Economic Inequality of Health Outcomes Among the Elderly in Bankura District: A Decomposition Analysis

Ujjwal Das[#*] and Nishamani Kar[^]

Economic inequality plays a critical role in shaping population health. This study examines the extent of socio-economic inequality in health outcomes among the elderly population in the Bankura district of West Bengal. A cross-sectional survey was conducted using a multi-stage random sampling design among 480 older residents. Socio-economic inequality in health outcomes was assessed using the Concentration Index, concentration curves, and a regression-based decomposition approach to identify the major contributors to observed inequalities. Overall, 92% of the elderly reported at least one chronic disease. The Concentration Index indicated that cholesterol (0.40), diabetes (0.29), and hypertension (0.04) were more concentrated among the richer population, whereas bone diseases (-0.11), lung diseases (-0.24), and heart diseases (-0.04) were more prevalent among the poorer groups. Decomposition analysis showed that non-vegetarian food preference (64.5%), poverty status (15.4%), smoking (13.2%), alcohol consumption (26.2%), and being aged 60 years or above (3.8%) were key contributors to pro-rich inequality. The probit model further revealed higher odds of chronic morbidity with increasing age, living alone, alcohol intake, and smoking. The findings highlight the need for strengthened health infrastructure and targeted interventions in rural areas, especially for the oldest old.

Keywords: socio-economic inequalities, multi-stage random sampling, concentration index, decomposition, smoking

[#] Corresponding Author: Ujjwal Das[*], Fakir Mohan University, Balasore, Odisha, India
Email: ujjwaldas608@gmail.com
[^] Rajiv Gandhi University, Itanagar, Arunachal Pradesh, India,

For supplementary materials such as appendices, datasets, and author disclosure statements, see the article page at https://healthempirics.org/

Health inequality has become a major public health issue and challenge globally. Reducing health inequalities and developing effective public health policies for individuals is one of the important targets of the Sustainable Development Goals (SDG-10) (Bradby, 2008). Generally, health is defined as physical, mental, and social well-being, not merely the absence of disease. It is a necessary basis for people to realize their capabilities (Sen et al., 2004). However, when inequality exists, society falls short of moderating socio-economically disadvantaged individuals through social and economic policies (Fonta et al., 2020). A growing number of studies have revealed that economic inequality can negatively affect health outcomes (Neufcourt et al., 2021). Economic inequalities affect population health both directly and indirectly (Truesdale, 2016). Social theory suggests that socioeconomic inequality widens the gap in health outcomes through income inequality and exacerbates social instability. Furthermore, it increases unemployment and poverty, which are crucial challenges for social stability (Xie, 2009). Evidence from high-income countries suggests that higher levels of income inequality increase the burden of non-communicable diseases, particularly among poorer populations (Melaku et al., 2019). A study conducted by Xie found a significant pro-rich inequality in health outcomes, where richer people tend to have better health outcomes than poorer individuals (Xie, 2011). By contrast, in low- and middle-income countries, this relationship can be reversed, as rapid economic growth often results in health service utilization being more concentrated among poorer people than among the wealthier (Gu, 2019).

India is one of the middle-income countries, with an unprecedented population growth rate and currently the second most populous nation in the world. India is also experiencing rapid growth in its aging population due to an increase in life expectancy at birth (Smith, 2012). According to the 2011 Census, the 60+ population in the country accounted for 8.6%, which has increased from 5% in 1951 (Census of India, 2011). It is estimated that this share will reach 20% of the total population (323 million) by 2050 (Agarwal et al., 2020). The increasing aging population, along with rising life expectancy, raises critical concerns about whether longer lives are accompanied by healthy years. Older people are generally more vulnerable, as they are more likely to suffer from non-communicable diseases and disability (Jiao, 2019). According to the Global Burden of Disease (GBD) study, cardiovascular disease and diabetes accounted for 34.3% and 2.5% of the mortality burden in India, respectively (Tandon et al., 2018). Older people often suffer from multiple chronic diseases, such as hypertension, diabetes, stroke, heart disease, bone disease, hearing loss, and visual impairment. Furthermore, many older adults are lonely and sometimes suffer from depression when their children leave home for education or work, do not provide financial support, or fail to provide care when needed (Zeng et al., 2018). Not all older adults face these issues equally; some fare better than others depending on socio-economic factors (Marmot et al., 2008). Established

literature suggests that socioeconomic status is a key determinant contributing to the unequal distribution of chronic diseases both across and within communities (Ataguba et al., 2011). The relationship between non-communicable diseases and economic status varies depending on the distribution of resources in society (Corsi & Subramanian, 2019). Studies show that non-communicable diseases manifest differently between the wealthy and the deprived, and these differences are major predictors of premature mortality and life expectancy disparities among older people (Di Cesare et al., 2013)

In the context of the Bankura district, older people residents have little or no education, and only a small proportion are economically active in the formal sector (Manna & Mistri, 2018). Regarding health disparities, older adults in this district are more prone to various diseases at higher ages, and they tend to report more illnesses due to limited access to medical facilities (Kumar et al., 2013). Older people residents in rural areas are more likely to report poor health compared to their urban counterparts. Additionally, a substantial proportion of the population belongs to the poorest economic groups. These individuals often do not utilize preventive care services and are more likely to experience premature mortality from chronic diseases than wealthier groups (Singh et al., 2019).

