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COVID-19 Impacts and Adaptive Responses in Enugu Slums: Lessons for Urban Sustainability

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ABSTRACT

The COVID-19 pandemic exposed deep-seated socio-economic and infrastructural vulnerabilities within urban slums, disproportionately affecting low-income communities in developing countries. In Nigeria, systemic challenges such as underfunded healthcare, limited social protection, and widespread poverty intensified the crisis for urban poor populations. This study examines the impacts of the pandemic on slum dwellers in Enugu City, marked by overcrowding, poor sanitation, etc., and explores their adaptation strategies. The study adopted a mixed-method approach, combining questionnaires and interviews to elucidate information. Data was collected from 180 respondents and selected key participants across five Enugu slums. Analysis involved SPSS for quantitative data and thematic coding for qualitative insights. The study reveals that the COVID-19 pandemic had significant social, economic, and environmental impacts on slum dwellers in Enugu Urban. Socially, residents faced increased poverty, crime, and marginalization, but relied heavily on local support for survival. Economically, job losses, rising costs, and restricted mobility deepened hardship. Despite these challenges, slum dwellers demonstrated resilience through adaptive practices

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like digital business, farming, and mutual support. Drawing lessons from these adaptive responses, the paper highlights the need for inclusive, context-sensitive urban policies that strengthen the resilience of informal settlements and promote sustainable development in pandemic preparedness and urban planning frameworks.

Keywords: COVID-19; Pandemic; Slums; Urban Sustainability

1. Introduction

COVID-19, also known as coronavirus, is an infectious disease caused by the severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). The disease was first identified in Wuhan, China, in December 2019, and its highly contagious nature led to its rapid global spread [1]. By March 2020, the World Health Organization (WHO) had declared COVID-19 a global pandemic. The number of cases and infected, continued to rise globally and the pandemic posed a serious threat to public health.

In Nigeria, the pandemic caused several deaths and many reported cases. The high fatality rate was exacerbated by general weaknesses in the healthcare system, such as inadequate facilities, insufficient funding, among other environmental issues in the country. Unlike previous pandemics, COVID-19 created unparalleled socio-economic disruptions and triggered unprecedented challenges, particularly for vulnerable populations [2]. Slum dwellers in developing countries, who constitute one-third of the global urban population, were disproportionately affected by the pandemic due to their living conditions [3]. Implementing WHO-recommended measures—such as social distancing, hand-washing, isolation, and lockdowns—proved extremely challenging in slum communities. Factors like overcrowding, poor sanitation, and insufficient amenities limited the effectiveness of these interventions [3,4]. In many slums and generally, non-pharmaceutical measures such as travel restrictions, school closures, and hygiene campaigns were adopted, but slum dwellers faced significant barriers to compliance due to their socio-economic vulnerabilities [3,5].

The pandemic not only led to a significant loss of life but also caused widespread disruption to public health, food systems, and employment. The socio-economic impact was especially severe for slum dwellers, often referred to as the urban poor. According to Yahaya et al. [6], the pandemic exacerbated poverty in urban areas, with many poor households losing jobs and income, particularly those employed in the informal and private sectors. The impact of the pandemic could be catastrophic considering the fragility of the nation's (Nigeria) infrastructure and the socio-economic status of the people [7]. Thus, there is a need to assess the impact of the pandemic on different areas of varying socio-economic nature, to guide policy and interventions targeted to such contexts. This study, therefore, seeks to assess the socio-economic and environmental impacts of COVID-19 on slum dwellers in Enugu City, Nigeria, and examine their adaptability measures. The findings aim to provide lessons for fostering sustainable urban development.

2. Literature Review

2.1. Impact of COVID-19 on Urban Livelihoods and Slum Dwellers

The COVID-19 pandemic had a devastating effect on the livelihoods and food access of urban communities in Nigerian states. Prolonged lockdowns, economic downturns, and rising food prices left many households struggling to meet basic needs. The pandemic exacerbated existing vulnerabilities in low- and middle-income countries, overwhelming already stressed health systems and further marginalizing impoverished communities [8].

Slum dwellers faced disproportionate impacts compared to other urban residents due to the physical, structural and social constraints of their environments. Preventive measures like hand washing, self-isolation, and social distancing were largely impractical in slums, where access to safe water and sanitation is limited [3,5]. The crowded living conditions, shared facilities, and inadequate infrastructure in these areas heightened the risk of disease transmission, making slums hotspots for outbreaks. However, Friesen and Pelz [9] argued that the major challenge during the COVID-19 pandemic in Global South slums was the absence of reliable data on population size, living conditions, and health. Without accurate data, effective health interventions and policy responses were severely hindered.

The pandemic's health implications were compounded by its socio-economic toll. Life expectancy in Nigeria, already among the lowest globally, declined further due

to excess mortality linked to COVID-19 [7]. Additionally, strained resources and rising unemployment contributed to a surge in crime, as hunger and desperation grew despite significant international aid and relief efforts [10]. Nigeria's lack of a functional social security system significantly increased its vulnerability to the economic impacts of COVID-19. The lockdown restrictions devastated informal sector workers, who constitute 65% of the workforce and depend on daily earnings for survival [11]. Thus, the economic impacts of the lockdown were a 14-percentage point temporary increase in the poverty headcount rate for Nigeria, implying that 27 million additional people fell below the poverty line during lockdown [12]. The World Bank forecasted in January 2021 that the pandemic would result in an additional 10.9 million Nigerians entering poverty by 2022 [13]. The absence of unemployment or disability and child benefits left many households without safety nets, with only 4% of the poorest households accessing any social programs before the pandemic according to the World Bank [13], making it impossible for the majority to access any form of social safety net.

Moreover, decreasing incomes and rising food prices deepened food insecurity. Two factors that were affected by the COVID-19 pandemic: they showed that the life expectancy of many rural Nigerians has largely been considered close to the bottom as the third lowest in the world and excess years of life lost associated with the COVID-19 pandemic in 2020 were more than five times higher than those associated with the seasonal influenza epidemic in 2015 [10]. They also showed that Crime on the other hand was believed to have escalated in Nigeria during the COVID-19 pandemic. Environmentally, the pandemic's effects extended to physical realms [10]. In India, for instance, biomedical waste generation increased, while recycling activities and municipal waste management systems faced significant disruptions [14]. These trends underscore the cascading consequences of the pandemic across multiple environments. With slums largely being an impoverished and underserved area, the effect may likely be more severe; this study hopes to unveil this.

2.2. Adaptation Measures to the Pandemic and other Extremities by Slum Dwellers

Faced with inadequate government support, many slum dwellers displayed remarkable resilience. Some slum dwellers violated lockdown and physical distancing policies and went about their businesses. They were resilient and determined to survive and not die of hunger while observing elitist instructions [15]. Two options were always the last resort for the elitist state and its authorities: First, provide small palliatives and stimulus packages to the people; and second, get the police to enforce strict lockdown and physical distancing policies, and clamp down on the people if they refuse to comply [15]. Daily wage earners, unable to comply with lockdowns without risking starvation, continued their activities despite the risks. This defiance highlighted the disconnect between elite-driven policy decisions and the lived realities of the urban poor [15]. Small-scale palliatives provided temporary relief but may have been insufficient to address widespread hunger and poverty in some or most slums.

An investigation into the livelihood strategies of slum dwellers in Enugu Urban, emphasizing their reliance on diverse income-generating activities such as petty trading and informal services [4]. By engaging in multiple sources of income, residents mitigate the risks associated with unemployment and irregular wages, thereby enhancing their economic resilience. This study hopes to reveal how slum dwellers leverage this resilience tendency to navigate the effect of COVID-19. Moreover, Ma et al. [16] highlighted the need for social capital and networks to address common challenges like disasters and health pandemics. Through collective efforts, residents mobilize resources, advocate for their rights, and implement communal projects, demonstrating the importance of solidarity in fostering resilience. A study investigated healthcare access among slum dwellers in Enugu Urban, emphasizing their reliance on informal healthcare providers and traditional healing practices due to limited access to formal medical facilities [17]. By leveraging informal supports and traditional knowledge, residents navigate barriers to healthcare access and address their health needs within their local context. However, these traditional health systems may not be trusted to address the pandemic. The impact of the pandemic could be catastrophic considering the fragility of the nation's (Nigeria) infrastructure and socio-economic status of the people [7]. With a slum as an area with fewer services and a high poverty level, coupled with a deplorable environment, it's pertinent to explore the effect of the pandemic on this area, so as to guide interventions and policies. The cascading effects of COVID-19 on the econ-

omy, social fabric and environment call for an urgent study of its impact on slum dwellers of Enugu city. Exploring their adaptability provides critical insights into sustainable urban development, addressing inequities, strengthening resilience and informing policies that integrate the lived realities of marginalized communities for better preparedness against future crises.

3. Study Area and Methodology

3.1. Study Area

Enugu urban, located in the South-Eastern geopolitical zone of Nigeria (**Figure 1**), West Africa, is the capital of Enugu State (**Figure 2**). Enugu is geographically located between latitude $06^0 21^0$N and 06^0 30^0 and between longitude 07^0 26^0 E and $07^0 37^0$E. It lies on a plain of 763ft above the sea level with 72.8 square kilometers of land area [18]. At the East, it is bounded by Nkanu East Local Government Area, in the West by Udi Local Government Area, in the North by Igbo-Etiti and Isiuzo Local Government Area and in the South by Nkanu West Local Government Area [18]. Enugu metropolis comprises three Local Government Areas, namely Enugu North, Enugu South and Enugu East.

Figure 1. Map of Nigeria, West Africa.

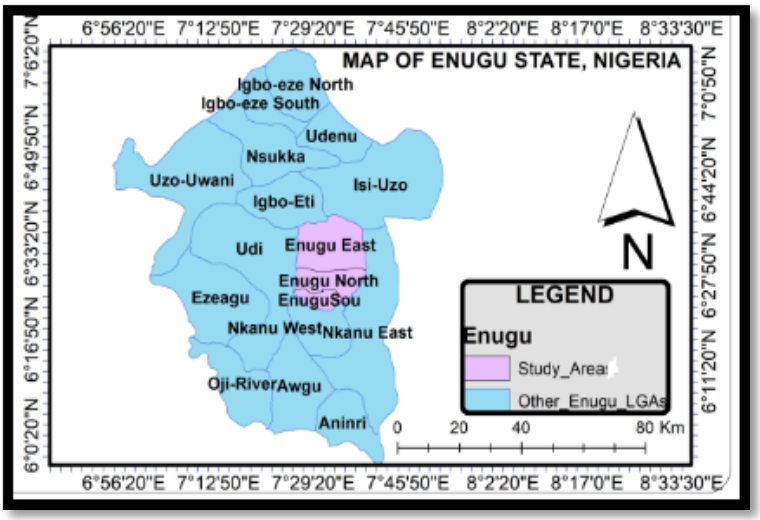

Figure 2. Map of Enugu State, showing Enugu Urban.

3.2. Research Design

The study focused on assessing the impact of COVID-19 on slum dwellers and the measures initiated by them to adapt to the impact of the pandemic. The study followed a mixed method employing a quantitative and qualitative research model through the use of mainly interview schedule and questionnaire. Data was simultaneously gathered; both qualitative and quantitative, which were then independently analyzed and integrated together [19,20]. A stratified random sampling technique was applied to ensure representation across different local government areas using a ratio. The data on the slums in each local government area obtained from Town Planning Town authorities in the local government areas showed Enugu North-10 slums, Enugu South- two slums and Enugu East-twelve slums. A selection of five of the slums was made from the total number of slums in all three local government areas (LGA) within Enugu metropolis based on the total number of slums in each LGA: one Enugu South, two from Enugu East and two from Enugu North LGAs: a ratio of 1:2, respectively. Data collected from the questionnaire reflect the impact of COVID-19 on slum dwellers, while deeper insight was gleaned on this from interview responses (including information on their adaptability).

3.3. Population, Sample, and Response Rate

The study focuses on slum residents in Enugu Metropolis, particularly heads of households in slums across different local government areas (LGAs). Due to the unavailability of aggregate data on the population of slum dwellers in formal registers, the sample size was put at 200 and the response rate was 90% (**Table 1**). The sample size of 200 was selected as a result of time and accessibility constraints (security threat and non-compliance by dwellers due to fear of eviction). For the interview, a total of twenty-five (25) participants were selected (five from each of the slums under study). This agrees with the assertion by Creswell [21] that between 5 and 25 interviews are appropriate for a qualitative study.

Table 1. Questionnaire Distribution and Responses.

S/N	Location (Slum)	Number Distributed	Number Returned	Percentage returned
1	**Enugu North-Obiagu**	30	27	90%
2	**Enugu North-UgboOkonkwo**	40	38	95%
3	**Enugu East-UgbeneNike**	35	31	89%
4	**Enugu East- Ugboezeji**	30	29	97%
5	**Enugu South- Ikiriki (1,2, and 3)**	65	55	85%
	Total	200	180	90%

Source: Researchers' field survey, 2022/2023.

The interview participants were carefully selected from capable individuals within the slums who can provide information that generally reflects their lived experience and that of other members of the community. Thus, an effort was made to include those who have economic and/or social inclination in the slums as interview participants. By economic inclination, we mean those who have their businesses or source of livelihood within the slum, while those with social inclination are those who have one social status or the other, like youth leaders, ward leaders, among others. It is believed that this set of people will be more exposed to the live realities of dwellers in such a settlement during the pandemic and can best describe life in such an area during such a crisis.

3.4. Data Collection

Primary data was collected through three methods: direct observation, interviews, and questionnaires. The participants in the interview and the questionnaire consented to the survey while the researchers pledged anonymity of participants in the study. Direct Observation was conducted from November 29 to December 5, 2022, in the selected slums. This allowed for an understanding of the general conditions of the study areas and how to navigate the areas during data collection. Face-to-face interviews were conducted from December 2022 to January 2023, utilizing a structured approach with predetermined questions. These questions focused on the impact of COVID-19 on businesses, health, environment, survival strategies and social

relations during the pandemic. It allowed the slum dwellers to freely describe their lived realities during the pandemic and how they adapted to the crisis. The interview questions contained a total of 9 explanatory questions for easy response from slum dwellers in the selected slum areas. The responses from the slum dwellers to the interview questions were recorded and transcribed for analysis. The recording was protected from external access.

In addition, the questionnaire was administered between December 2022 and January 2023. The questionnaire contained four sections, addressing demographic information, social, economic, and environmental impacts of COVID-19, and adaptability practices. The first section dealt with the personal and demographic data of the respondents. Some variables collected under this section include the occupational status of respondents, educational level, marital status, etc. Sections B, C and D dealt with the impact and adaptability of slum dwellers to the COVID-19 pandemic in relation to social, economic and environmental parameters. Questions in this section were designed with Likert scale options.

3.5. Data Analysis and Interpretation of Findings

Data analysis involved categorizing responses and compiling the results in tabular form using the Statistical Package for Social Sciences (SPSS). The findings from both the questionnaires and interviews were organized and presented in tables to show frequencies, percentages, and sample characteristics, enabling interpretation of the COVID-19's impact on slum residents. The Likert scale responses were analysed using mean scores while demographic data were analysed using frequencies and percentages. The interviews were coded by multiple coders (two researchers); multiple meetings were held to resolve coding discrepancies and the final themes were derived through consensus and analysis based on patterns related to the study objectives. Both interview and questionnaire responses were analysed and discussed concurrently. This provided deeper insight into the findings of the study and its implications.

4. Findings and Discussions

The findings presented represent the responses from the questionnaire and interview administered to household heads of five slums in Enugu metropolis.

4.1. Descriptive analysis

4.1.1. Questionnaire Respondents' Profile

The results first reveal the demographic feature of questionnaire respondents, that of the interview participants, their mean rating of social, economic and environmental impacts of COVID-19, and are discussed in relation to the interview responses. The demographic data of the questionnaire respondents is shown in **Table 2** below.

Table 2. Demographic Features of Questionnaire Respondents.

Demographic	Characteristics	Frequency	Percent (%)
Sex of respondents	Male	107	59.4
	Female	73	40.6
Age of respondents	18	20	11.1
	19–29	68	37.8
	30–39	51	28.3
	40–49	17	9.4
	50 and above	24	13.3
Marital status of respondents	Single	64	35.6
	Married	89	49.4
	Divorced	7	3.9
	Widowed	7	3.9
	Separated	13	7.2

Table 2. *Cont.*

Demographic	Characteristics	Frequency	Percent (%)
Household size of respondents	1	1	0.6
	2	7	3.9
	3	21	11.7
	4	29	16.1
	5	33	18.3
	6	32	17.8
	7	32	17.8
	8	11	6.1
	9	3	1.7
	10	4	2.2
	11	1	0.6
	12	6	3.3
Educational level of respondents	FSCL	29	16.1
	WAEC/GCE/NECO	50	27.8
	OND/NCE	27	15.0
	HND/Bachelor Degree	62	34.4
	Post-graduate /Masters/Doctorate	12	6.7
Primary occupation of respondents	Full time trading	59	32.8
	Civil/public service	29	16.1
	Unskilled Labor	35	19.4
	Other Self-employment	36	20.0
	Artisan	19	10.6
	Student/Retired	2	1.1

Source: Researchers' field survey, 2022/2023.

Table 2 above shows that the dominant respondents are men (59.4%). This may be because the sample population is household heads. The prominent age groups among the respondents are 19–29 years (37.8%), 30–39 years (28.3%) and 50 and above years (13.3%). This reveals that the respondents are predominantly those at the early phase of career and family development, followed by those who are advanced and may have retired from active service. **Table 2** further revealed that 64 respondents are single, 89 respondents are married, 7 respondents are divorced, 7 respondents are widowed and 13 are separated. This shows that the respondents are predominantly married, this group is assumed to be able to provide varied information related to their living conditions and livelihood, therefore aiding the study. The household size of the respondents revealed that 33 respondents had 5 members of the household, while 32 respondents had 6 or 7 household members. Therefore, this likely reveals that the studied slums may be overpopulated and overcrowded.

With the exception of 29 respondents who have lower educational qualifications, that is, First school leaving certification and WAEC, 50 respondents have high or secondary certification—WAEC/GCE/NECO, while 62 respondents have higher degrees of education (HND/Bachelor Degree). This is beneficial to the study as the high rate of literacy made interaction and data collection much easier in terms of communication and the ability of the respondent to understand what is being communicated. The high rate of literacy is an advantage to the reliability of this study. The findings show that the occupation with precedence is full-time trading with report from 59 (32.8%) respondents. Other respondents are civil or public servants 29 (16.1%), engage in unskilled laborers 35 (19.4%), other self-employment 36 (20.0%), artisans 19 (10.6%) and students or retired 2 (1.1%). It is pertinent to note that most of the students and retired respondents were still engaged in one economic activity or another.

4.1.2. Interview Participants' Profile

Five interview participants were involved in each of the slums studied, making a total of twenty-five participants. The majority of the interview participants were male (15)—see **Table 3**.

Table 3. Interview Participants Information.

S/N	Obiagu		UgboOkonkwo		UgbeneNike		Ugbo-Ezeji		Ikiriki	
	Name	Sex	Name	Sex	Name	Sex	Name	Sex	Name	Sex
1	OBI 1	M	UGBO-O 1	F	UGBE 1	F	UGBO-E 1	F	IKI 1	M
2	OBI 2	M	UGBO-O 2	F	UGBE 2	M	UGBO-E 2	F	IKI 2	M
3	OBI 3	F	UGBO-O 3	M	UGBE 3	F	UGBO-E 3	M	IKI 3	M
4	OBI 4	M	UGBO-O 4	M	UGBE 4	F	UGBO-E 4	M	IKI 4	M
5	OBI 5	M	UGBO-O 5	F	UGBE 5	M	UGBO-E 5	F	IKI 5	M

Source: Researchers' field survey, 2022/2023.

4.2. Impact of COVID-19 on Enugu Slum Dwellers

4.2.1. Interview Responses on the Impact of COVID-19 on Slum Dwellers

Table 4 below shows the themes emanating from the responses on the impact of COVID-19 and the adaptability measures adopted by the slum dwellers. The interview responses as presented in the **Table 4** below will be discussed further together with the findings from the questionnaire responses.

4.2.2. Analysis of Questionnaire Responses on the impact of COVID-19 on Slum Dwellers

According to **Table 5**, the slum dwellers strongly agreed (based on the rating: ≥ 3.1 and ≤ 4.0) that the following factors are very strong factors that had social impact on them: unavailability of social protection by the government, increase in poverty rate, increase in crime rate, opinion neglect and marginalization, public accusation of being a COVID-19 carrier after sneezing. Furthermore, with MS ratings ≥ 2.1 and ≤ 3.0, respondents ranked 3 variables as factors that impacted the general and social well-being of slum dwellers during the COVID-19 pandemic. These are difficulties with interaction and communication with neighbors due to restrictions. Women and girls are mostly affected by the pandemic due to exposure to domestic abuse, movement restriction, benefit from the distributed incentives and food packages and COVID-19 being the cause of death of a loved one. None of the variables present was rated insignificant and unimpactful to the general and social well-being of slum dwellers during the COVID-19 pandemic.

Table 4. Summary of interview Responses on the Impact and Adaptability to COVID-19 Pandemic.

Category	Action	Exposition	Quote
COVID Infection	Most respondents did not contract COVID-19. Some had health check-ups for other illnesses like malaria.	They reported experiencing poverty, hunger or malaria symptoms instead of COVID-19. COVID infections were less common compared to other pressing challenges.	"No, the only COVID we had was poverty and lack of food." (Iki 1) "I had signs of malaria but not COVID." (Ugbo-O 4)
Access to Support	Some received government assistance; others could not access palliatives or support. Neighbors and family played a significant role in survival during the pandemic.	Issues like police interference or lack of distribution to slums were barriers. Local supports s provided immediate and reliable support.	"Yes, government gave palliatives but the police did not allow us to access it." (Obi 1) "I survived because of my neighbors and family." (Ugbe 2)
Economic Impact	Businesses were negatively impacted, with closures, reduced revenue, and slow recovery for some. Others adapted to new ways of selling, such as going online or diversifying their income sources.	Lockdowns and reduced customer base affected business operations. Economic necessity forced innovation and adaptation.	"The pandemic caused irreversible damage to our client base. Some of our clients did not return to us." (Ugbo-E 3) "I had to cut costs and shift to selling online." (Ugbo-E 3)

Table 2. *Cont.*

Category	Action	Exposition	Quote
Social Impact	Physical distancing and lockdowns disrupted social relationships, but virtual connections grew in importance. Close-knit communities fostered enhanced relationships and mutual support during the pandemic.	Social interaction was limited due to COVID restrictions. Dependence on local resources and neighbors encouraged collaboration.	"Social relationships suffered due to physical distancing, but virtual connection became more crucial." (Ugbo-E 3) "It enhanced relationships with my neighbors because we had to depend on what each other had, but I was far from family." (Obi 2)
Environmental Impact	Reduced pollution during lockdowns; increased waste and insecurity post-pandemic.	Lockdown-related restrictions; post-pandemic relaxation and worsening socio-economic conditions.	"The pandemic reduced pollution in the environment... but after COVID, the environment became unsafe, and the crime rate increased" (Ugbo-O 2).
Adaptation Mechanisms	Respondents adapted by cutting costs, shifting to digital methods, relying on farming, and following health rules. Managed resources and relied on local supports during the lockdown.	Necessity prompted resilience and innovative problem-solving. Limited mobility and economic hardship necessitated resourcefulness.	"I had to cut costs and adapt to new ways of making money, which is digitally." (Obi 4) "At first, we were all indoors and had to rely on what we had before the lockdown. " (Obi 2). "I survived because of my neighbors and family " (Ugbe 2)

Source: Researchers' field survey, 2022/2023.

Table 5. Mean Ranking of the impact of COVID-19 on Enugu slums dwellers.

N=180 **1= Very strong (≥ 3.1 and ≤ 4.0); 2 = Strong (≥ 2.1 and ≤ 3.0); 3 = Weak (≥ 1.1 and ≤ 2.0); 4 = Very Weak (≥ 0.9 and ≤ 1.0)**	**Mean**	**Rank**
Mean Ranking of Social Impacts of COVID-19 on Enugu slums dwellers		
The COVID-19 lockdown restricted my movement.	2.4	8
Crime rate has not increased here since the COVID-19 pandemic	3.2	3
It was difficult to interact and communicate with neighbors as a result of restrictions.	2.9	6
When I sneezed in public where I was accused of having COVID-19, even without medical check-up.	3	5
During the COVID-19, my voice, complaints and opinions were not listened to.	3.15	4
There was no social protection provided for me by the Government or external bodies	3.9	1
The women and girls where most affected by the pandemic	2.7	7
The COVID-19 pandemic pushed the poor to extreme poverty	3.3	2
I personally benefited from the incentives and food packages distributed during the COVID-19, pandemic.	2.4	8
The pandemic caused the death of a loved one	2.4	8
Mean Ranking of Economic Impact of COVID-19 on Enugu slums dwellers		
The COVID-19 pandemic led to loss of jobs and income	3.4	2
The cost of food, basic amenities and utility bills increased.	3.4	2
The COVID-19 pandemic made it difficult to purchase food and household items	3.3	5
It was difficult to carry out work activities.	3.3	5
It was difficult to source for income, food and other household needs	3.4	2
During the COVID-19, the rate of poverty in the slums increased.	3.5	1
Mean Ranking of Environmental Impact of COVID-19 on Enugu slums dwellers		
Your roads and environment where well sanitized and cleaned regularly as a result of the pandemic.	2.6	6
COVID-19 pandemic reduced the noise pollution.	2.9	1
I couldn't dispose my waste properly due to the restrictions	2.7	5
Waste generation increased as a result of the COVID-19 pandemic	2.8	2
COVID-19 pandemic improved the air quality of the environment.	2.8	2

Source: Researchers' field survey, 2022/2023.

The findings from the interview revealed that the social landscape during the pandemic underwent significant transformations. Lockdown measures and physical distancing protocols disrupted traditional social interactions, according to interview respondents. However, they also fostered stronger local relationships within communities. As one respondent noted, "It enhanced relationships with my neighbors because we had to depend on what each other had" (Obi 2). Conversely, wider physical social networks were strained due to restricted mobility and reduced interactions. Interview participants noted that digital platforms became a lifeline for maintaining connections, albeit with limitations in accessibility for those lacking technological resources. This duality of social impacts: strengthened local ties and weakened broader networks, illustrates the complex dynamics of social resilience during crises. Moreover, the pandemic starkly revealed inequities in access to formal support systems. While some interview respondents acknowledged receiving government palliatives, others reported significant barriers such as police interference or inadequate distribution. As one respondent pointed out, "Yes, government gave palliatives, but the police did not allow us to access it" (Obi 1). While this finding may not be applicable to all slums, the researcher found, through the interview data collected, that one of the selected slums had access to incentives provided by their local government, although these incentives were insufficient for the majority of the slum dwellers. This refutes the findings of Gebre and Gebremedhin [22] that the government does not provide certain services for unplanned areas. On the other hand, informal supports: friends, family, and local initiatives, proved indispensable and filled critical gaps left by formal structures, demonstrating the resilience of community-based support mechanisms. However, this reliance also highlighted the absence of robust institutional safety nets for marginalized populations, emphasizing the need for inclusive policy frameworks that prioritize equity and accessibility. Interview respondents' narratives suggested minimal direct health impacts from COVID-19 infections within their communities. Instead, existing health challenges such as malaria symptoms and hunger took precedence over concerns about the virus itself. For example, one respondent remarked, "No, I didn't have COVID, just hunger" (Ugbe 1). This highlights a critical gap in pandemic responses, where underlying socio-economic vulnerabilities overshadow health crises. Moreover, the low incidence of reported infections could be attributed to limited access to testing and healthcare facilities. This underscores the need for improved healthcare outreach and diagnostic capabilities in underserved areas, ensuring that communities are better equipped to identify and address public health crises in the future.

Furthermore, with mean score ratings ≥ 3.1 and ≤ 4.0, respondents ranked all variables presented (see **Table 5**) as factors that strongly impact on the economic dynamics of slum dwellers during the COVID-19 pandemic: increased rate of poverty, loss of jobs and income, increased cost of basic amenities, food and utility bills, non-availability of income, food and household needs, difficulty in carrying out work activity and difficulty in purchasing food and household items. The ranking showed that the pandemic led to the loss of jobs and sources of income, it led to an outrageous increase in the cost of food, other basic amenities and utility bills. According to interviewees, business closures, revenue losses, and job insecurity were common experiences. Respondents described the financial strain caused by lockdowns, with one stating, "The pandemic caused irreversible damage to our client base. Some of our clients did not return to us" (Ugbo-E 3). Due to the low income rate and the increase in the cost of food, it was difficult to purchase food and household items. The general lockdown restriction on movement made it difficult to carry out work activities, to source for income, for food and for household needs. This therefore led to an increased rate of poverty in the slums. Economic challenges were among the most pervasive effects of the pandemic. During the COVID-19, pandemic, restrictions on movement and fear of the virus caused a fixed stop to the economic activities of the slum dwellers. For instance, the majority of the government parastatals were closed at the heat of the pandemic, which affected the civil and public servants who live in the slum area. Slum dwellers involved in unskilled labor had their workplaces closed down. Food supply was limited and scarce, leading to a rise in the cost of food. This agrees with Human Rights Watch [23], which showed how the price of food had gone up in a year. In the current study, with the majority of respondents falling into occupations like trading, unskilled Labor, and other self-em-

ployment, movement restriction can definitely aggravate the suffering of this group of individuals. The pandemic did not stop the issue of annual rent, which some of the residents complained of, as there was no source of income to pay bills like utility, electricity and rent. These challenges could aggravate the crime rate in slums. This supports Islam et al. [3] who believed that the Crime rate in Nigeria had gone overboard during the COVID-19 pandemic.

Environmentally, with mean score ratings ≥ 2.1 and ≤3 .0, respondents ranked all variables presented (see **Table 5**) as factors that impact the environment during the COVID-19 pandemic. The factors include increased waste generation, cleaner environment, reduction in noise pollution and improved air quality. Responses from the interview revealed that the pandemic had notable environmental implications, both positive and negative. During lockdowns, interview respondents observed reduced pollution levels and quieter surroundings as human activity declined. This temporary improvement in environmental quality highlights the potential benefits of reduced industrial and vehicular emissions. However, these gains were short-lived. Post-pandemic, environmental conditions in some areas worsened due to increased waste generation and socio-economic pressures. Respondents reported heightened insecurity and environmental degradation, with one stating, "After the COVID pandemic, the environment became unsafe, and the crime rate increased" (Ugbo-O 2). These findings align with global observations, where temporary environmental benefits during lockdowns were counterbalanced by post-pandemic challenges.

The impact of the pandemic on the environment was not as drastic as the impact on the economy and social life. The pandemic caused the sudden evacuation of the streets, schools, churches, malls, markets and any place that requires gathering of people to avoid the spread of the disease. These resulted in a cleaner environment and improved air quality. Other negative effects of the pandemic on the environment were experienced after the pandemic as people quickly reverted to their normal activities at a heightened stance in a bid to meet the economic downturn occasioned by the pandemic. This may have contributed to the fast reversal of the environmental gains witnessed during the pandemic.

4.3. Adaptability Practices by the Slum Dwellers in Response to the COVID-19 Pandemic

The adaptive practices of slum dwellers in Enugu Urban reflect their resilience and resourcefulness in the face of challenging living conditions. