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Applying the Paired-t-test and Cohen's d to Assess How Far Remittances Improve Household Welfare in Zanzibar: The Case of Wete and Chake-Chake Districts in Pemba

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Abstract

Diaspora remittances play a significant role in supporting household income in many developing countries, particularly in areas with limited employment opportunities and weak social protection. This paper uses the Paired-t-test and Cohen's d to determine how far remittances have been used to improve household welfare. Also, it is guided by the altruism theory of remittances, the Amartya Sen Framework, and the self-interest theory of remittances. Three data collection methods were employed—household surveys, documentary reviews, and in-depth interviews—to source a sample of 300 households that received remittances, and 15 key informants. The results show that remittances tend to improve household welfare, with most households reporting increased welfare levels: from 77% at a low level and 23% at a high level before receiving remittances, to 18% at a low level and 82% at a high level afterwards. Paired-t-tests confirmed significant welfare improvements in the household indicators, with households shifting from low levels to high levels of improvement, and remittances acting as an intervening factor. The Cohen's d indicated a medium to large effect size across all welfare indicators. The paper concludes that remittances play a statistically significant role in the improvement of household welfare in Pemba; and recommends promoting the productive use of remittances through increased diaspora engagement, and the strengthening of formal remittance channels to maximise benefits.

Keywords: *remittances, household welfare, paired sample t-test, Cohen's d.*

1. Introduction

Global migration continues to rise and has become an important household strategy for coping with economic shocks and reducing vulnerability through remittances (Abuiyada, 2018). Migrants send remittances to support their households, thereby helping tackle household issues (Kamran et al., 2013). Valuable contributions of remittances include expertise in technological know-how, which is transferred to countries of origin when members of the diaspora share ideas with their home countries (Mbaye et al., 2020). Among other things, remittances have been involved in the establishment of projects that contribute to increased development in different sectors, such as education projects through, for example, building schools and other educational infrastructures (Malik, 2015). In this sense, the diaspora considers themselves as a part of their societies that need to make changes; hence, they participate in building productive capacities in origin countries using their accumulated knowledge, experience, and networks (Adow, 2025).

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Globally, remittances grew by 10% to US$689 billion, with nearly three-quarters flowing to developing countries (Hueay et al., 2019). Asia remains the largest recipient, led by India, China, and the Philippines; while Latin America and the Caribbean—particularly Mexico—also receive substantial inflows. Africa's share is comparatively modest at about US$40 billion; though remittances are critical in countries such as Somalia and South Sudan, where they account for over 15% of GDP (Helblig & Kalkum, 2018). In East Africa, Kenya, Uganda, and Somalia are the major recipients; while Tanzania receives approximately US$757 million annually, a figure that has steadily increased over two decades (Docquier et al., 2023). These global and regional patterns highlight the growing importance of remittances as a source of household and national income, setting the stage for examining their impact in Zanzibar, where migration and diaspora engagement are particularly significant.

Previous studies on remittances in Tanzania and Zanzibar have largely described household impacts in narrative terms, without applying statistical tests to confirm whether observed changes were attributable to remittances or other factors (Ismailov et al., 2019; Docquier et al., 2023; Kilama, 2016; Makina & Magwedere, 2023; Panizzon, 2015, Nzilano & Magoti, 2025, Nassor, 2023; Yahya & Mbonile, 2016; Sheha, 2018; Marshal, 2021). Most analyses have focused on macroeconomic contributions or descriptive household outcomes, leaving methodological gaps in measuring welfare changes before and after remittance receipt. This study addresses that gap by employing a before-and-after comparative design using paired-samples t-tests and Cohen's d effect size (hereafter, Cohen's d), thereby providing empirical evidence of the extent to which remittances improve household welfare in Pemba. By focusing on Wete and Chake-Chake districts, which are heavily affected by diaspora migration, the study contributes context-specific insights that advance both empirical and methodological understanding of the impacts of remittances in Zanzibar.

2. Theoretical Framework

The paper was guided by three theories: the altruism theory of remittances, the self-interest theory of remittances, and Amartya Sen's household welfare theory. The altruism theory of remittances—developed by Robert E.B. Lucas and Oded Stark in 1985—holds that migrants send money home out of love, empathy, or solidarity to support their families' well-being and alleviate financial hardships. This implies that remittances are sent to households with the intention of supporting them. On the other hand, the self-interest theory of remittances—proposed and formalised by economists Robert E.B. Lucas and Oded Stark in 1985—argues that the diaspora send remittances to their households for the purpose of benefiting themselves rather than for purely supporting their household members. Lastly, Amartya Sen's welfare theory (1999) views household welfare in terms of the ability to achieve improved living conditions

across key indicators. Thus, while the altruism and self-interest theories explain motivations for sending remittance, Sen's capability approach frames how remittances expand household welfare. This theoretical triangulation positions remittances as both a social and economic intervention. In this paper, remittances are examined as an intervening factor that expands household capabilities and enhances welfare.

3. Conceptual Framework

The conceptual framework depicted in Figure 1 distinguishes between household welfare dimensions (education, healthcare, food security, housing) and the specific indicators used to measure them. Box 1 represents the baseline household welfare status before remittances, measured using indicators such as school enrolment and expenditure (education), healthcare expenditure and access (healthcare), frequency of meals per day (food security), and housing ownership (housing). Remittances are conceptualised as the independent variable influencing these welfare outcomes. Box 3 presents the same indicators post-remittances, allowing for paired comparison. This structure ensures consistency between baseline and outcome measures, and aligns with the paper's use of paired-t-tests and Cohen's d. By operationalising welfare dimensions through measurable indicators, the framework avoids subjective terms and enhances conceptual clarity.