Despite the growing literature, little is known about district-level health disparities among older adults in Bankura, creating a critical research gap that this study seeks to address. While previous studies have highlighted the burden of non-communicable diseases and the role of socioeconomic inequality in shaping health outcomes, limited research has focused specifically on rural districts such as Bankura, where structural disadvantages in education, healthcare access, and economic resources amplify these disparities. The findings of this study will provide valuable insights for policymakers to strengthen healthcare facilities for older people residents in vulnerable rural areas such as Bankura. By focusing on older people residents, this study addresses a key research gap and generates district-level evidence to inform policies aligned with the National Programme for Health Care of the Elderly and the Sustainable Development Goals, particularly reducing health inequalities and ensuring healthy aging. Therefore, the aim of the study is to measure socio-economic health disparities among the older people in the Bankura district

- **Study Area**

The study was conducted in Bankura district, located in the western part of West Bengal, India. The district is predominantly rural with significant socio-economic and health disparities. For the present study, five blocks—Khatra, Taldangra, Simlapal, Sarenga, and Raipur—were purposively selected. Supplementary Figure S1 illustrates the geographical location of the study area.

Data and Methods

Data for the present study were drawn from a primary survey conducted using a multi-stage random sampling procedure among older adults (aged 45 and above) in the Bankura district of West Bengal, from May 2023 to September 2023. Data were collected through face-to-face interviews using a pre-tested structured questionnaire. The sample size was estimated based on a chronic morbidity prevalence of 50%, as reported in an earlier study conducted in West Bengal (Kumar et al., 2013). The calculated total sample size was 480, with a 95% confidence interval and a 5% margin of error. The sampling formula is placed in the supplementary material.

- **Study Design**

A three-stage sampling procedure was employed for the selection of the study sample. In the first stage, blocks were selected; in the second stage, villages were chosen; and in the third stage, the target population was identified. The study adopted a stratified systematic random sampling design. Initially, all 22 blocks of the district were arranged in ascending order according to the percentage of the elderly population. The blocks were stratified into three categories: low, middle, and high percentages of older people residents. From these, five blocks in the southern part of the district were purposively selected, and within each block, three villages were chosen, resulting in a total of 15 villages.

In each village, 32 respondents (16 male and 16 female) were surveyed to achieve the required sample size (Supplementary Figure S2). This strategy was employed to ensure balanced gender representation in the sample, thereby allowing meaningful comparisons between elderly men and women with respect to chronic morbidity and economic inequality. The household survey began from roadside houses, targeting individuals aged 45 years and above, and continued until the required number of respondents was reached in each village. Ethical approval for the study was obtained from the Institutional Ethics Committee of Rajiv Gandhi University prior to data collection (Approval ID: RGU/IEC/2023/017). Data were collected using pre-tested, pre-designed, semi-structured questionnaires. Information on morbidity was based on self-reporting by participants, except for hypertension, which was measured directly. The validity of the questionnaire was ensured through pilot testing before the main survey. Face validity was assessed through a pilot survey among 30 elderly respondents in a non-sampled village of Bankura district. Feedback from the pilot was used to refine question wording, sequencing, and response options to improve clarity and cultural appropriateness.

Variable Description

- **Dependent Variable**

The present study used eight Non-Communicable Diseases to measure economic inequality in health outcomes among older adults aged 45 years and above. These include Hypertension, Diabetes, Heart disease, Depression, Cholesterol, Stroke, Lung disease, and Bone disease. If a respondent reported suffering from at least one of these diseases, it was considered as the presence of chronic morbidity. The presence of any of the eight chronic conditions was coded as 1 (yes) and 0 (no).

- **Independent Variable**

As established reviewed literature suggested that several socio-demographic and behavioral factors have a significant effect on chronic diseases among the elderly aged people (Mini, 2017; Muksor, 2018). The age of the elderly is categorized into two groups: older adults (45-49 years) and Older old (60 years and above). For marital status, respondents were categorized into married and single (never married, separated, divorced, or widowed). The socio-economic factors, education categorized into three groups (no education, primary and secondary), working status two categorized formed (currently working as yes and never worked), income ranked into five quintiles (poorest, poorer, middle, richer and richest). We regrouped the quintiles into two groups. The first group is defined as non-poor if respondents belong to the last two income quintiles (richer and richest) and the poorest, poorer, and middle quintiles are defined as poor. The lifestyle behavior factors, such as food preference categorized into two choices (vegetarian and non-vegetarian), and intake of smoking, alcohol, and tobacco are formed into two groups either yes or no.

- **Statistical Methods**

For the measurements of inequality, concentration curve and concentration index were applied in the study population. "The concentration curve provides a visual impression of socioeconomic inequality in the distribution of health outcomes and depicts how shares of the health outcome variable (y-axis) are accounted for by the cumulative percentage of adults ranked by household income from the poorest to the richest (x-axis)" (Xu, 2016).

