

Health and Social Impacts of Relocation to Alternative Housing Areas in Egypt: Changes in Health Expenditures and Healthcare Service Quality

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Abstract

This study assessed the health and social impacts of relocating families from informal settlements to alternative housing areas in Egypt, with a particular focus on changes in healthcare expenditures and satisfaction with healthcare services. A stratified random sample of 1,139 households was selected from three alternative housing areas: Al-Mahrousa (n = 684), Ard El-Khayala (n = 264), and Rawdat El-Sayeda (n = 191). Data were collected using a purpose-designed questionnaire that captured demographic characteristics, household health conditions, chronic diseases, disabilities, medication needs, housing conditions, and perceptions of healthcare services before and after relocation. To evaluate the effects of relocation, a random-effects linear regression model was used to analyze changes in household health expenditures, while an ordered logistic regression model was applied to identify determinants of satisfaction with healthcare services after relocation. The findings indicated that average monthly household health expenditures increased by 69%, rising from 241 EGP before relocation to 407 EGP afterward. Although housing conditions improved substantially, 59.8% of respondents rated healthcare services as poor, suggesting persistent concerns regarding service accessibility and quality. The regression analysis showed that relocation was significantly associated with increased health expenditures ($\beta = 316.53$, $p < 0.001$), particularly among households with chronic diseases, disabilities, and higher educational attainment. Satisfaction with healthcare services declined significantly following relocation ($\beta = -2.94$, $p < 0.001$), with income changes and relocation site influencing perceived service quality. These findings highlight the importance of integrating accessible and affordable healthcare services into housing relocation programs to reduce financial burdens, address service gaps, and promote equitable access to healthcare for vulnerable populations.

Introduction

About 55% of the world's population lives in urban areas, and this proportion is expected to rise to 68% by 2050. Urbanization, the gradual shift in population from rural to urban areas, combined with overall global population growth, is projected to add 2.5 billion people to urban areas by 2050, with nearly 90% of this increase occurring in Asia and Africa, according to a new dataset released today by the United Nations¹. The rapid and uneven urbanization in many developing countries has led to urban sprawl outpacing governments' capacity to plan and provide adequate housing and basic services. As a result, increasing numbers of low-income residents have resorted to settling in unplanned areas known as slums or informal settlements, which often lack basic infrastructure and sufficient health and social services^{2,3}.

Over time, slums have extensively spread across developing countries and have become a distinctive feature of urban landscapes. Worldwide, the proportion of the urban population living in slum areas increased from 23% in 2014 to 24% in 2018, reaching approximately 1 billion slum dwellers⁴. These areas have become a prominent feature of urbanization in major cities, particularly in developing countries, including Egypt, making slums one of the most significant urban and health challenges of the modern era.

In Egypt, informal settlements constitute a significant portion of the urban fabric, characterized by a lack of planning and basic services such as drinking water, sanitation, and electricity, which adversely affect residents' quality of life. According to the Central Agency for Public Mobilization and Statistics (CAPMAS) and the National Slum Development Fund, there are approximately 1,100–1,221 informal settlements across the country, spread over 226 out of 234 cities, housing an estimated 15 million people, including around 6.1 million in Cairo alone.

These areas include both unplanned and unsafe settlements, where residents often face environmental, structural, and social risks. Living conditions in these settlements contribute to poor health outcomes, limited access to healthcare, and increased vulnerability to social and economic hardships, making them a central concern for urban development and public policy in Egypt⁵.

Deteriorating health conditions are among the most critical challenges facing slum dwellers ⁶. Their health deteriorates due to the severe living conditions they endure, especially inadequate health facilities, a lack of clean water, and inadequate food^{7,8}. They also suffer from social risks such as crime and deprivation, in addition to the impact of social and economic factors that exacerbate the spread of disease and limit access to healthcare⁹

Slum dwellers face negative impacts on their health as a result of social and economic factors ¹⁰. The health of children in informal settlements is worse than that of children living in safer areas with better health resources. Children's health is significantly affected by housing conditions and the surrounding environment ¹¹ In informal settlements, children suffer from multiple health problems such as respiratory diseases, diarrhea, and tuberculosis due to overcrowding, lack of sanitation facilities, and unsafe drinking water ¹².