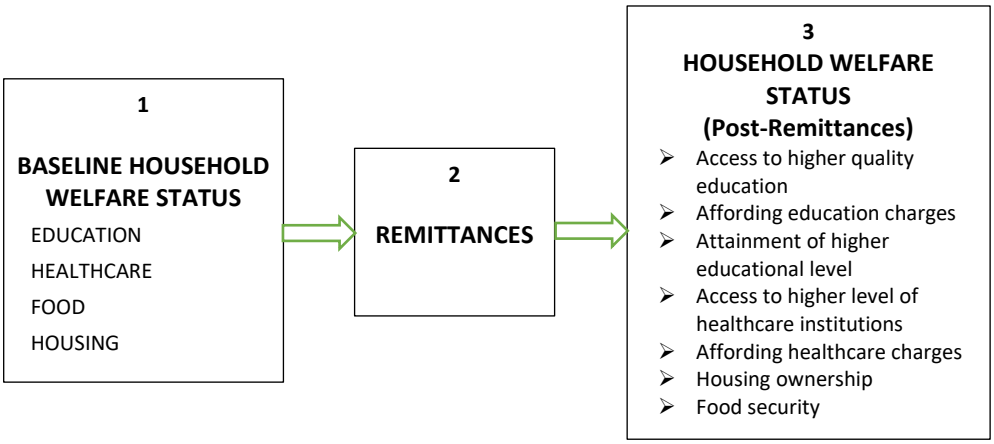


Figure 1: Modified Conceptual Framework

Source: Authors

The conceptual framework illustrates household welfare status before remittances (Box 1), remittances as the independent variable (Box 2), and household welfare status post-remittances (Box 3). Welfare dimensions include education, healthcare, food security, and housing; each measured through

specific indicators (e.g., enrolment, expenditure, access, frequency of meals, and housing ownership). Remittances are conceptualised as the explanatory factor driving changes in these indicators. The same measures are assessed before and post-remittances, enabling paired comparison through t-tests and effect size analysis. This structure ensures conceptual clarity, methodological consistency, and alignment with the study objectives.

The literature reveals an ongoing and significant debate regarding the role of remittances in development. Some studies contend that remittances should not be regarded as a tool for advancing development within a country, citing factors such as their insufficiency, bureaucratic barriers to transfers, low-income levels among the diaspora, and the presence of extended family obligations (Win, 2024; Kumar et al., 2024; Kweka, 2009). Conversely, most of the literature posits that remittances have contributed to community and national development, although with a predominant focus on macro-level impacts and limited consideration of household-level effects (Sheha, 2018; Ali, 2013; Hansen, 2012; Marshal, 2021; Isoto & Kraybill, 2017; Musakwa & Odhiambo, 2022; Ismailov et al., 2019). However, although these studies show that remittances help reduce poverty, increase consumption, and improve access to basic needs, they do not compare household welfare indicators before and post-remittances; and also they do not perform statistical tests to confirm whether changes were due to remittances or other factors. Hence, this paper aims to assess the extent to which remittances improved household welfare indicators before and post-remittances using a paired-samples t-test and Cohen's d.

4. Context and Methods

4.1 Description of the Study Area

Pemba is one of the two main islands—alongside Unguja—that make up Zanzibar, which gained its political independence through the 1964 Revolution. The Pemba Island is surrounded by several smaller islands; including Fundo, Kojani, Shamiana, Makoongwe, and Kisiwa Panza. It is located on the western side of the Indian Ocean, approximately 30km from the coast of East Africa. It lies between latitudes 7 and 5 degrees south, in the southern part of the equator. The island has a total area of about 988km^2. The study was conducted in two districts in Pemba: Wete and Chake-Chake. These districts were purposively selected because they are intensely affected by diaspora migration compared to the other districts (Yahya & Mbonile, 2016).

4.2 Sample and Sampling Process

A total of 300 households were selected, with one diaspora-origin member from each household participating in the survey, along with 15 key informants. For this study, a household is defined as a group of people who sleep under the same roof, eat together, and have one or more family members living outside the country.