Furthermore, the value of the concentration index ranges between -1 to +1. When the concentration curve lies above the line of equality, it indicates that this outcome variable is more concentrated among the poor disadvantage groups and vice versa. The mathematical notion of concentration index is as shown below,

$$C = \frac{2}{\mu} cov(h, r)$$

Where C represents the overall index, h is the health outcome variable μ is its mean, and r is the factional rank of household income.

Furthermore, Wagstaff decomposition methods of concentration index was established to quantify each determinant's contribution to health outcomes (Wagstaff et al. 2007). The health outcome variables such as the presence of chronic diseases is a binary variable. It has codded 0 and 1. The study employed the decomposition method based on the probit regression model to conduct the decomposition Concentration Index.

In Probit regression, the cumulative standard normal distribution function $\Phi(\cdot)$ is used to model the regression function when the dependent variable is binary, which could be specified as

$$E(Y|X) = P(Y = 1|X) = \Phi(\beta_0 + \beta_1 X)$$

The presence of chronic disease Y is a binary variable. The Model is

$$Y = \beta_0 + \beta_1 + X_1 + \beta_2 X_2 + \cdots + \beta_K X_K + \mu$$

X is the vector of regressors or socio-economic factors, x1, x2, ...xn . β is a vector of parameters β1,β2,…….βn

The decomposition of the concentration index could be explained as

$$C = \sum k \quad (\beta_{\underline{k\bar{x}_k}})C_k + GC_\varepsilon \ /\mu$$

Where C is the concentration index of health outcome, βk are the coefficients, and (x)¯_k represents the mean ofC=2/μ cov(h,r), μ stands for the mean health outcome, C_k is the concentration index for xk and GC_ε denotes the generalized concentration index for ε.

Results

Table 1 summarizes the socio-demographic characteristics of the study population and the prevalence of any morbidity. The study population consisted of 480 elderly respondents, with a nearly equal distribution of men (49.4%) and women (50.6%). More than half of the respondents were in the older old age group (60 years and above, 56.9%), while 43.1% belonged to the younger elderly (45–59 years). In terms of education, more than half (55%) had attained secondary education, whereas 22.9% had no formal education.

Table 1: Descriptive summary of the study population and prevalence of any morbidity among the Older people in Bankura district (N = 480)

Background Characteristics	Total	Percentage	% of Any morbidity (N)
Sex			
Male	237	49.38	93.25 (221)
Female	243	50.63	92.59 (92.59)
Chronic Diseases			
Absent	34	7.08	-
Present	446	92.92	-
Age			
Older Adult (45-59 Years)	207	43.13	86.96 (180)
Older Old (60Year and above)	273	56.88	97.44 (266)
Marital status			
Married	354	73.75	90.66 (332)
Single	126	26.25	98.41 (124)
Education			
No Education	110	22.92	92.73 (102)
Primary	106	22.08	94.34 (100)
Secondary	264	55.00	92.42 (244)
Currently Working			
Yes	187	38.96	87.70 (164)
Never worked	292	61.04	96.25 (282)
Economic Status			
Poor	138	28.75	92.03 (127)
Non-Poor	342	71.25	93.27 (319)
Food Preference			
Vegetarian	91	19.83	84.62 (77)
Non-Vegetarian	368	80.17	94.57 (348)
Health Insurance			
No	292	60.83	88.70 (259)
Yes	188	39.17	99.47 (187)
Smoking Status			
Yes	159	33.13	97.48 (155)
No	321	66.88	90.65 (291)
Tobacco Consumption			
Yes	259	53.96	93.44 (242)
No	221	46.04	92.31 (204)
Alcohol Consumption			
Yes	206	42.92	97.57 (201)
No	274	57.08	89.42 (245)

Table 2: Prevalence of chronic diseases among the elderly by their wealth status

Background Characteristics	Wealth Status				
	Q1	Q2	Q3	Q4	Q5
Sex					
Male	22 (9.95)	31 (14.03)	43 (19.46)	33 (14.93)	92 (41.63)
Female	25 (11.11)	49 (21.78)	42 (18.67)	33 (14.67)	76 (33.78)
Age					
Older Adult (45-59 Years)	19 (10.56)	36 (20.0)	35 (19.44)	23 (12.78)	67 (37.22)
Older Old (60Year and above)	28 (10.53)	44 (16.54)	50 (18.80)	43 (16.17)	101 (37.97)
Marital status					
Married	34 (10.56)	55 (17.08)	60 (18.63)	42 (13.04)	131 (40.68)
Single	13 (10.48)	25 (20.16)	25 (20.16)	24 (19.35)	37 (29.84)
Education					
No Education	25 (24.51)	30 (29.41)	27 (26.47)	11 (10.78)	9 (8.82)
Primary	13 (13.00)	32 (32.0)	23 (23.00)	21 (21.00)	11 (11.00)
Secondary	9 (3.69)	18 (7.38)	35 (14.34)	34 (13.93)	148 (60.66)
Currently Working					
Yes	16 (9.76)	29 (17.68)	38 (23.17)	16 (9.76)	65 (39.63)
Never worked	31 (11.03)	50 (17.79)	47 (16.73)	50 (17.79)	103 (36.65)
Food Preference					
Vegetarian	8 (10.39)	13 (16.88)	16 (20.78)	13 (16.88)	27 (35.06)
Non-Vegetarian	39 (11.21)	60 (17.24)	65 (18.68)	53 (15.23)	131 (37.64)
Health Insurance					
No	46 (17.76)	63 (24.32)	59 (22.78)	47 (18.15)	44 (16.99)
Yes	1 (0.53)	17 (9.09)	26 (13.90)	19 (10.16)	124 (66.31)
Smoking Status					
Yes	14 (9.03)	24 (15.48)	22 (14.19)	30 (19.35)	65 (41.94)
No	33 (11.34)	56 (19.24)	63 (21.65)	36 (12.37)	103 (35.40)
Tobacco Consumption					
Yes	38 (15.70)	42 (17.36)	54 (22.31)	48 (19.83)	60 (24.79)
No	9 (4.41)	38 (18.63)	31 (15.20)	18 (8.82)	108 (52.94)
Alcohol Consumption					
Yes	14 (6.97)	29 (14.43)	24 (11.94)	25 (12.44)	109 (54.23)
No	33 (13.47)	51 (20.82)	61 (24.90)	41 (16.73)	59 (24.08)