Previous studies have investigated the factors associated with reporting poor health status, especially chronic diseases in slums⁸, as well as factors influencing healthcare-seeking behavior among their residents.^{6,13–16}. These studies revealed significant factors affecting healthcare demand and utilization in slums, particularly among patients with chronic diseases. The quality, source, and scope of healthcare access are significantly influenced by socioeconomic characteristics, including geographic location, gender, and income level. Additionally, they also demonstrate widespread dependence on the private health sector, especially in areas with inadequate public service delivery, leading to catastrophic financial costs for low-income families. Many common barriers, such as lack of health knowledge, social stigma, financial constraints, and lack of formal recognition of slum residents, have emerged as factors influencing both healthcare access and provision.

Due to the challenges faced by residents in these areas, the government has started to adopt a more positive approach. They are developing policies and strategies aimed at improving living conditions by providing alternatives to slums that feature better infrastructure and more suitable housing, especially basic services. However, few studies have explored the impact of slum alternatives on residents' lives. (Barnhardt et al., 2017; Bradlow et al., 2011; Chetty et al., 2015; Kapse et al., 2012).

Although resettlement is supposed to be a crucial step in improving slum dwellers' living standards, enhancing their economic status, and, in some cases, saving their lives, its success cannot be guaranteed in all cases ¹¹. For example, resettlement was successful in the United States¹⁷, but failed in South Africa¹⁸ and India as many residents returned to their original locations^{19,20}. These studies have confirmed that slum dwellers must agree to relocate, and that providing high-quality, fully equipped housing and sufficient employment opportunities will allow for effective resettlement.

It is necessary to assess the success of slums alternatives in providing adequate and high-quality health services, as residents' satisfaction with these services is a crucial indicator of the effectiveness of the policies being implemented. In this context, this study aimed to assess the health and social impacts of relocating families to alternative housing areas by analyzing changes in their health status and satisfaction with available

health services after relocation. The study sought to provide a comprehensive understanding of how health expenditures and the quality of health services provided in the relocation areas were affected, as well as to explore the socioeconomic factors that might explain these changes. The hope is that the findings will contribute to improving relocation policies and ensuring equitable access to appropriate health services for the population.

Methods

Sample Size and Selection Method

The study relied on a stratified random sample representative of the original population of households that relocated to three alternative areas: Al-Mahrousa, Rawdat Al-Sayeda, and Ard Al-Khayala. A random sample was then selected from each stratum, proportional to its relative size within the overall population, ensuring accurate representation of each area under study.

The actual number of households in Al-Mahrousa is 4,200, in Rawdat Al-Sayeda 816, and in Ard Al-Khayala 1,300, totaling 6,316 households. The sample design was based on these actual household sizes in each area, with a margin of error of 5% and a 95% confidence level. The initial sample size was 892 households, distributed across the three districts according to their relative weight. The number of households in Rawdat El Sayeda was 143, in El Mahrousa 538, and in Ard El Khayala 211, bringing the total number of households in the three districts to 892.

To ensure the quality of the field data, 10% was added to account for non-response rates, and an additional 25% to cover incomplete visits or unmet cases. The final sample size was 1,139 households, divided as follows: 191 in El Sayeda, 684 in El Mahrousa, and 264 in Ard El Khayala.

Data collection tool

The study specifically developed questionnaire to assess the conditions of families relocated to alternative slum areas in Egypt, including Al-Mahrousa, Rawdat Al-Sayeda, and Ard Al-Khayala. The questionnaire included several key sections: demographic characteristics, education level, employment status and income, family health conditions, an assessment of housing conditions before and after relocation, water sources, hygiene levels, availability of basic services, and community problems within the area. It also included questions about future needs and the services that participants deemed essential in the area.