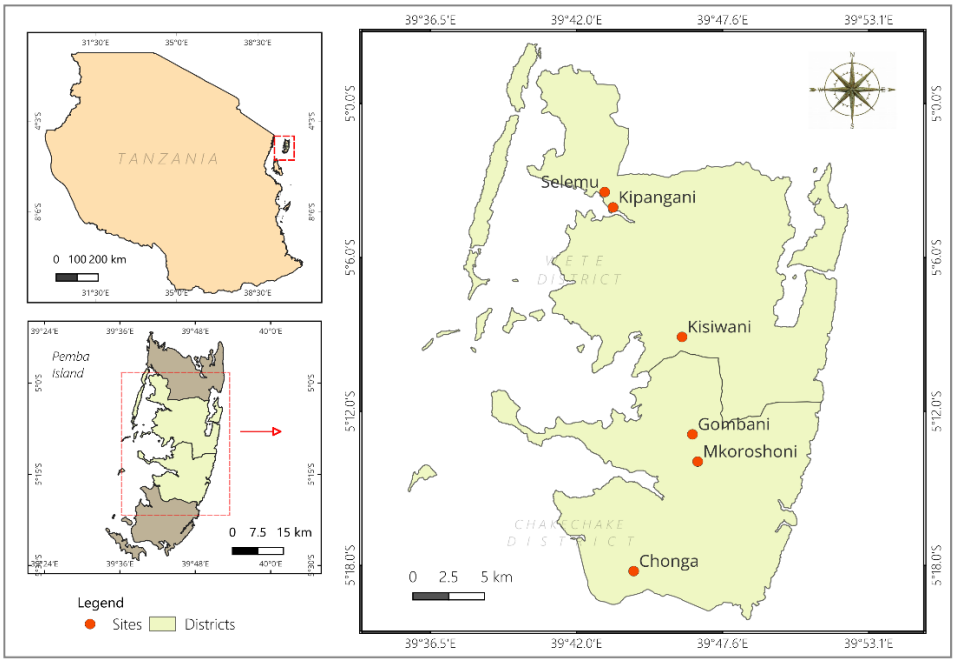


Figure 2: The Study Area

Source: UDSM Cartographic Unit, 2021

Simple random sampling was used to select the sample from the district and *shehia* registers that list households with diaspora. Since most households were not fluent in English, the questionnaires were translated into Kiswahili to ensure clarity and comprehension. This translation improved the accuracy of responses and facilitated smooth communication between the researchers and participants, effectively eliminating problems of language barriers.

4.3 Data Collection

The paper used three data collection methods; including a household survey, document review, and in-depth interviews. Structured questionnaires were administered to gather quantitative data on household well-being aspects—e.g., healthcare, educational costs, food access, and housing—to compare the situation before and after receiving remittances. Besides, an in-depth interview methodology was employed as certain primary data could only be obtained through key informant interviews. An interview guide was meticulously prepared to assist the researchers in gathering the necessary data. The key informants included officials from various agencies, such as the Zanzibar Diaspora Department, the migration unit, Zanzibar Milele Foundations, and banking personnel. These agencies provided pertinent information used to gather data regarding household welfare experiences both prior to and following remittances.

4.4 Data Analysis

The collected data were quantitatively analysed using the statistical measures of the paired samples t-test and Cohen's d. The tests were used to determine the extent to which remittances improve household welfare before and post-remittances. The paired samples t-test was performed to determine whether there were statistically significant differences in household welfare improvements between the two periods, either before or post-remittances. Moreover, Cohen's d was utilised to measure the effect size of remittances as an intervention on households' welfare improvement before and post-remittances.

Because the study compares household conditions before and post-remittances, the 'before' data were collected retrospectively through household surveys and interviews. The possibility of recall bias was acknowledged and sought to be mitigated by triangulating responses with key informants and documentary records. Education attainment was coded as ordinal (low/high), healthcare access as categorical (low/high), food security as frequency of meals per day, and housing as binary (own/not own). Assumptions underlying the paired-samples t-test—including normality of differences and independence of observations—were assessed and met prior to analysis. Normality of differences was checked using Shapiro-Wilk tests; and independence was ensured by household-level sampling.

Paired-samples t-tests were used to assess statistical evidence of changes in household welfare following remittances using data on seven indicators: accessing higher quality education, attaining higher education level, affording education charges, food security, affording healthcare charges, accessing best healthcare, and housing ownership. The indicators effectively measured welfare changes before and post-remittances, and evaluated the impact of an intervention. Accordingly, the question was stated as: "Are household welfare levels different before and post-remittances?" The hypotheses were also stated as:

a) Null Hypothesis (Ho): No significant differences between the two variables.
b) Alternative hypothesis (H_1): There is a significant difference between the two related variables.

In these hypotheses, the p-value was used to either reject or accept the null hypothesis. If $P \leq 0.05$, the null hypothesis was rejected, indicating statistically significant differences. If $P > 0.05$, the null hypothesis was not rejected, indicating no statistically significant differences between variables. Tests were run, using IBM SPSS, to assess changes in household welfare indicators before and post-remittances.

Besides the paired samples t-tests, the mean differences have been used to assess the difference between household welfare indicators in the level of improvement. The mean difference is obtained by taking the mean before remittances and subtracting it from the mean post-remittances.

$$\text{Mean Difference} = \text{Mean Post Remittances} - \text{Mean Before Remittances}$$

From the above, a positive mean difference indicates that the mean post-remittances is higher than the mean before remittances; whereas a negative mean difference indicates that the mean before remittances is higher than the mean post-remittances. A positive mean difference indicates that remittances, as an intervening factor, brought changes to a household, resulting in a higher mean post-remittance.

Cohen's d—named after psychologist Jacob Cohen (1923–1998)—is a standardised measure of effect size that quantifies the difference between two population means in standard deviation units. It indicates the relative strength of the difference between two group means. The calculation involves dividing the difference between the means by the data's standard deviation, typically the pooled standard deviation. Cohen identified 0.2 as small, 0.5 as medium, and 0.8 or higher as indicative of a large effect size. The mean and standard deviation differences were obtained after the data were entered into SPSS and analysed. The mean and standard deviation differences were processed through the software, and the results are shown in Table 1.