Table 3: Concentration Index in wealth quintile by different chronic diseases

Wealth Quintile						
Variables	**Poorest**	**Poorer**	**Middle**	**Richer**	**Richest**	**Total**
Hypertension	0.06	-0.11	0.03	0.01	0.15	0.04
Diabetes	0.29	-0.04	0.24	0.07	0.14	0.29
Heart Diseases	0.14	0.23	-0.09	0.24	0.09	-0.01
Lung Diseases	-0.05	0.26	0.37	-0.77	-0.56	-0.24
Depression	-0.13	-0.15	0.37	-0.28	-0.18	0.06
Bone diseases	0.08	-0.2	-0.06	-0.04	-0.22	-0.11
Cholesterol	-0.02	0.13	-0.1	0.13	-0.03	0.4
Stroke	-0.14	-0.3	-0.25	0.14	-0.11	-0.01
All	0.00039	0.0233	0.0271	-0.0252	0.0319	0.013

Overall, 92.9% of the respondents reported at least one morbidity. The prevalence of morbidity was slightly higher among men (93.3%) than women (92.6%). Older adults aged 60 years and above had a markedly higher prevalence (97.4%) compared to those aged 45–59 years (87.0%). Similarly, widowed/single respondents reported a higher burden of morbidity (98.4%) than married respondents (90.7%).Those who had never worked (96.3%) reported more morbidity than those currently working (87.7%). By economic status, prevalence was comparable—92.0% among the poor and 93.3% among the non-poor. Notably, non-vegetarians (94.6%) had a higher morbidity prevalence than vegetarians (84.6%). Behavioral risk factors also showed strong associations: smokers (97.5%), alcohol users (97.6%), and tobacco users (93.4%) had higher prevalence of morbidity compared to their counterparts.

Table 2 presents the prevalence of chronic diseases among the study population by household wealth status. The results show that both males and females from the richest households (Q5) had a higher prevalence of chronic diseases (41.6% and 33.8%, respectively) compared to those from the poorest households (Q1). Older adults in the richest households also reported a higher prevalence (37.9%). Interestingly, non-educated individuals from the poorest households had a greater burden of chronic diseases than their counterparts in the richest households (24.5% vs. 8.8%). In addition, the richest households had the highest proportion of health insurance coverage and reported more chronic diseases (66.3%). Overall, wealth and lifestyle behaviors were positively associated with a higher prevalence of chronic diseases in the study population.

Table 3 shows the estimated concentration index of different chronic diseases across wealth quintiles. A negative value implies pro-poor inequality, meaning that poorer older people have suffered more from these diseases. For example, the concentration indices of heart disease (-0.01), lung diseases (-0.24), bone disease (-0.11), and stroke (-0.01) indicate that these conditions were more prevalent among individuals with lower wealth status. In contrast, hypertension (0.04), diabetes (0.29), depression (0.06), and cholesterol (0.40) were more concentrated among individuals with higher wealth status (Fig. 3).