The questionnaire included a section dedicated to assessing the health conditions of the relocated families, addressing a range of key indicators reflecting their health status before and after relocation. Questions included checking for chronic diseases among family members such as diabetes, hypertension, heart disease, spinal disorders, osteoarthritis, and allergies, as well as a section for other potential illnesses. It also included questions about malnutrition or anemia and the need for regular, periodic medication. The questionnaire also assessed respondents' perceptions of how much their health had improved after relocating, and their opinions on the level and availability of healthcare services before and after relocation, including service quality, doctor availability, cost of healthcare, and the distance of service providers. Information was also collected on where they previously received treatments such as government hospitals, health units, private clinics, and pharmacies—providing a comprehensive understanding of changes in healthcare service usage patterns after relocation.

Statistical analysis

A descriptive analysis of the sample characteristics was first conducted to study the social, demographic, and health features of the households. This included calculating the frequencies and percentages of qualitative variables, such as gender, employment status, educational attainment, marital status, and the presence of chronic diseases or disabilities within the household. Means and standard deviations were also calculated for continuous variables such as the age of the respondent, household size, the number of elderly individuals, and the number of individuals with anemia or taking monthly medication.

We estimated two complementary statistical models to evaluate both the objective and subjective aspects of household's health related outcomes in the alternative areas. The first model involves changes in health expenditure which serves as an objective measure of health care use and the financial effort involved. The other model concerns evaluation of health services which captures household's satisfaction with access to care and its quality. In sum, we have two health outcomes: change in health expenditure and health services evaluation after relocation.

Model 1: Change in Household Health Expenditure

Since our outcome variable, which is presented as the change in household health expenditure, is a continuous variable, and given that all the assumptions of the linear regression have been verified and satisfied, and since the structure of the data includes repeated observations for the same households before and after relocation, thereby creating a panel framework in which observations are not independent but clustered within households, the study employs a random-effects linear regression model to investigate the factors associated with the change in health expenditure among households. Using this model, the study analyzes how the relocation process is associated with variations in household health spending and its relationship with key socio-demographic and economic characteristics of the respondents and their households.

The independent variables included in the model are the number of household members, age of the respondent, number of elderly members aged 60 years or above, presence of disability, gender of the respondent and of the household head, employment status after relocation, educational attainment, marital status, presence of chronic diseases, and the change in total household income. Additionally, the model includes interaction terms between the relocation status (before and after) and critical variables such as slums areas, income change, disability, chronic diseases, and household size to capture the potential differences in how relocation affects different household types. Through these relationships, the study seeks to explore how relocation influences households' capacity and willingness to spend on healthcare services, identifying whether improvements in living conditions translate into greater access and utilization of health services.

To assess the presence of multicollinearity among the explanatory variables, the Variance Inflation Factor (VIF) and its reciprocal (Tolerance) were examined using an ordinary least squares specification of the health expenditure model.

Model 2: Household Satisfaction with Health Services After Relocation

Because the dependent variable—household evaluation of health services—is ordinal, an ordered logistic regression was applied to examine the determinants of satisfaction with healthcare quality and accessibility following relocation. An initial random-effects ordered logit was tested to account for within-household correlation and then compared with pooled ordered logistic model.

The model controls for a set of socio-demographic and economic variables, including household size, respondent’s age, presence of elderly or disabled members, gender of the respondent and household head, employment status, education, marital status, chronic disease, post-relocation income level, and relocation site. This allows for assessing how relocation from informal to formal housing settings influences households perceived quality of healthcare services.

Results

Sample Characteristics

Table 1 presents Socio-demographic Profile of Residents in Alternative Housing Areas Most respondents were female (68.7%), currently married (64.4%), and unemployed at the time of the survey (68.3%). More than one-third of respondents (35.9%) had no formal schooling, while an additional 23.1% had education below the intermediate level. Only 9.1% had attained post-secondary or higher education. The average age of respondents was 47.6 years. The mean household size was 4.1 members, with households including an average of 0.5 elderly individuals aged 60 years or above.

Male-headed households constituted the majority of the sample (70.5%), while female-headed households represented 29.5%. Regarding household income after relocation, 48% of respondents reported an increase, 24% reported a decrease, and 28% indicated no change. In terms of geographic distribution, the largest proportion of respondents resided in El Mahroosa (60.1%), followed by Ard El-Khayala (23.2%) and Rawdat El-Saidah (16.8%).

