures on latent class membership probability and gender, adjusting for demographics. Specifically, for each of the 6 health outcome measures (5 binomial and 1 continuous), a mixed effects regression model with a random effect for community unit was used to examine the relationship between each health outcome as the dependent variable and the probability of latent class membership (using the largest group as the reference) and sex. All models included covariates for age group, health insurance status, and employment and income status. For the continuous health score, the effects measured the difference in health status. For the binomial symptom measures (pain, anxiety and depression, mobility, self-care, and ability to complete usual activities) we used logistic mixed effects models and compared having any symptoms to no symptoms using the odds ratio (OR).

Results

Demographics and self-rated health

Of the 1447 participants, 58% were women. Women were more likely to be unemployed (Table 1*).* Of those not working, 40% of women and 63% of men indicated they were retired or too old. Excluding this, the top reason for not working reported by women was that they were caring for family, whereas for men, the next most cited reason was inability to find work. Among those with formal employment, women were more likely to report earning less than 5000 KS (~ 50 USD) per month. A large proportion of the study population was not enrolled in health insurance of any type, with only 13% of women and 17% of men indicating enrollment in Kenyan NHIF. Women reported worse self-reported quality-of-life status than men, with more women reporting issues with mobility, ability to perform usual activities, pain, anxiety and depression, and lower overall median health score compared to men.

Table 1
Summary of Participant Demographic Characteristics and Self-Rated Health by Sex.

Category		Total N = 1447	Female N = 838	Male N = 609
Age (years)		55.0 (42.0, 66.0)	54.0 (42.0, 65.0)	56.0 (40.0, 67.0)
Employment				
	No Job	304 (21)	231 (28)	73 (12)
	Farmer	728 (50)	431 (51)	297 (49)
	Business Person	185 (13)	104 (12)	81 (13)
	Public Sector Employee	54 (4)	17 (2)	37 (6)
	Student	4 (0)	3 (0)	1 (0)
	Other	150 (10)	43 (5)	107 (18)
	Missing	22 (2)	9 (1)	13 (2)
Reason for Not Working				
	Retired or too old	138 (45)	92 (40)	46 (63)
	Caring for Family	68 (22)	65 (28)	3 (4)
	Could not find or get work	41 (13)	31 (13)	10 (14)
	Illness or Disability	38 (12)	32 (14)	6 (8)
	In School	6 (2)	1 (0)	5 (7)
	Temporary Gap in Employment	5 (2)	4 (2)	1 (1)
	Other	8 (3)	6 (3)	2 (3)
Monthly Earnings Among Working (KS)				
	< 5000	712 (62)	438 (72)	274 (51)
	≥ 5000 & <10,000	198 (17)	78 (13)	120 (22)
	≥ 10,000 & <20,000	78 (7)	23 (4)	55 (10)
	≥ 20,000 & <30,000	36 (3)	13 (2)	23 (4)
	≥ 30,000	28 (2)	8 (1)	20 (4)
	Missing	91 (8)	47 (8)	44 (8)
Have NHIF				
	Yes	213 (15)	110 (13)	103 (17)
	No	1205 (83)	712 (85)	493 (81)
	Missing	29 (2)	16 (2)	13 (2)
How would you describe your pain?				
	No pain	721 (50)	349 (42)	372 (61)

All monetary values in are Kenyan Shillings. Continuous variables are presented as "median (IQR)" and categorical variables as N (%). Percentages are by column.