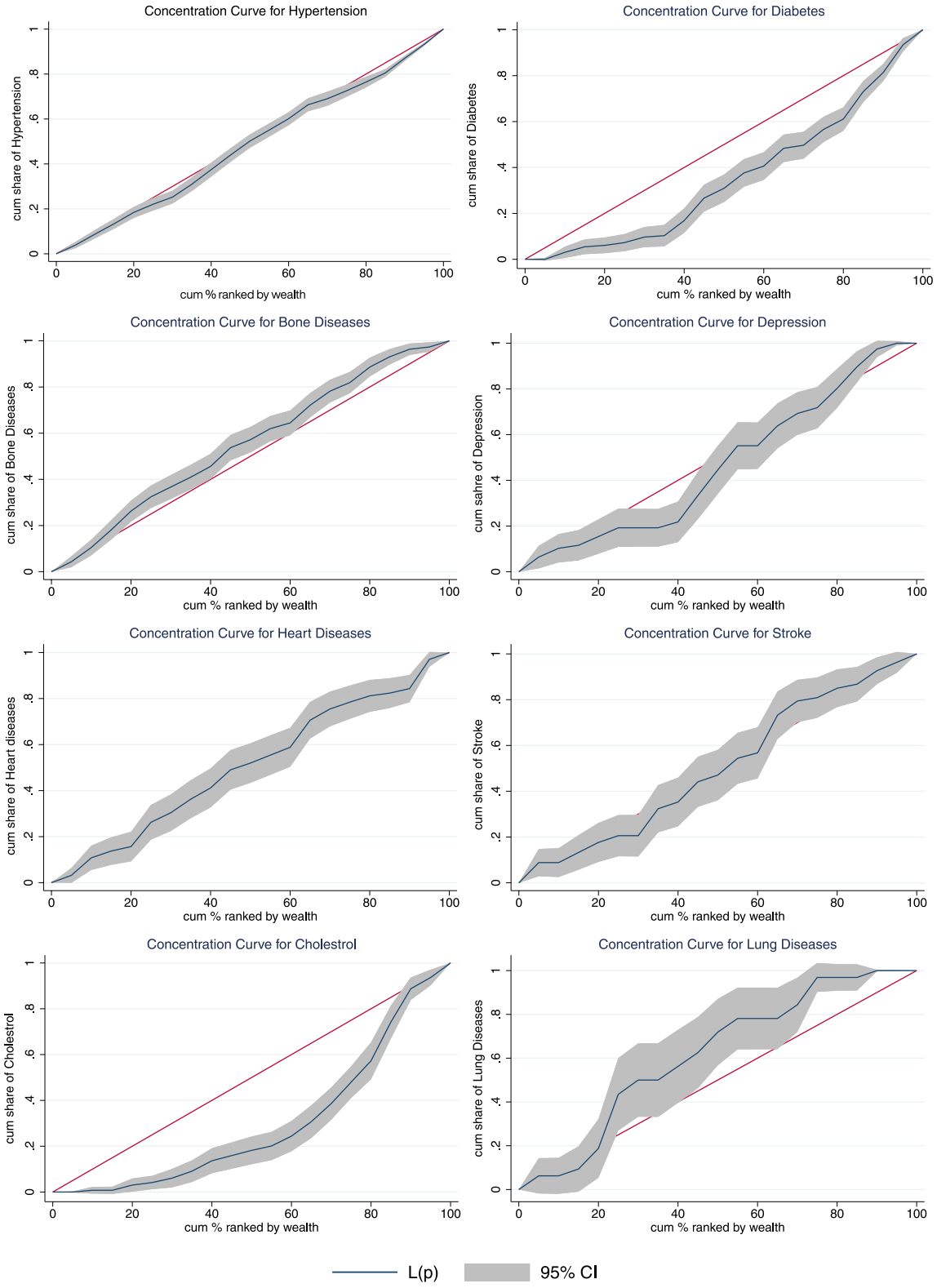
Table 4 depicts the results of the decomposition analysis of the concentration index for the presence of chronic diseases. The prevalence of chronic diseases was higher among those aged 60 years and above (CI = 0.001), individuals with secondary education, those living alone (CI = -0.0017), the economically poor (CI = 0.0302), and those who consumed tobacco or alcohol. Further decomposition of the CI contribution factors revealed that non-vegetarian food preference (64.5%), poverty (15.4%), smoking (13.2%), alcohol consumption (26.2%), and age 60 years and above (3.8%) were the major contributors explaining the pro-rich inequality in the presence of chronic diseases. By contrast, the contribution of health insurance to the concentration index was only 0.08%, indicating that coverage by health insurance made a relatively smaller contribution to pro-rich inequality in disease prevalence.

Table 4: Decomposition analysis of probit regression and contributions to inequality in the presence of chronic diseases among the elderly

Background Characteristics	Coeff.	95% CI	Elasticity	CIs	Absolute contribution	Percentage contribution
Age						
Older Adult (45-59 Years)	Ref.					
Older Old (60 and above)	0.82	(0.31 – 0.93)	0.502	0.001	0.0003	0.038
Marital status						
Married	Ref.					
Single	0.32	(0.11– 0.69)	0.089	-0.0017	-0.0002	-0.0182
Education						
No Education	Ref.					
Primary	-0.03	(-0.69 – 0.62)	-0.008	-0.0393	0.0003	0.0372
Secondary	0.01	(-0.54 – 0.57)	0.008	0.0368	0.0003	0.0369
Currently Working						
Never worked	Ref.					
Yes	-0.50	(-0.97 – -0.04)	-0.211	0.0098	-0.0021	-0.2446
Economic Status						
Non-Poor	Ref.					
Poor	0.14	(-0.31 – 0.59)	0.043	0.0302	0.0013	0.1546
Health Insurance						
No	Ref.					
Yes	1.31	(0.49 – 2.14)	0.553	0.0001	0.0001	0.0080
Food Preference						
Vegetarian	Ref.					
Non-Vegetarian	0.43	(-0.03 – 0.89)	0.371	0.0146	0.0054	0.6459
Smoking Status						
No	Ref.					
Yes	0.21	(-0.51 – 0.93)	0.076	0.0146	0.0011	0.1327
Tobacco Consumption						
No	Ref.					
Yes	0.13	(-0.31 – 0.56)	0.075	-0.0060	-0.0004	-0.0531
Alcohol Consumption						
No	Ref.					
Yes	0.37	(-0.32 – 1.05)	0.170	0.0130	0.0022	0.2625
Total					0.008	1.000

Moreover, the probability of chronic diseases increased with age—older adults aged 60 years and above (coeff = 0.82, $p < 0.001$), those living alone (coeff = 0.32, $p < 0.05$), the elderly with health insurance (coeff = 1.31, $p < 0.001$), and those with a non-vegetarian food preference (coeff = 0.43, $p = 0.07$) had higher risks. In contrast, older people who were currently working had a reduced risk of chronic diseases (coeff = -0.50, $p < 0.05$) compared to those who were not working.

Figure 3: Concentration curve of chronic diseases



Discussion

The present study investigated the economic inequality of health outcomes among older adult people in the Bankura district. About 92% of individual were suffer from at least one chronic diseases. The prevalence of these diseases was higher among the oldest old (60 years and above) compared to older adults (45 years and above). These results are consistent with previous findings that elderly individuals aged 60 years and above had higher odds of suffering from chronic diseases (Bardage et al., 2005). Literate older people had a higher likelihood of reporting chronic diseases than non-literate older people. Other studies have mentioned that individuals with different education levels may evaluate their health differently; for example, lower health ratings are more strongly associated with mortality among adults with higher education (Srivastava et al., 2021). Older people from poor households had a higher likelihood of chronic diseases than those from non-poor households. A study by Beckfield et al. (2013) also noted that poor health is significantly associated with individuals from lower socio-economic backgrounds and low-income families. Poverty plays an influential role in the presence of chronic diseases. An earlier study conducted in China found that the prevalence of chronic diseases was three times higher among low-income earners compared to high-income earners (Feng et al., 2012).

Our findings further suggested that older people living alone were more likely to report chronic diseases compared to those not living alone. This aligns with previous research, which found that elderly men without spousal support are often exposed to poor diets, undisciplined lifestyles, difficulties in carrying out household chores, and lack of personal care, making them more vulnerable to poor psychological well-being compared to those in relationships (Khura et al., 2022). In addition, older people living in rural areas are structurally disadvantaged due to limited healthcare resources, poor socio-economic status, unhealthy lifestyles, risky behaviors such as smoking, alcohol, and tobacco consumption, and lower levels of educational attainment. As a result, they are more vulnerable to chronic diseases. Furthermore, the suffering from multiple chronic conditions among poor elderly individuals is exacerbated by lack of access to quality healthcare services, advanced medical technology, and the burden of out-of-pocket expenditures—another significant finding of this study (Jiao, 2016).

The key findings of the study indicate that economic inequality in chronic diseases among the elderly varied widely across different socio-economic statuses in the district. Chronic morbidity emerged as a significant predictor of poor health among older adults. The observed inequalities suggest that elderly individuals from lower socio-economic backgrounds may face barriers in accessing timely therapy for conditions such as hypertension and diabetes, potentially due to the burden of out-of-pocket expenditure. This interpretation is consistent with a large number of studies conducted in low- and middle-income nations, which have documented a significant association between economic gradients and health outcomes (Vellakkal

et al., 2015). Therefore, differences in social, cultural, economic, and health care systems contribute to the unequal distribution of non-communicable disease prevalence in households.

Results from the decomposition analysis suggested that food preference, specifically being non-vegetarian, was identified as the biggest contributor to pro-rich inequality in the presence of chronic diseases. The study also revealed that economic status was the second most important contributor to pro-rich inequality in elderly health, which is consistent with the earlier findings of Xu et al. (2016). In middle-income countries, evidence shows that NCDs are more prevalent among low socio-economic households due to poor access to healthcare, psychosocial stress, and lack of awareness and control of NCDs. Risky lifestyle behaviors, such as alcohol intake and smoking, further widened economic inequality in elderly health outcomes. A prior study mentioned that the "DALY rate of alcohol abuse in men is 16 times more affected by economic inequality than the DALY rate of alcohol abuse in women" (Pinkhasov et al., 2010).

Another important finding of the study is that older people who were currently working contributed to reduced inequality in health outcomes. From these findings, it is well documented that the burden of non-communicable diseases intensifies economic inequality at the household level, with the effect being higher in households that include the oldest old population (65 years and above) (Liu et al., 2016). A higher level of income inequality has been shown to increase the risk of depression, though not anxiety, as demonstrated in an earlier cross-sectional study (Chiavegatto et al., 2013). Non-communicable diseases often stem from lifelong exposure to detrimental health and socio-economic conditions within households.

The economic inequality in the distribution of these diseases indicates that individuals with higher socio-economic status generally experience higher levels of NCDs on average. Simultaneously, economic inequality may influence population health through multiple pathways—for example, the impact of social factors that increase the risk of cardiovascular disease prevalence (Karriker-Jaffe et al., 2013), and reduced healthcare utilization caused by high out-of-pocket expenditures (Pinkhasov et al., 2010). The reduction of economic inequality alongside addressing the burden of non-communicable diseases are critical strategies embedded within the Sustainable Development Goals, namely SDG 10 and SDG 3 (Gaspar et al., 2021). Therefore, comprehensive healthcare services are urgently required for the rural elderly population in the Bankura district to reduce the high burden of NCDs while simultaneously addressing socio-economic inequality.