Table 1
Socio-demographic Profile of Residents in Alternative
Housing Areas (n = 1139)

Characteristics	N	%
Gender		
Male	356	31.3%
Female	783	68.7%
Household head Gender		
Male	803	70.5%
Female	336	29.5%
Working Status after relocation		
Unemployed	778	68.3%
Employed	361	31.7%
Education		
No schooling	409	35.9%
below intermediate	263	23.1%
Intermediate	363	31.9%
Post-secondary or higher	104	9.1%
Marital status		
Single	103	9.0%
Married	733	64.4%
Widowed	223	19.6%
divorced/separated	80	7.0%
Age of Respondent (Mean ± SD)	47.6 ± 14,82	
Household size (Mean ± SD)	4.1 ± 1.74	
Elderly Members (≥ 60 years) (Mean ± SD)	0.5 ± 0.99	
Relocation Areas		
El Mahroosa	684	60.1%
Rawdat El-Saidah	191	16.8%
Ard El-Khayala	264	23.2%

Table 2 indicates that health problems are highly prevalent among households in the alternative housing areas. More than half of the respondents (60.4%) reported that at least one household member suffers from a chronic disease. Hypertension (66.4%) and diabetes (52%) were the most reported chronic conditions, followed by

osteoarthritis and joint diseases (48.4%). Other diagnosed conditions such as heart diseases (30.7%), allergies (19.2%), and spinal disorders (16.1%) were also reported at different levels. Regarding nutritional health, 23.2% of households reported at least one member suffering from anemia or malnutrition, with an average of 1.72 affected members per household.

Approximately 26% reported having at least one disabled member. More than half of the households (55.4%) reported that at least one member requires monthly medication, with an average of 1.29 individuals per household. The results indicate that the majority of residents who relocated to alternative areas are dissatisfied with the level of healthcare services provided in these areas. 59.8% of respondents rated healthcare services as "poor," while only 9.1% considered them "good." A significant percentage (25.8%) were unable to provide a clear assessment.

Table 2
Health Profile of relocated residents in Alternative Areas

Characteristics	N (%)
Presence of chronic diseases among household members	688 (60.4)
Yes	452 (39.6)
No	
Types of chronic diseases (for those who answered "Yes")	
Diabetes	358 (52)
Hypertension	457(66.4)
Heart diseases	211(30.7)
Spinal disorders	111(16.1)
Osteoarthritis and joint diseases	333(48.4)
Allergies	132(19.2)
Other (specified)	119(17.3)
Presence of anemia or malnutrition among household members	265(23.2)
Yes	875(76.8)
No	
Number of household members with anemia or malnutrition (Mean ± SD)	1.72 ± 1.23
Disability	302 (26.5)
Yes	837 (73.5)
No	
Household members requiring monthly medication	632 (55.4)
Yes	508(44.6)
No	
Number of household members requiring monthly medication (Mean ± SD)	1.29 ± 0.54

Household's health related outcomes

Household health expenditure increased markedly following relocation. Before relocation, the average monthly spending on health services was 241 EGP, while after relocation it rose to approximately 407 EGP, representing a significant 69% increase in average expenditure.

A substantial deterioration in perceived access to health services is observed after relocation. Before relocation, nearly 89% of households rated health service availability as good or very good. In contrast, after relocation, only 31% expressed positive evaluations, and almost 60% described service availability as poor.

This decline in satisfaction suggests that the new relocation areas may lack adequate health facilities or that access barriers—such as distance, transportation, or availability of medical personnel—have increased after resettlement. These descriptive findings align with the regression results, which also indicate significantly lower satisfaction with health services after relocation.

The results highlight the significant challenges families encounter in accessing adequate healthcare services following relocation to alternative housing areas. The most prominent issues are related to the limited availability and quality of basic medical services. Nearly half of respondents (47.8%) reported that medical examination centers were located far from their homes, while more than half indicated a shortage of doctors (50.8%) and high costs for healthcare services (51.1%), reflecting both financial burdens and restricted access to care. Additionally, 37.6% of respondents reported poor doctor competence, and 18.9% noted that pharmacies were distant, which further complicates access to necessary medications, particularly for individuals requiring chronic treatment or continuous medical monitoring. These findings suggest that healthcare provision in the new housing areas is inadequate, contributing to the observed dissatisfaction among relocated residents.