Category		Total N = 1447	Female N = 838	Male N = 609
	Moderate pain	677 (47)	459 (55)	218 (36)
	Extreme pain	28 (2)	22 (3)	6 (1)
	Missing	21 (1)	8 (1)	13 (2)
How would you describe your anxiety or depression?				
	Not anxious	635 (44)	318 (38)	317 (52)
	Moderately anxious	671 (46)	428 (51)	243 (40)
	Extremely anxious or depressed	120 (8)	84 (10)	36 (6)
	Missing	21 (1)	8 (1)	13 (2)
How would you describe your mobility?				
	No problems in walking	972 (67)	517 (62)	455 (75)
	Some problems in walking	448 (31)	308 (37)	140 (23)
	Confined to bed	3 (0)	2 (0)	1 (0)
	Missing	24 (2)	11 (1)	13 (2)
How would you describe your self-care?				
	No problems with self-care	1321 (91)	759 (91)	562 (92)
	Some problems washing or dressing	98 (7)	66 (8)	32 (5)
	Unable to wash or dress myself	6 (0)	4 (0)	2 (0)
	Missing	22 (2)	9 (1)	13 (2)
How would you describe your usual activities?				
	No problems with usual activity	1148 (79)	632 (75)	516 (85)
	Some problems performing usual activity	257 (18)	185 (22)	72 (12)
	Unable to perform usual activity	18 (1)	11 (1)	7 (1)
	Missing	24 (2)	10 (1)	14 (2)
How is your health today, 0-100?				
		70.0 (60.0, 80.0)	70.0 (60.0, 80.0)	75.0 (65.0, 82.5)
	Missing	22	8	14

All monetary values in are Kenyan Shillings. Continuous variables are presented as "median (IQR)" and categorical variables as N (%). Percentages are by column.

Healthcare utilization and associated costs

Women reported higher rates of having been told about their elevated blood pressure within the past 12 months, attendance at an outpatient medical visit, and taking prescription medication *(*Table 2*).* Women and men had similar low rates of hospital admissions over the previous 12 months, with less than one percent of the participants having multiple admissions. Men and women also had similar rates of visits to herbalists or spiritual leaders, with almost one-fifth of participants seeking these alternative care sources. A higher proportion of women had no costs for their outpatient visits, though a lower proportion of women paid ≤ 200 KS for their outpatient visit compared to men. Similarly, a higher proportion of women paid no cost for herbalist visits, but a lower proportion of women paid ≤ 200 KS for their herbalist visit.

Table 2
Healthcare utilization and cost by sex.

Category	Value	Total N = 1447	Female N = 838	Male N = 609
Told have high BP in past 12 months?				
	Yes	585 (40)	380 (45)	205 (34)
	No	835 (58)	445 (53)	390 (64)
	Missing	27 (2)	13 (2)	14 (2)
One or more hospitalization				
	Yes	56 (4)	36 (4)	20 (3)
	No	1391 (96)	802 (96)	589 (97)
Inpatient Cost				
	No Cost for Visit	20 (36)	13 (36)	7 (35)
	≤ 5,000 KS	21 (38)	13 (36)	8 (40)
	> 5,000 KS	15 (27)	10 (28)	5 (25)
Any Outpatient Visit past 12 months				
	Yes	499 (34)	327 (39)	172 (28)
	No	948 (66)	511 (61)	437 (72)
Outpatient Cost				
	No Cost for Visit	154 (31)	110 (34)	44 (26)
	≤ 200 KS	122 (24)	67 (20)	55 (32)
	> 200 KS	223 (45)	150 (46)	73 (42)
Ever go to Herbalist				
	Yes	271 (19)	166 (20)	105 (17)
	No	1176 (81)	672 (80)	504 (83)
Herbal Cost				
	No Cost for Visit	136 (50)	90 (54)	46 (44)
	≤ 200 KS	69 (25)	33 (20)	36 (34)
	> 200 KS	66 (4)	43 (26)	23 (22)
Any Prescription				
	Yes	538 (37)	354 (42)	184 (30)
	No	909 (63)	484 (58)	425 (70)
Prescription Cost				
	No Cost for Prescription	191 (36)	134 (38)	57 (31)
	≤ 200 KS	65 (12)	42 (12)	23 (13)
	> 200 KS	282 (52)	178 (50)	104 (57)

Costs are presented in Kenyan Shillings (KS) and presented only for individuals that reported utilizing that health resource. Continuous variables are presented as "median (IQR)" and categorical variables as N (%). Percentages are by column.

Classes of healthcare utilization and costs

LCA showed an AIC with a three-class model (*Supplemental Table 1)*. When sensitivity analysis was performed that omitted inpatient costs, an almost identical 3-class model was produced, with concordant utilization, class breakdown, and class membership; only one participant's predicted class changed. Details of the three classes used in the original LCA are shown in Table 3 and Supplemental Table 2.

Table 3
Estimated distribution of manifest (dependent) variables by latent class.