Limitations of the study

This study has certain limitations that should be acknowledged. First, the data on morbidity were self-reported, which may be subject to recall bias and could affect

the accuracy of the estimates. Second, the study did not include information on communicable diseases, limiting the scope of health outcomes assessed. Third, the cross-sectional design restricts the ability to establish causal relationships between socioeconomic status and health outcomes. Fourth, while the sample size was adequate for the objectives, the findings are drawn from a single district and may not be fully generalizable to other regions of India. Finally, as with any survey-based study, issues related to reporting errors and data quality cannot be entirely ruled out.

Conclusion

This study highlights substantial economic inequalities in health outcomes among the elderly in Bankura, with chronic diseases being highly prevalent. The burden was particularly pronounced among the oldest old (60 years and above), elderly without spousal support, those with secondary education, and individuals from economically poor households. These findings underscore the need for targeted interventions addressing vulnerable subgroups rather than adopting a one-size-fits-all approach.

From a policy perspective, strengthening geriatric healthcare services in rural areas is essential. Government agencies should prioritize expanding the National Programme for Health Care of the Elderly (NPHCE) at the district level, with a focus on screening and early detection of chronic diseases. NGOs and community-based organizations can play a vital role in promoting health awareness, reducing risky behaviors such as smoking and alcohol use, and offering psychosocial support for elderly living alone. Strengthening primary healthcare infrastructure, ensuring affordable access to medicines, and integrating health insurance coverage for chronic disease management are also critical steps. By addressing both medical and socio-economic determinants, these measures can reduce inequalities and promote healthy aging in vulnerable rural populations.

- **Funding:** None

- **Conflict of Interest:** None

- **Author Contributions:** UD and NK contributed to the conception and design of the study. UD was responsible for the acquisition, analysis, and interpretation of data, as well as drafting and writing the manuscript. NK provided supervision and project administration. Both authors critically revised the manuscript, approved the final version to be published, and agreed to be accountable for all aspects of the work.

- **Supplementary Material:** Visit https://healthempirics.org/ for more information

References

Agarwal, A., Lubet, A., Mitgang, E., Mohanty, S., & Bloom, D. E. (2020). Population aging in India: Facts, issues, and options. In Population change and impacts in Asia

and the Pacific (pp. 289-311). Singapore: Springer Singapore.

Ataguba, J. E., Akazili, J., & McIntyre, D. (2011). Socioeconomic-related health inequality in South Africa: evidence from General Household Surveys. International journal for equity in health, 10(1), 48.

Bardage, C., Pluijm, S. M., Pedersen, N. L., Deeg, D. J., Jylhä, M., Noale, M., ... & Otero, Á. (2005). Self-rated health among older adults: a cross-national comparison. European Journal of Ageing, 2(2), 149-158.

Beckfield, J., Olafsdottir, S., & Bakhtiari, E. (2013). Health inequalities in global context. American Behavioral Scientist, 57(8), 1014-1039.

Bradby, H. (2008). What works in tackling health inequalities? Pathways, policies and practice through the lifecourse-by Asthana, S. and Halliday. J. Sociology of Health & Illness, 30(5), 810.

Census of India. (2011). Census of India 2011 META DATA. Office of the Registrar General & Census Commissioner, India.

Chiavegatto Filho, A. D. P., Kawachi, I., Wang, Y. P., Viana, M. C., & Andrade, L. H. S. G. (2013). Does income inequality get under the skin? A multilevel analysis of depression, anxiety and mental disorders in Sao Paulo, Brazil. J Epidemiol Community Health, 67(11), 966-972.

Corsi, D. J., & Subramanian, S. V. (2019). Socioeconomic gradients and distribution of diabetes, hypertension, and obesity in India. JAMA network open, 2(4),

Di Cesare, M., Khang, Y. H., Asaria, P., Blakely, T., Cowan, M. J., Farzadfar, F., ... & Ezzati, M. (2013). Inequalities in non-communicable diseases and effective responses. The Lancet, 381(9866), 585-597.

Feng, Z., Wang, W. W., Jones, K., & Li, Y. (2012). An exploratory multilevel analysis of income, incomeinequality and self-rated health of the elderly in China. Social Science & Medicine, 75(12), 2481–2492.

Fonta, C. L., Nonvignon, J., Aikins, M., Nonvignon, J., & Aryeetey, G. C. (2020). Economic analysis of health inequality among the elderly in Ghana. Journal of Population Ageing, 13, 113-127.

Gaspar, R. S., Rossi, L., Hone, T., & Dornelles, A. Z. (2021). Income inequality and non-communicable disease mortality and morbidity in Brazil States: a longitudinal analysis 2002-2017. The Lancet Regional Health–Americas, 2.

Gu, H. (2019). Coordinating the urban and rural medical insurance system, income-related medical service utilization and health inequality. Social Sci J, 2, 88-97.

Jiao, K. (2019). Inequality of healthy life expectancy for the Chinese elderly and its trend. The Journal of Chinese Sociology, 6(1), 22.

Karriker-Jaffe, K. J., CM Roberts, S., & Bond, J. (2013). Income inequality, alcohol

use, and alcohol-related problems. American Journal of Public Health, 103(4), 649-656.