Table 1: Mean and Standard Deviation Differences Across Household Welfare Indicators (SPSS Results)

Variable	Mean Difference	Standard Deviation Difference
Attaining a High Educational Level	1.25	0.537
Housing Ownership	1.023	0.799
Affording Healthcare Charges	0.83	0.426
Food Security	0.783	0.435*
Affording Educational Charges	0.76	0.827
Accessing Best Healthcare	0.55	1.015
Accessing Best Education	0.38	0.676

Sources: Field Survey

According to Cohen's d, the formula for the paired samples' t-test to determine the effect size of remittances as an intervening factor, is:

$$d = \frac{Mean\ Difference}{Standard\ Deviation\ of\ Differences}$$

5. Results and Discussion

5.1 Remittances Inflows to Pemba

The results show that the UAE accounts for about 43% of the remittances to Pemba, while the US and Canada have smaller diaspora shares; they contribute about 23% of remittances, likely due to higher incomes. Europe contributes around 15%. Countries like India, South Africa, and China send 2–6%. The

flowline map (Figure 3) shows remittance volumes by line thickness, with wider lines from the UAE indicating higher inflows, and narrower ones from China representing lower flows.

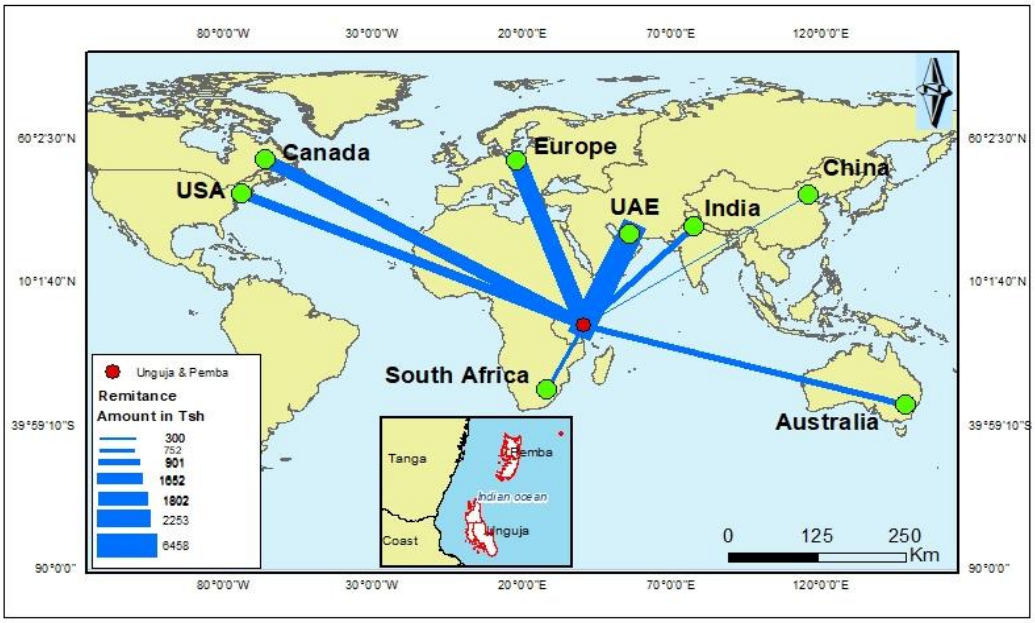


Figure 3: Remittances by Source Country
Source: UDSM Geography Cartographic Unit, 2021

The results suggest that countries with high remittances are engaged in formal employment, allowing them to sign labour contracts similar to those presented by the Region (2018) in Europe. This enables families to rely on monthly or seasonal monetary support through regular remittances, as reported by Carling (2014). Countries with low remittances may be due to their diaspora being engaged in low-income or non-productive activities, as noted by Crush and Tawodzera (2023) in Zimbabwe.

5.2 Situation of the Household Welfare Indicators Before and Post-remittances

5.2.1 Remittances and Housing Ownership

Figure 4 presents the results of the combined household welfare improvement before and post-remittances. Regarding housing ownership, it was found that before remittances, households experienced a high rate of improvement at 29%, while the low improvement rate was about 71%. This indicates that prior to remittances households had a limited capacity to own assets due to insufficient financial standing. The rate of low improvement shifted from 71% to 15% post-remittance, while the great improvement level increased from 29% to 85%.