	Utilization					Cost			
	Told High BP	Had an Inpatient Visit	Had an Outpatient Visit	Had an Herbalist or spiritual counselor Visit	Had a prescription	Inpatient cost > 5000Ks	Outpatient cost > 200Ks	Prescription cost > 200Ks	Herbalist or spiritual counselor cost > 200Ks
High-cost Utilizers	59.9	6.1	100	20.3	95.3	2.4	100	76.4	5.7
Low-cost utilizers	50.7	8.7	78.8	16.5	98.3	1.2	0	22.2	4.1
Non-Utilizers	32.4	1.9	1.7	19.3	0	0.6	0	0	4.4

All values are percentage of latent class. Red cells show a high percentage of individuals (gradient from > 10–100%). Blue cells show a low percentage of individuals (gradient from 0–10%).

The largest class, "non-utilizers", comprised of 61% of the population and had little to no health utilization outside of herbalist and spiritual healers *(*Table 3*).* The next largest class, characterized as "low-cost utilizers", comprised of 23% of the population and showed engagement with the medical system through outpatient visits and prescriptions with low cost of care (no outpatient bills > 200 KS (~ 2 USD)). The smallest class, "high-cost utilizers", comprised of 16% of the population and showed engagement with the medical system with high cost of care (with outpatient bills > 200 KS (~ 2 USD)).

Non-utilizers had the largest proportion of men (47%) and high cost-utilizers had the largest proportion of women (67%) (*Supplemental Table 2).* High-cost utilizers were disproportionately younger, with 45% of the group less than the age of 50 years. Income distribution was similar across the three classes. Interestingly, high-cost utilizers had the highest rate of enrollment national insurance at 20%.

Relative risk calculations showed sex and insurance had the strongest effect on membership in a healthcare utilization class: Women had 1.77 (95% CI: 1.21 to 2.58) times the odds of being in the high-cost utilizer class versus the non-utilization class compared to men, and 1.51 (95% CI: 1.10 to 2.08) times the odds of being in the low-cost utilizer class. Having national insurance was significantly associated with membership in the high-cost utilizer class with an odds ratio of 2.07 (95% CI: 1.31 to 3.26) (Fig. 1, *Supplemental Table 3*).

Self-reported quality-of-life

The high-cost utilizer class had the highest proportion of participants reporting difficulty with mobility, performing usual activities, and pain. The high-cost and low-cost utilizer classes also reported the lower overall health score compared to the non-utilizer class *(*Table 4*).* Overall, being in the low-cost utilizer class was associated with worse self-reported health (difference: -4.83) and more problems with mobility (OR 1.60), self-care (OR 1.78), and usual activities (OR 1.77) than membership in the non-utilizer class. *(Table 6)* Similarly, membership in the high-cost utilizer class was associated with a worse self-reported health (difference: -3.40) and more problems with pain (OR 1.70), mobility (OR 2.15), self-care (OR 2.21), and usual activities (OR 2.84).

Table 4
Description of health outcomes stratified by the 3 latent classes.

Category	Value	Total N = 1339	Non-utilizers N = 821	Low-cost utilizers N = 306	High-cost utilizers N = 212
How would you describe your mobility?					
	No problems in walking	909 (68)	601 (73)	189 (62)	119 (56)
	Some problems in walking	424 (32)	217 (26)	116 (38)	91 (43)
	Confined to bed	3 (0)	0 (0)	1 (0)	2 (1)
	Missing	3 (0)	3 (0)	0 (0)	0 (0)
How would you describe your self-care?					
	No problems with self-care	1236 (92)	772 (94)	275 (90)	189 (89)
	Some problems washing or dressing	96 (7)	47 (6)	27 (9)	22 (10)
	Unable to wash or dress myself	6 (0)	1 (0)	4 (1)	1 (0)
	Missing	1 (0)	1 (0)	0 (0)	0 (0)
How would you describe your usual activities?					
	No problems with usual activity	1068 (80)	694 (85)	229 (75)	145 (68)
	Some problems performing usual activity	250 (19)	117 (14)	71 (23)	62 (29)
	Unable to perform usual activity	18 (1)	7 (1)	6 (2)	5 (2)
	Missing	3 (0)	3 (0)	0 (0)	0 (0)
How would you describe your pain?					
	No pain	685 (51)	457 (56)	141 (46)	87 (41)
	Moderate pain	630 (47)	355 (43)	155 (51)	120 (57)
	Extreme pain	24 (2)	9 (1)	10 (3)	5 (2)
How would you describe your anxiety or depression?					
	Not anxious	599 (45)	361 (44)	139 (45)	99 (47)
	Moderately anxious	633 (47)	408 (50)	137 (45)	88 (42)
	Extremely anxious or depressed	107 (8)	52 (6)	30 (10)	25 (12)
How is your health today, 0-100?					

Category	Value	Total N = 1339	Non-utilizers N = 821	Low-cost utilizers N = 306	High-cost utilizers N = 212
		75.0 (60.0, 80.0)	75.0 (65.0, 85.0)	70.0 (60.0, 80.0)	70.0 (60.0, 80.0)
	Missing	1	1	0	0

Table 5
Regressions of health outcomes on health utilization latent class membership, gender, and other covariates.

Coefficient	Self-Reported Health (Diff, 95% CI)	Pain (OR, CI)	Anxiety and Depression (OR, CI)	Mobility (OR, CI)	Self Care (OR, CI)	Usual Activities (OR, CI)
Low-cost utilizer vs Non-utilizer	**-4.83 (-6.60, -3.08)**	1.33 (1.00, 1.77)	1.49 (0.89, 2.48)	**1.60 (1.18, 2.16)**	**1.78 (1.07, 2.94)**	**1.77 (1.26, 2.50)**
High-cost utilizer vs Non-utilizer	**-3.40 (-5.43, -1.41)**	**1.70 (1.22, 2.37)**	1.58 (0.90, 2.76)	**2.15 (1.53, 3.03)**	**2.21 (1.26, 3.87)**	**2.85 (1.95, 4.16)**
Female vs Male	**-1.51 (-3.01, -0.01)**	**2.04 (1.60, 2.61)**	**1.79 (1.12, 2.87)**	**1.74 (1.33, 2.28)**	1.16 (0.72, 1.87)	**1.68 (1.21, 2.32)**
Age 50–64 vs < 50	**-2.16 (-3.83, -0.50)**	**1.90 (1.45, 2.50)**	1.09 (0.67, 1.79)	**1.74 (1.28, 2.36)**	**2.76 (1.40, 5.44)**	**1.98 (1.35, 2.89)**
Age ≥ 65 vs < 50	**-6.00 (-7.82, -4.17)**	**3.07 (2.26, 4.15)**	0.93 (0.53, 1.62)	**3.22 (2.33, 4.45)**	**5.20 (2.72, 9.93)**	**3.25 (2.22, 4.75)**
Have NHIF vs Not	1.60 (-0.40, 3.63)	**1.44 (1.03, 2.00)**	0.83 (0.43, 1.59)	0.86 (0.59, 1.24)	0.62 (0.30, 1.30)	0.84 (0.54, 1.30)
Earn < 5,000 KS vs No Job	1.62 (-0.30, 3.51)	0.82 (0.60, 1.12)	1.75 (0.97, 3.15)	0.74 (0.54, 1.02)	**0.32 (0.20, 0.53)**	**0.40 (0.29, 0.57)**
Earn ≥ 5,000 KS vs No Job	**5.05 (2.74, 7.34)**	**0.55 (0.38, 0.80)**	0.89 (0.42, 1.85)	**0.50 (0.33, 0.75)**	**0.38 (0.19, 0.75)**	**0.35 (0.22, 0.55)**

Values presented as Odds Ratio or Difference (95% confidence interval). Overall health is a score of 0-100, where higher values indicate better health. A negative effect means that women have lower reported health than men. The other symptom measures compare having any symptoms to no symptoms. OR CI that exclude 1.0 are bolded. Difference CI that exclude 0.0 are bolded.