Model 1: Factors Influencing Changes in Health Expenditure in the Alternative Areas

Before conducting the random-effects model to investigate the factors associated with the change in health expenditure among households, we ensured that all the assumptions of linear regression were verified and satisfied. Multicollinearity was not problematic, as the analysis yielded a mean VIF of 3.0, indicating an overall low level of collinearity. Most predictors showed VIF values well below the conventional threshold of 10 and Tolerance values above 0.10. Only one interaction term (relocation status and relocation areas) displayed a slightly elevated VIF (10.5; Tolerance = 0.09), and the interaction term (relocation status and household size) had a VIF of 7.25 (Tolerance = 0.14), which is commonly expected for interaction variables and does not pose a substantive concern. Other linear regression assumptions, including linearity, homoscedasticity, normality of residuals, independence of errors, and absence of influential outliers, were also examined and met.

The choice of the random-effects specification assumed that unobserved household-specific effects are uncorrelated with the explanatory variables. This assumption was supported by the Hausman test, which indicated no significant correlation between the unobserved effects and the predictors, validating the appropriateness of the random-effects model for this analysis.

Overall, the model demonstrates a robust fit (Wald $\chi^2(26) = 359.19$, $p < 0.001$; within $R^2 = 0.31$), confirming that relocation significantly influences household health spending patterns. As shown in Table 3, the relocation had a statistically significant positive effect on household health expenditure ($\beta = 316.53$, $p < 0.001$), confirming that families spent substantially more on healthcare services after moving to formal housing. Households whose income decreased spent significantly less after relocation (after $\times$ income decreased: $\beta = -105.75$, $p < 0.001$), as did those reporting no income change (after $\times$ income unchanged: $\beta = -91.58$, $p < 0.001$).

In terms of health vulnerability, households without chronic diseases showed markable lower expenditures ($\beta = -102.63$, $p < 0.001$), and the interaction between relocation and the absence of chronic conditions was also negative and significant ($\beta = -123.15$, $p < 0.001$). Similarly, households without disabled members had lower overall spending ($\beta = -51.29$, $p = 0.025$), and the interaction term (after $\times$ no disability) indicated a further reduction ($\beta = -90.13$, $p = 0.001$). Among socioeconomic factors, education emerged as a significant positive on

health expenditure—households with highly educated heads reported greater expenditures ($\beta = 104.81$, $p = 0.048$)—while other demographic characteristics, including age, gender, and marital status, did not exert significant effects.

Table 3
Factors Associated with Household Health Expenditure based on Random-Effects Linear Regression

Variable	Description	Coefficient (β)	Robust SE	z-value	p-value
Relocation Status		316.53	44.26	7.15	0.000
Relocation Areas	Rawdat El-Saidah	-24.69	23.16	-1.07	0.286
	Ard El-Khayala	-17.23	26.29	-0.66	0.512
	Interaction (Relocation × Rawdat El-Saidah)	-28.31	22.17	-1.28	0.202
	Interaction (Relocation × Ard El-Khayala)	2.50	26.53	0.09	0.925
Income after relocation	declined	-23.73	23.96	-0.99	0.322
	No change	13.30	20.30	0.66	0.512
	Relocation × Income decreased	-105.75	27.54	-3.84	0.000
	Relocation × No income change	-91.58	22.94	-3.99	0.000
Chronic disease	No	-102.63	21.39	-4.80	0.000
	Interaction (Relocation × No)	-123.15	19.73	-6.24	0.000
Disability	No	-51.29	22.93	-2.24	0.025
	Interaction (Relocation × No disability)	-90.13	26.56	-3.39	0.001
Household size		-0.87	8.01	-0.11	0.914
	Interaction (Relocation × HH Size)	1.65	6.72	0.25	0.806
Age of respondent		1.32	1.27	1.04	0.298
Elderly Members (≥ 60 years)		11.19	7.67	1.46	0.145
Gender respondent	female	-12.10	34.33	-0.35	0.725
Household head Gender	female	12.54	37.67	0.33	0.739
Working Status after relocation	Employed	37.93	29.73	1.28	0.202
Education:	below intermediate	24.54	27.77	0.88	0.377
	intermediate	58.38	34.06	1.71	0.086
	Post-secondary or higher	104.81	53.07	1.97	0.048
Marital status	married	18.01	43.58	0.41	0.679
	widowed	-1.34	58.78	-0.02	0.982