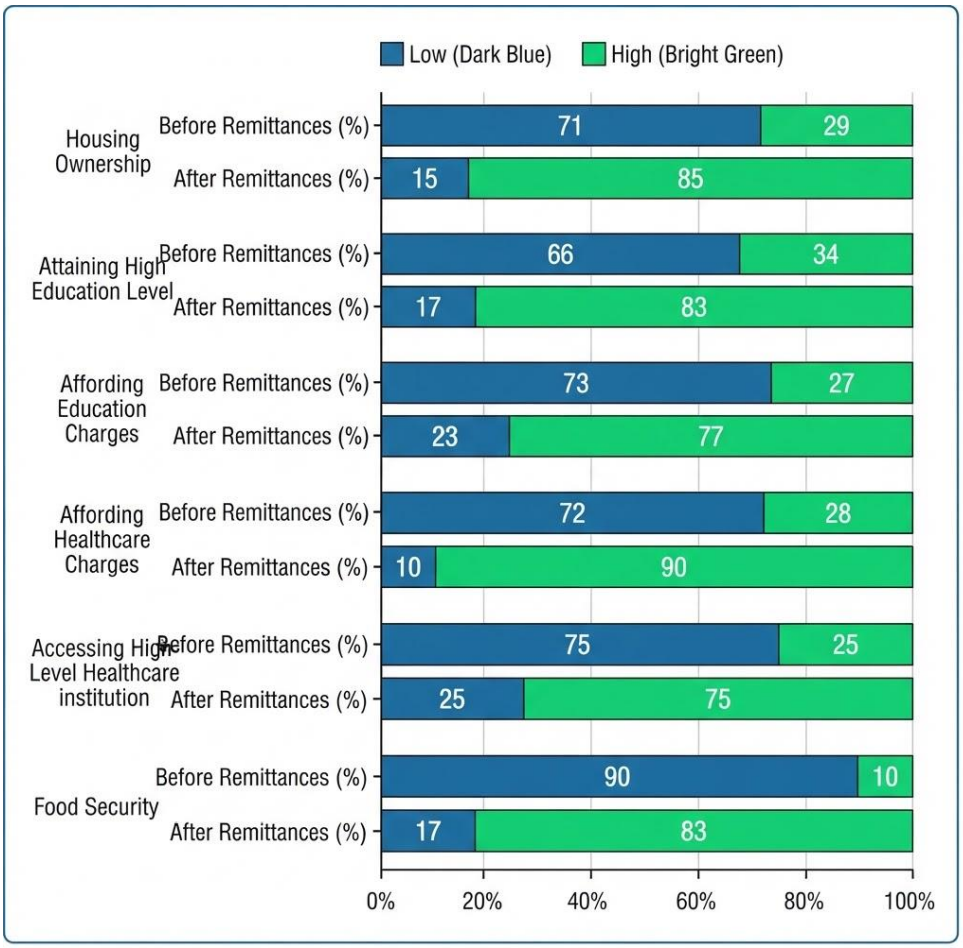


Figure 4: Combined Household Welfare Improvement
Source: Field Survey 2021

This result suggests that remittances have significantly contributed to improving housing ownership and facilitating asset accumulation, including purchasing land, constructing new houses, and even buying houses. The transformation indicates that remittances have been utilised to enhance housing conditions, i.e., transitioning from substandard to more adequate dwellings. This is similarly documented by Asongu and Ondiambo (2022) in their report on sub-Saharan African nations. Additionally, remittances are employed to upgrade housing and facilitate a shift from provisional accommodations (such as mud houses) to permanent residences. Comparable findings have also been observed in the study conducted by Nadeem and Cheema (2022) in Pakistan. Also, the findings from qualitative interviews reinforced these results. One informant explained: "*Remittances allowed*

families to move from mud houses to permanent structures, which changed our living standards." Such testimonies highlight how remittances not only improved the quantitative indicators of housing ownership, but also transformed perceptions of household security and dignity.

5.2.2 Remittances, Attainment of Education Level and Affording Costs

Regarding education level, the results in Figure 4 show that only 34% of the households had a high educational level before remittances, while about 66% had a low educational level. This indicates that most households attained a low level of education prior to remittances, and struggled to stay longer in school due to limited financial resources. The findings reveal that low-level education decreased to 17% post-remittances, while high-level education increased to 83%. This suggests that remittances potentially play a significant role in improving educational attainment by providing financial support for school fees, educational materials, and school uniforms.

As concerns affording education charges, the findings revealed that most households (about 73%) had low costs in using money for education before remittances, while only 27% used high costs in education. This means that households lacked sufficient financial resources to invest in education before remittances. Also, the cost for sponsoring education in households increased from 27% to 77% post-remittances, while the low cost decreased from 73% to 27%. The results provide clear evidence that remittances improve households' education by providing substantial financial resources that enable them cover higher education costs. This is similar to what Santra (2019) noted in West Bengal, India. The findings also imply that remittances enable household members to shift from low-cost public schools to high-cost private schools, specifically to obtain higher-quality education, as shown in a study in Malawi by Malik (2015).

5.2.3 Remittances, Health Costs and Institutions

In the case of health costs, the results show that a high number of households (about 72%) used low-cost healthcare before remittances, while around 28% used high-cost healthcare services. This suggests that prior to remittances, most households relied on low-cost healthcare mainly due to low household income. There was a significant shift post-remittances: households using low-cost healthcare decreased from 72% to 10%, while those using high-cost healthcare increased from 28% to 90%. Before remittances, about 75% of health institutions were low-level facilities with low-quality healthcare services, while roughly 25% were high-level institutions. The results suggest that financial capacity was limited prior to remittances, leading to the prevalence of low-level healthcare facilities.

The proportion of households using low-level health institutions decreased from 75% to 25%, while the number of households accessing high-level healthcare institutions increased from 25% to 75%. This indicates that remittances play a crucial role in improving healthcare services by expanding the capacity to cover healthcare expenses, consistent with the study results of Bocgan and Bavindi Erdal (2021). These findings imply that households can access better healthcare services due to stable financial support from remittance inflows: thus, remittances considerably boost the healthcare welfare of recipient households. This also concurs with Bettin and Zazzaro (2018) in their findings on middle-income countries.