Even after accounting for latent class membership probability, being a woman was associated with worse self-reported health (difference: -1.51) and more problems with pain (OR 2.04), anxiety/depression (OR 1.79), mobility (OR 1.74), and performing usual activities (OR 1.68). Compared to being younger than 50 years old, being between the ages of 50 and 64 years was associated with worse self-reported health by 2.16 points, more problems with pain (OR: 1.90), mobility (OR: 1.74), self-care (OR 2.76), and performing usual activities (OR 1.98). The effect of age was attenuated when comparing individuals greater than 65 years old to those less than 50, with worse self-reported health by six points, more problems with pain (OR: 3.07), mobility (OR: 3.22), self-care (OR 5.20), and performing usual activities (OR 3.25). Having NHIF was associated with more problems with pain (OR: 1.44), but not the other outcomes. Those with jobs with formal income reported fewer issues with pain, mobility, self-care, and usual activities than unemployed individuals, with reduced odds of having issues with higher income.

Discussion

Our analysis of 1447 adults with elevated blood pressure in rural Kenya revealed that women were of poorer socio-economic status, had poorer self-reported health status, and greater healthcare utilization of outpatient visits and medication prescriptions compared to men. Three distinct patterns emerged among the entire study cohort: health care utilizers with high medical costs, health care utilizers with low medical costs, and non-utilizers. Being female and having insurance had the most influence on being in a health-utilizing class. However, across all classes, women experienced worse functional health status than men.

Greater health care-seeking behavior by women, especially outpatient care, is consistent with findings from several parts of the world.(3, 15–19) However, there were some notable differences and patterns that were illuminated by our latent class analysis. First, individuals with no or low utilization of health care services also had lower awareness of their elevated blood pressure, likely reflecting a long-term cycle of low utilization leading to lower awareness of health issues, leading to further under-utilization of health care, and so on. However, one-third to one-half of these individuals did endorse knowing about their elevated blood pressure, yet did not utilize healthcare. It is possible that competing obligations, such as concern about work and employment, constrained health care-seeking behavior. Finally, contrary to what has been reported in other populations,(16, 20, 21) our latent class analysis indicated that the level of healthcare utilization was similar across incomes of those employed. This unexpected finding merits further inquiry, and research is needed to clarify the factors that may impact health care utilization.

Our latent class analysis revealed that one group of individuals faces higher health costs without increased income or employment. This combination of low income and high health costs is clearly concerning and highlights the urgent need for financial risk protection such as health insurance. Notably, the rates of national insurance (NHIF) enrollment among our participants was very low, with only 13% of women and 17% of men reporting current enrollment, in line with national statistics.(22) While we found that those with the highest healthcare costs had the highest rates of enrollment in NHIF, we were not able to determine whether the NHIF enrollment was initiated before or after the high-cost health care experience.

Additionally, it is worth noting that NHIF does not cover the cost of visits to herbalists or spiritual healers, seen by a substantial proportion of participants in our study, thus increasing the out-of-pocket burden for those individuals. In addition, efforts to medically engage this population need to consider collaborating with these practitioners, in order to maximize the reach across different segments of the population. Partnering with nontraditional medical providers in communities has been shown to be beneficial with respect to building trust and improving blood pressure control.(23–25)

Several potential strategies to improve the implementation gap with respect to blood pressure treatment and control arise from our findings. These include the need to improve community awareness of hypertension, address poverty, reduce out-of-pocket health care expenditures, and consider alternative sites of health care delivery. Community health workers can improve awareness and help to serve as a critical link between communities and the health sector.(26) Efforts to combine economic and financial programs with health care delivery are underway and actively being evaluated.(27, 28) Kenya, along with many other countries, is expanding universal health coverage in alignment with population health initiatives.(29) Finally, shifting clinical care out of the clinic and into community settings is gaining popularity and support throughout the world.(24, 25, 30) Across all of these strategies, accounting for sex-specific differences, preferences, and patterns will be critical to ensure population-level success.

We acknowledge the following limitations in our study. The sex of our participants was gathered from clinical data that were linked to the research database instead of being directly reported to the research team. In addition, all data regarding health care utilization, health care costs, and functional status were cross-sectional and self-reported and therefore subject to recall bias. We did not gather information on family income level, and it is quite likely that family members pool financial resources. Similarly, we did not collect data on education level. Lastly, the participants in the study are from rural, agricultural areas, and might not be fully representative of the general population.