Khura, B., Mohanty, P., Patnaik, L., Pradhan, K. B., Khubchandani, J., & Padhi, B. K. (2022). Socioeconomic inequalities in the prevalence of non-communicable diseases among older adults in India. Geriatrics, 7(6), 137.

Kumar, P., Mallik, D., Mukhopadhyay, D. K., Sinhababu, A., Mahapatra, B. S., & Chakrabarti, P. (2013). Prevalence of diabetes mellitus, impaired fasting glucose, impaired glucose tolerance, and its correlates among police personnel in Bankura District of West Bengal. Indian journal of public health, 57(1), 24-28.

Liu, R., Li, J., & Wang, J. (2016). Analyzing the health equity of rural residents in China and its decomposition. Chinese Health Service Management, 33(8), 611-614.

Manna, P., & Mistri, T. (2018). Block-wise Developmental Scenario of Bankura District, West Bengal. Research Journal of Humanities and Social Sciences, 9(3), 499-508.

Marmot, M., Friel, S., Bell, R., Houweling, T. A., & Taylor, S. (2008). Closing the gap in a generation: health equity through action on the social determinants of health. The lancet, 372(9650), 1661-1669.

Melaku, Y. A., Renzaho, A., Gill, T. K., Taylor, A. W., Dal Grande, E., de Courten, B., ... & Kinfu, Y. (2019). Burden and trend of diet-related non-communicable diseases in Australia and comparison with 34 OECD countries, 1990–2015: Findings from the Global Burden of Disease Study 2015. European journal of nutrition, 58, 1299-1313.

Mini, G. K., & Thankappan, K. R. (2017). Pattern, correlates and implications of noncommunicable disease multimorbidity among older adults in selected Indian states: a crosssectional study. BMJ open, 7(3), e013529

Muksor, A., Dixit, P., & Varun, M. R. (2018). Rural-Urban Differentials in NCD Multimorbidity in Adult Population in India: Prevalence and Cost of Care. J Trop Med Health JTMH-121.

Neufcourt, L., Zins, M., Berkman, L. F., & Grimaud, O. (2021). Socioeconomic disparities and risk of hypertension among older Americans: the Health and Retirement Study. Journal of Hypertension, 39(12), 2497-2505. DOI: 10.1097/HJH.0000000000002959

Pinkhasov, R. M., Wong, J., Kashanian, J., Lee, M., Samadi, D. B., Pinkhasov, M. M., & Shabsigh, R. (2010). Are men shortchanged on health? Perspective on health care utilization and health risk behavior in men and women in the United States. International journal of clinical practice, 64(4), 475-487. https://doi.org/10.1111/j.1742-1241.2009.02290.x

Sen, A., Anand, S., & Peter, F. (2004). Why health equity?. 659–666. Singh, P. K., Singh, L., Dubey, R., Singh, S., & Mehrotra, R. (2019). Socioeconomic determinants of chronic health diseases among older Indian adults: a nationally representative

cross-sectional multilevel study. BMJ open, 9(9), e028426.

Smith, J. P. (2012). Preparing for population aging in Asia: Strengthening the infrastructure for science and policy. In Aging in Asia: Findings from New and Emerging Data Initiatives. National Academies Press (US).

Srivastava, S., Chauhan, S., & Patel, R. (2021). Socio-economic inequalities in the prevalence of poor self-rated health among older adults in India from 2004 to 2014: a decomposition analysis. Ageing International, 46(2), 182-199.

Tandon, N., Anjana, R. M., Mohan, V., Kaur, T., Afshin, A., Ong, K., ... & Dandona, L. (2018). The increasing burden of diabetes and variations among the states of India: the Global Burden of Disease Study 1990–2016. The Lancet Global Health, 6(12), e1352-e1362.

Truesdale, B. C., & Jencks, C. (2016). The health effects of income inequality: averages and disparities. Annual Review of Public Health, 37, 413-430. https://doi.org/10.1146/annurev-publhealth-032315-021606

Vellakkal, S., Millett, C., Basu, S., Khan, Z., Aitsi-Selmi, A., Stuckler, D., & Ebrahim, S. (2015). Are estimates of socioeconomic inequalities in chronic disease artefactually narrowed by self-reported measures of prevalence in low-income and middle-income countries? Findings from the WHO-SAGE survey. J Epidemiol Community Health, 69(3), 218-225.

Wagstaff, A., O'Donnell, O., Van Doorslaer, E., & Lindelow, M. (2007). Analyzing health equity using household survey data: a guide to techniques and their implementation. World Bank Publications.

Xie, E. (2009). On the Equalization in Health and Medical Service in Urban and Rural Areas.

Xie, E. (2011). Income-related inequalities of health and health care utilization. Frontiers of Economics in China, 6(1), 131-156.

Xu, Y., Yang, J., Gao, J., Zhou, Z., Zhang, T., Ren, J., ... & Chen, G. (2016). Decomposing socioeconomic inequalities in depressive symptoms among the elderly in China. BMC public health, 16, 1-9.

Zeng, Y., Lu, J., & Lei, X. (2018). Healthy Aging in China: Trends and Determinants.