5.2.4 Remittances and Food Security

The results show that before remittances, most households (about 90%) had a low level of food security (eating two or fewer meals per day), while around 10% ate three or more meals. The food security situation improved post-remittances: approximately 17% of the households remained in a low security level, while about 83% achieved a high level of food security. These findings suggest that remittances enhance household food security by providing financial support that enables households to purchase sufficient food and maintain three or more regular meals more per day. Generally, the improvement in household welfare before and post-remittances is notable across all indicators of household welfare. All the results in this study indicate that remittances in Pemba play a potential role in improving food security, as noted in the Region (2022) report. The results also imply that most households experience a high level of improvement after receiving remittances, allowing them to access secure, balanced food. This aligns with the findings of by Lazzarini et al. (2015) in Brazil. Hence, there is a statistically significant role of remittances as an intervening factor in the improvement of household welfare in Pemba.

5.3 Application of Paired-t-tests and Cohen's d for Household Welfare Indicators Improvement

5.3.1 Remittances and Access to Higher-quality Education

As Table 2 shows, the study found a mean difference of 0.38, with a p-value of 0.000. The higher post-remittance value suggests that remittances, as an intervening factor, brought significant improvements in education: i.e., people have access to higher-quality education post-remittances. The p-value for educational institutions is 0.000 ($p < 0.05$). The null hypothesis was rejected and the alternative hypothesis accepted, indicating a significant difference in educational remittances when comparing pre- and post-intervention data. Regarding Cohen's d, the results revealed a mean difference of 0.38 and a standard deviation difference of 0.676 across educational institutions, resulting in a 0.562 effect size. According to Cohen's d conventions, this value falls within the medium effect category, indicating a medium effect in educational institutions brought by remittance inflows. The results show a moderate change

in educational institutions, with remittances possibly helping to improve education as households could now switch from public to private schools, which are believed to be better. Hence, households have used remittances to overcome barriers and enhance education.

Table 2: Paired-t-test for Household Welfare (Before and Post-remittance)

	Before Remittance	Post-remittance	Difference	
Variable	***M***	***M***	***M***	***p***
Accessing Higher Quality Education	1.50	1.88	0.38	< .001
Affording Education Charges	1.39	2.15	0.76	< .001
Attaining a high Education Level	3.02	4.25	1.25	< .001
Accessing higher-level healthcare institutions	1.28	1.83	0.55	< .001
Affording Healthcare Charges	1.33	2.16	0.83	< .001
Housing Ownership	2.88	3.90	1.02	< .001
Food Security	2.17	2.95	0.78	< .001

Source: Field Survey, 2021

The results of the paired samples t-test and Cohen's d confirmed that remittances, as an intervening factor, brought changes in the access to best education: i.e., from public to private schools that are believed to offer higher quality education than public schools. These findings are consistent with those of Ambler et al. (2015), who found that remittances increased households' ability to afford education costs that enabled them move from public to private schools. Arif et al. (2019) also found that remittances in many developing countries have been used to support educational transformation, with the number of private schools increasing as financial capacity grew. Similar results have been observed in Tajikistan, where remittances enabled people to invest in education, thereby leading to transformations in the education sector (Kollner, 2013). A slightly different finding was observed by Ali et al (2022), who found that remittances are typically allocated to day-to-day consumption, which in turn leads to underinvestment in other areas.

5.3.2 Remittances and Affording of Educational Charges

The results showed that the p-value was 0.000 ($p < 0.05$), and the mean difference was 0.761. Overall, the mean difference is 0.76, meaning that there is an increase in the mean post-remittances. Consequently, this indicates that households can afford higher educational charges, which in turn increases their ability to access better education. This implies that remittances facilitate improvement in household welfare while showing a potential shift in households' monetary abilities to cover education charges; including uniforms,

learning materials, school fees, and financing private studies. In addition, the p-value for the paired samples tested (before and after) is 0.000 ($p < 0.05$). Therefore, the null hypothesis of no difference is rejected, and the alternative hypothesis is accepted; thereby confirming a significant shift in household educational costs after receiving remittances.

Based on the SPSS-processed data, the results show that the mean difference in educational charges is -0.76, while the standard deviation difference is 0.827, resulting in 0.919. This suggests that remittances have a substantial effect on education by significantly increasing households' capacity to afford education-related expenses. The results also suggest that households bear significant educational costs that are substantially supported through remittances. Generally, the results in both the paired samples t-test and Cohen's d showed statistically significant results that remittances play a potential role in affording education charges. This implies that as remittances increase, the ability of households to pay for education costs also rises. This is consonant with Malik's (2015) results which found that remittances in Zambia enable households to prioritise educational quality over costs. Similar results were found in Nigeria, where households were found to increase their ability to support their children in schools by affording school fees (Eze, 2017). However, the study findings by Azam and Gubert (2006) differ from those of this paper: they found that remittances can be insufficient to support all aspects of household life since the priority in most households is daily consumption.

5.3.3 Remittances and Attainment of Higher Education Level

The t-test on the education level revealed that the mean difference was 1.25, and the p-value was 0.000 ($p < 0.05$). The mean difference in the education level between before and post-remittances is 1.25, indicating that the education level after is higher than before remittances. This suggests that remittances enable household members to stay in school for longer periods due to improved financial ability. Also, the results show that the p-value for the education level was 0.000 ($p < 0.05$). Hence, the null hypothesis (that there is no significant difference in education levels before and after receiving remittances) is rejected. Consequently, the alternative hypothesis (that a significant difference exists) is supported. The findings reveal that household members with high levels of education maintained their status post-remittances. Conversely, those with low levels of education experienced an upward shift, achieving high education levels after the influx of remittances.

Regarding Cohen's d, the results revealed that the mean difference in educational level is 1.25, and the standard deviation difference is 0.537; whereas the effect size is 2.32: this indicating a very large effect size of remittances at the household level. Remittances act as an enabling factor that facilitates changes

in educational attainment by increasing the number of household members who graduate at a high level. Remittances may play roles such as keeping children in school for longer periods, reducing dropouts, ensuring payment of school fees and learning materials, and supporting private studies. Both the paired samples t-test and Cohen's d support the assertation that remittances make a potential contribution to the attainment of higher educational levels. This result aligns with results from Askarov and Doucouliagos (2020), whose findings showed that remittances in developing countries support education, leading to higher education levels. Similarly, Souza (2024) reports that remittances help households afford educational costs, thereby increasing educational attainment. Likewise, Matache (2023) found that remittances enable household members to remove educational barriers. On their part, Lu and Treiman (2011) note that, in South Africa, remittances can promote educational growth but also cause educational stratification among households. Bucheli et al. (2018) argue that while remittances often improve schooling, sometimes they reduce school participation when households prioritise non-educational activities.

5.3.4 Remittances and Access to Higher-level Healthcare Institutions

The processed data showed that the mean difference was 0.55, with a p-value of 0.000 ($p < 0.05$). This implies that access to higher-level healthcare institutions improved significantly post-remittances, likely because the additional funds helped cover healthcare expenses. Regarding the p-value, the paired samples t-test for health institutions yielded a p-value of 0.000 ($p < 0.05$). Therefore, the null hypothesis (that there is no difference in health institutions before and post-remittances) is rejected. The alternative hypothesis (that there is a difference in the health institutions before and post-remittances) is accepted; hence, there is a significant statistical role.

The mean difference of 0.55 and the standard deviation of the differences of 1.015 gives a Cohen's d of 0.541, indicating a medium effect. Before remittances, most households relied on public hospitals that are believed to provide low-quality services. In contrast, households shifted from public to private hospitals post-remittances, which, in turn, enabled people to access better healthcare services. Hence, according to Cohen's d rank, it is true that remittances play a crucial role in improving healthcare services as they are statistically significant and of medium size.

The results of the statistical tests generally indicate that remittances are a potential intervening factor that enables household members to access high-level healthcare institutions. This implies that higher remittances are associated with a greater access to healthcare services, and therefore, remittances should be encouraged in Pemba to improve healthcare access. This is consistent with Basu and Biswas (2024), who found that remittances in Kenya helped households to access better healthcare by enabling them to afford quality care in private

hospitals. Similarly, in an overall study in East Africa, Bocagn and Bavindi Erdal (2021) found that remittances-receiving households could access better healthcare services due to the support of remittances which allowed them to switch from public to private hospitals. Also, according to Abraham and Tao (2021), remittances reduce financial challenges and eventually increase access to private healthcare, and hence better services. However, this result differs from the findings of Yol (2017), who argued that shifting from public to private hospitals is not directly driven by remittances, but is instead facilitated by overcrowding in public facilities. Furthermore, according to Ebeke (2021), evidence suggests that remittances can inadvertently weaken public healthcare in that, when recipient families are perceived as capable of affording private medical costs, governments may reduce incentives and funding for public hospitals as patients shift to the private sector.

5.3.5 Remittances and Affording Healthcare Charges

The SPSS analysis revealed a mean difference of 0.83 and a p-value of 0.000 ($p < 0.05$). The paired-sample t-test showed a mean difference of 0.83 in healthcare costs, indicating that households were better able to cover health expenses after receiving remittances. This suggests that households spent very little on healthcare before receiving remittances, indicating that few were able to afford the required costs. In contrast, the mean increased post-remittances, suggesting that remittances act as an intervening factor that enabled households to cover healthcare charges. The test result was statistically significant ($p = 0.000$, $p < 0.05$), leading to the rejection of the null hypothesis; and confirming that remittances positively influence households' ability to meet healthcare costs. Overall, the results reflect an increase in coverage post-remittances.

The mean difference is 0.83, and the standard deviation difference is 0.426, resulting in a 1.948 effect size. The value indicates a very large effect size in Cohen's d, suggesting that remittances play a crucial role in improving household welfare related to healthcare costs by reducing financial constraints, thereby supporting both preventive and curative healthcare. The paired samples t-test and Cohen's d confirmed the role of remittances in enabling households to afford healthcare charges. As found by Van Asselt (2025), remittances positively influence healthcare access in Pemba by helping households manage shocks. This aligns with Kan (2021), who also showed that remittances increase healthcare spending, thereby improving healthcare access. Also, consistent with Bettin and Zazzaro (2018), remittances also assist households to fight diseases, and address current health issues as they enable access to any healthcare provider, free from financial barriers (Yang (2015).

5.3.6 Remittances and Housing Ownership

The results revealed that the mean difference in housing ownership was 1.189, and the p-value was 0.000 ($p < 0.05$). Household ownership showed the largest

improvement of all tested variables, with a mean difference that is both practically and statistically significant. Before remittances, a minimal number of households owned homes due to limited financial resources. The p-value for household homeownership was less than 0.001 ($p < 0.05$)), rejecting the null hypothesis in favour of the alternative hypothesis. Consequently, these results are statistically significant, demonstrating that remittances serve as a critical intervening factor that improves household welfare through housing ownership.