Conclusions

Overall, our study finds that women face unequal socioeconomic and health status compared to men with elevated blood pressure in rural western Kenya. Our findings reaffirm the need to identify barriers to seeking healthcare and develop interventions

and strategies that might be sex-specific. While our study focuses on the geography of western Kenya, we believe that the findings can be relevant for low-resource settings worldwide.

List Of Abbreviations

AMPATH: Academic Model Providing Access to Healthcare Partnership

SBP: systolic blood pressure

DBP: diastolic blood pressure

KS: Kenyan shilling – local Kenyan currency

NHIF: National Hospital Insurance Fund – Kenyan national health insurance

IQR: interquartile range

LCA: latent class regression analysis

USD: United States dollars

AIC: Akaike information criterion

OR: odds ratio

CI: confidence interval

Declarations

Ethics approval and consent to participate.

The LARK study was approved by institutional review boards by all participating institutions, including the Icahn School of Medicine at Mount Sinai (Program for the Protection of Human Subjects; GCO # 11-1056) and Moi University College of Health Sciences (Institutional Research and Ethics Committee; IREC/2012/26). Written informed consent was obtained from all participants.

Consent for publication.

Not applicable

Availability of data and materials.

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests.

The authors declare they have no competing interests.

Funding.

Research reported in this publication was supported by the National Heart, Lung, and Blood Institute of the National Institutes of Health under award number 1U01HL114200. The content is solely the responsibility of the authors and does not necessarily

represent the official views of the National Institutes of Health. The funder had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Author's contributions.

NS and RV developed the study conception, design, and drafted the manuscript. AD and JH assisted with study conception and design, analysed and interpreted data, and assisted with drafting of manuscript. JK, SK, and VO were integral to acquisition of data and analysis and interpretation. VF provided key critical revision. All authors read and approved the final manuscript.

Acknowledgements.

The authors would like to thank the LARK research team and the staff at AMPATH and the Moi Teaching and Referral Hospital and Moi University.