Variable	Description	Coefficient (β)	Robust SE	z-value	p-value
	divorced/separated	−31.22	54.24	−0.58	0.565
Constant		201.35	97.82	2.06	0.040

Factors Affecting Household Satisfaction with Health Services After Relocation

Ordered logistic regression was applied to examine the determinants of satisfaction with healthcare quality and accessibility following relocation. An initial random-effects ordered logit was assessed to account for within-household correlation; however, the estimated variance of the random intercept was effectively zero ($\sigma^2_u \approx 0$), and the likelihood-ratio test ($\chi^2(0) = 0.00$) indicated no significant difference from a pooled specification. Consequently, the results are based on the pooled ordered logistic model. The model demonstrated an overall fit (LR $\chi^2(19) = 680.90$, $p < 0.001$) and a McFadden pseudo- $R^2 = 0.2013$, indicating meaningful explanatory power for an ordinal satisfaction model.

As shown in Table 4, Relocation status was found to be a highly significant determinant of satisfaction ($\beta = -2.94$, $p < 0.001$). Given the coding structure (higher values = better evaluation), this negative coefficient implies that households were substantially increases the probability of reporting lower satisfaction after relocation to formal housing.

Households whose income decreased after relocation were markedly less satisfied ($\beta = -0.65$, $p < 0.001$), and those reporting no income change were also less satisfied ($\beta = -0.41$, $p = 0.001$) compared with those who experienced income gains. Result shows that households in Rawdat El-Saidah ($\beta = 0.86$, $p < 0.001$) and Ard El-Khayala ($\beta = 0.44$, $p = 0.001$) expressed significantly higher satisfaction levels than residents in the reference site, suggesting differences in healthcare accessibility or quality across resettlement locations.

Among personal characteristics, female respondents were significantly more likely to report higher satisfaction ($\beta = 0.35$, $p = 0.030$). Other socio-demographic factors—including household size, age, presence of elderly or disabled members, marital status, education, and employment—were not statistically significant predictors.

These findings suggest that relocation to formal housing substantially decline in households' satisfaction with health services, reflecting deterioration in both accessibility and perceived service quality. Moreover, disparities linked to income stability and relocation site highlight the need for targeted improvements in post-relocation healthcare provision to ensure equitable service access across communities.

Table 4
Determinants of Household Satisfaction with Health Services based on ordered Logistic Regression

Variable		Coefficient (β)	Std. Error	z-value	p-value	95% Confidence Interval
Relocation (After = 1)		-2.938***	0.135	-21.79	0.000	[-3.202, -2.674]
Household size		-0.014	0.034	-0.41	0.679	[-0.081, 0.053]
Respondent's age		0.006	0.006	1.00	0.320	[-0.005, 0.017]
Elderly Members (60+)		-0.043	0.050	-0.86	0.389	[-0.141, 0.055]
Disability (No)		-0.032	0.126	-0.26	0.797	[-0.279, 0.214]
Income level (after relocation)	Decreased	-0.649***	0.143	-4.54	0.000	[-0.929, -0.368]
	No change	-0.408***	0.126	-3.23	0.001	[-0.656, -0.160]
Relocation Area	Rawdat El-Saidah	0.860***	0.151	5.70	0.000	[0.565, 1.156]
	Ard El-Khayala	0.442***	0.139	3.19	0.001	[0.171, 0.714]
Gender (Female)		0.352**	0.162	2.17	0.030	[0.035, 0.670]
Household head gender (Female)		-0.013	0.199	-0.07	0.947	[-0.403, 0.376]
Employment Status (Working)		0.203	0.143	1.42	0.156	[-0.077, 0.483]
Education (Ref = Illiterate)	Below Intermediate	-0.038	0.147	-0.26	0.797	[-0.327, 0.251]
	Intermediate	-0.193	0.150	-1.29	0.196	[-0.487, 0.100]
	High	-0.223	0.230	-0.97	0.333	[-0.674, 0.228]
Marital status (Ref = Single)	Married/Union	-0.137	0.211	-0.65	0.517	[-0.551, 0.277]
	Widowed	-0.307	0.281	-1.09	0.274	[-0.857, 0.243]
	Divorced/Separated	-0.421	0.299	-1.41	0.159	[-1.007, 0.164]
Chronic diseases (No)		0.047	0.122	0.38	0.702	[-0.193, 0.287]

Discussion and conclusion

This study examined the impact of relocating households from informal settlements to alternative formal housing areas on healthcare access, household health expenditure, and satisfaction with health services. The study compared conditions before and after relocation and provided empirical evidence on whether slum upgrading and resettlement policies translate into improved healthcare outcomes. Unlike many previous studies

that focus on housing quality or economic mobility alone, this study contributes to literature by simultaneously analyzing health expenditure satisfaction with health services in the alternative's areas.

The findings indicate a substantial increase in household health expenditure following relocation. This result aligns with previous studies suggesting that relocation to formal housing may expose households to higher healthcare costs due to reduced access to informal, low-cost providers and increased reliance on private healthcare services^{13,15}. Our findings differ from Chetty et al. (2015), who documented long-term reductions in healthcare costs among relocated households in the United States, largely attributed to improved neighborhood resources and stronger healthcare infrastructure²¹.

The observed increase in health expenditure following relocation reflects multiple, overlapping mechanisms. On one hand, relocation to formal housing may reduce certain structural barriers to healthcare access, encouraging households to seek medical care for conditions that were previously untreated or inadequately managed. This increase in utilization can temporarily raise health spending, particularly in the short term after relocation²². On the other hand, the findings indicate that higher expenditure also represents a substantial financial burden, especially for low-income households and those with chronic diseases or disabilities who require continuous medical care and regular medication^{16,23}. In the absence of adequate public healthcare provision or financial protection mechanisms, increased reliance on private healthcare services may further exacerbate out-of-pocket spending^{24–26}. Therefore, the rise in health expenditure observed in this study reflects both improved healthcare-seeking behavior and heightened economic vulnerability, underscoring the need to accompany relocation policies with strengthened, affordable healthcare services.

Households experiencing income decline after relocation were less able to cope with increased healthcare costs, consistent with evidence that income stability is central to healthcare affordability in urban poor settings^{6,23,24,27}. Furthermore, households with chronic illnesses incurred significantly higher expenditures, highlighting the sustained financial pressures associated with long-term conditions^{25,28,29}. These results emphasize that relocation can amplify existing socioeconomic and health inequalities unless supported by targeted interventions, including affordable healthcare and income support.

Despite improvements in housing conditions, satisfaction with healthcare services declined post-relocation. This indicates that better housing alone does not guarantee improved healthcare experiences when access to essential services is limited^{11,18}. Relocation may disrupt established healthcare-seeking patterns, especially if new areas lack nearby clinics, adequate medical staff, or affordable services. Households previously relying on informal providers face greater challenges, which may reduce perceived quality and accessibility, offsetting the benefits of improved housing. Differences in satisfaction across sites suggest spatial inequalities, with higher satisfaction where healthcare services are better integrated^{20,23}.

Differences in satisfaction levels across relocation sites indicate spatial inequalities in healthcare provision. Higher satisfaction in some areas likely reflects better integration into existing healthcare networks, while lower satisfaction in others points to persistent access barriers. These findings highlight the importance of equitable spatial planning to ensure consistent healthcare availability across all relocation areas.

The strength of this study lies in being one of the few to specifically examine the impact of relocation on healthcare outcomes across three alternative housing areas, providing valuable insights into site-specific

variations. The study considers both actual health expenditures and households' satisfaction with healthcare services, offering a comprehensive understanding of how relocation affects households. However, several limitations should be noted. The data are self-reported, which may introduce recall bias. The study did not include a control group of non-relocated households, limiting the ability to fully isolate the effects of relocation. Additionally, indirect healthcare costs, such as transportation or lost income due to medical visits, were not measured, potentially underestimating the financial burden on households.