The mean difference in housing ownership was 1.023, with a standard deviation of 0.799, yielding a t-value of 1.28; indicating a very large effect size. The effect size indicates that remittances significantly increase household home-ownership by providing vital financial support and reducing the residential instability associated with the lack of permanent housing. Also, house-ownership promotes sustainable development through long-term economic stability. These empirical results provide clear evidence that remittance inflows promote home ownership as people often use remittances to build or repair their homes, much like what was found in Kenya by Kagochi and Kiambigi (2012). Also, according to Adams and Cuecuecha (2012), receiving households frequently use remittances for house improvements. Additionally, an increasing rate of home-ownership suggests that remittances reduce reliance on rental housing, a finding that aligns with the research by Nadeem and Cheema (2022). However, this finding contradicts that of a study in South Africa by Waidler and Devereux (2019), which revealed that remittances are often used more for housing consumption than for housing ownership.

5.3.7 Remittances and Food Security

Moreover, the results revealed that the mean difference was 0.783. Also, they indicate that food security was generally low prior to remittances, meaning households struggled to access sufficient meals throughout the day. The mean was higher post-remittances, suggesting that households improved their meals by providing enough food for their members. The p-value was 0.000 ($p < 0.05$), meaning that there is a significant statistical difference between food accessibility before and post-remittances. We can conclude from these results that remittances potentially play a role in food availability by providing financial support, thus enabling better food security.

The mean and standard deviation differences were 0.783 and 0.435, resulting in a very large Cohen's d effect size of 1.8. This suggests that remittances play a critical role in enhancing food availability by providing households with the financial resources necessary to secure an adequate and nutritionally balanced diet. Likewise, the tested results show that remittances have been responsible for improving food security, as similarly observed by Szabo (2022) and Mahmoud et al. (2022).

Overall, the findings confirm that remittances act as a significant intervening factor in improving household welfare in Pemba. By applying paired-samples t-tests and Cohen's d, the study demonstrates statistically meaningful improvements across education, healthcare, food security, and housing (Figure 5).

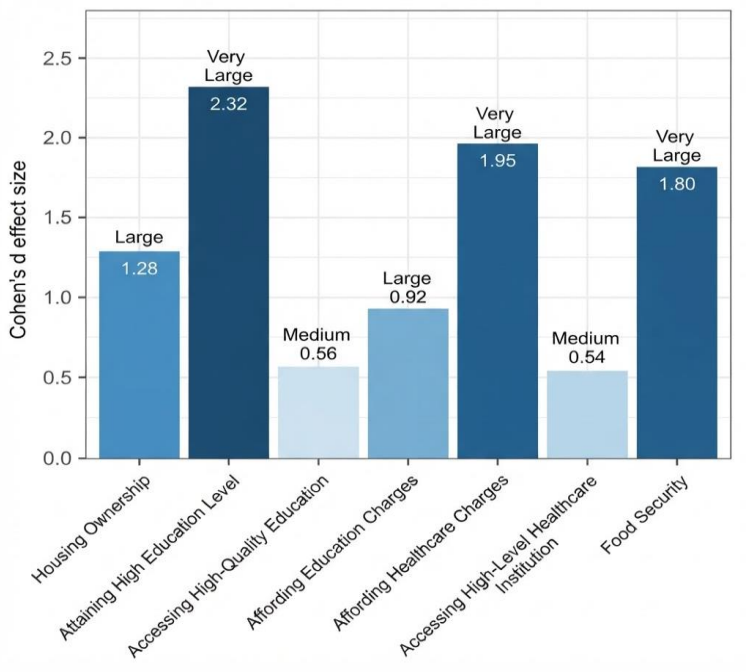


Figure 5: Cohen's d of the Household Welfare Improvement

Source: Field Survey, 2021

Importantly, the magnitude of change varies: healthcare and education show larger effects due to their urgent and lump-sum costs, while food security improvements are more incremental. Housing investments reflect both altruistic support and self-interest motives, consistent with the theoretical expectations. These results highlight the dual role of remittances in meeting immediate household needs and enabling longer-term asset accumulation. While the study is limited by recall bias and geographic scope, it provides robust evidence that remittances expand household capabilities and contribute to welfare enhancement in Zanzibar. Hence, strengthening diaspora engagement and formal remittance channels could further maximise these developmental benefits.

6. Limitations

This study has several limitations. First, the retrospective design relies on household recall, which may introduce bias despite triangulation efforts. Second, the geographic scope is restricted to two districts in Pemba, thereon

limiting generalisability to other regions. Third, while the paired-sample t-tests identify significant differences before and post-remittances, the design does not establish causality beyond correlation. Future research should employ longitudinal designs or panel data to strengthen causal inference, and should also broaden geographic coverage.

7. Conclusion and Recommendations

The study examined the extent to which remittances enhance household welfare using key indicators, including housing ownership, food security, healthcare services (expenditures and institutions), and education services (education level, institutions, and costs). The results indicate that prior to receiving remittances, approximately 77% of the households experienced a low level of improvement, while only 23% achieved a high level. Following the receipt of remittances, a significant shift occurred: 82% of the households progressed to a high level of improvement. This dramatic turnaround demonstrates that remittances act as a vital intervening factor in advancing household living standards. These results—confirmed by paired-sample t-test and Cohen's d testing—show that remittances brought about a number of changes towards household improvement. Specifically, the study found a statistically significant role of remittances in improving household welfare in Pemba. Consequently, it is recommended that strategies be implemented to enhance diaspora engagement, maximize the development impact of remittances, and strengthen social protection for migrant families.

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