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Figures

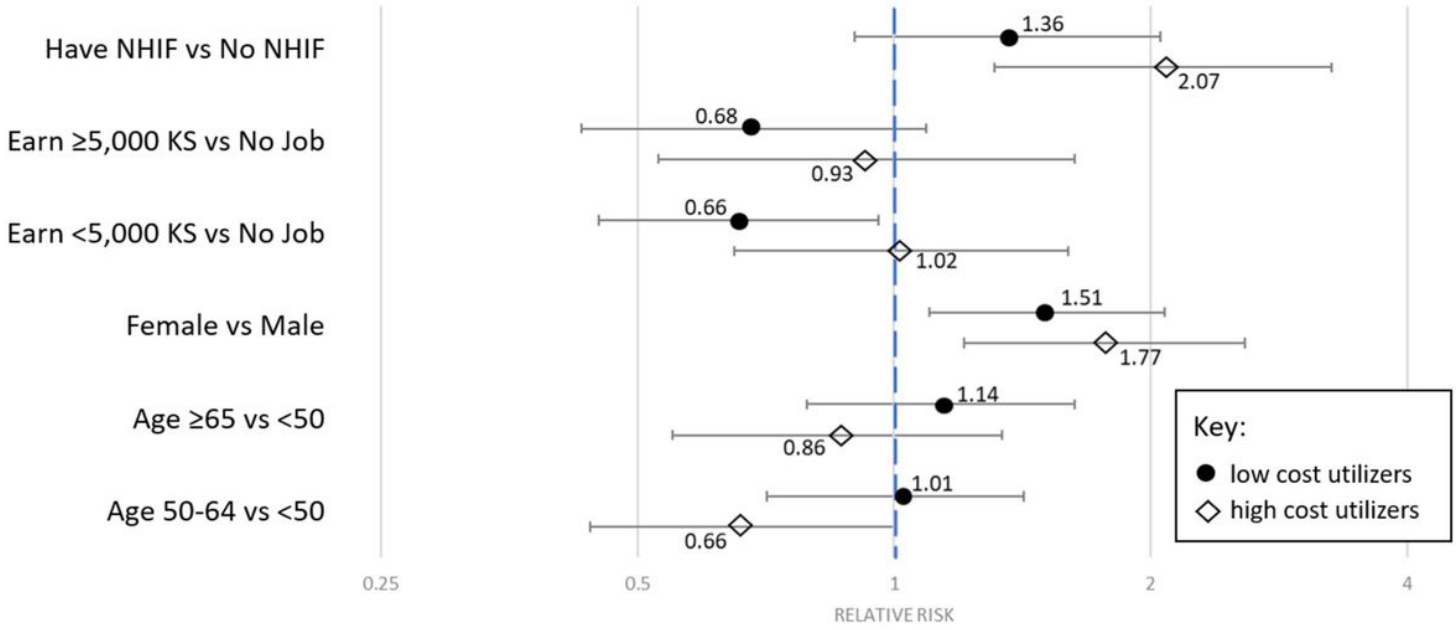
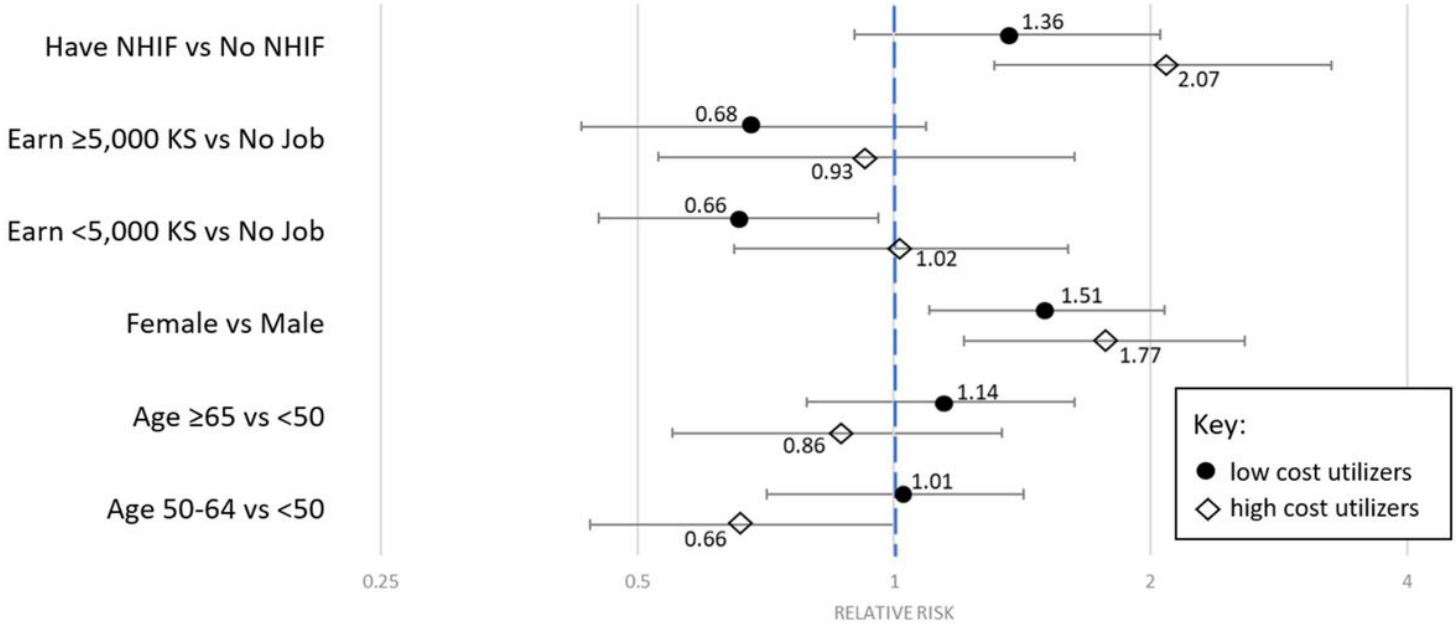


Figure 1

Relative risk of latent class membership by demographic. Relative risk of latent class membership probability compared to the largest, non-utilizer class. Error bars show 95% confidence intervals. Black dots indicate low-cost utilizer class compared to non-utilizers. White diamonds indicate high-cost utilizer class compared to non-utilizers. Please note the x-axis is logarithmic base 2. Numeric values can be found in supplement table 3.



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