Relocation policies should focus not only on improving housing but also on ensuring accessible and affordable healthcare, especially for households with chronic illnesses or disabilities. It is important to provide nearby health facilities, adequate staff, essential medicines, and financial protection to prevent increased healthcare spending. Continuous monitoring of residents' satisfaction can help quickly address gaps in services.

Declarations

Ethical approval

The study was approved by the Ethics Committee of the Faculty of Graduate Studies for Education, Cairo University, Egypt.

Consent to participate

Informed consent to participate in the study was obtained from all participants.

Consent to publication

Not applicable.

Availability of data and materials

The datasets analyzed during the current study are available from the corresponding author upon reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Figures

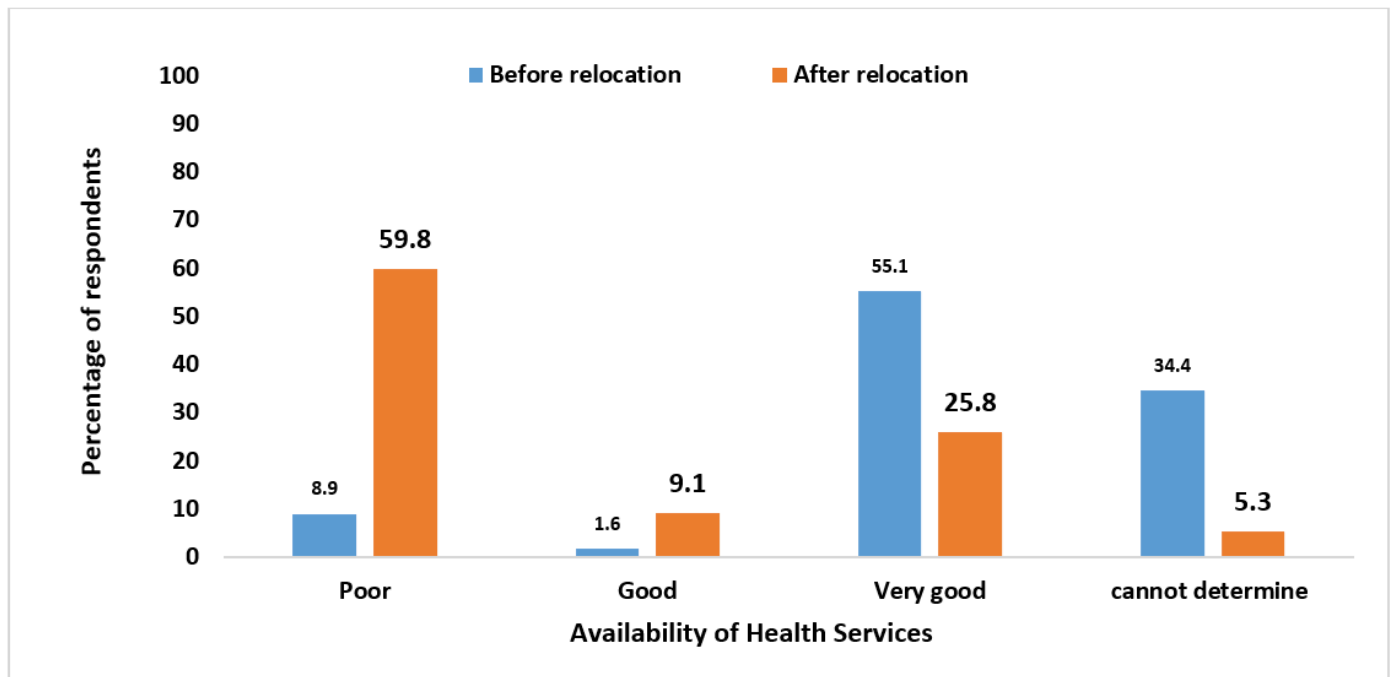


Figure 1

Unnumbered image in the Results section.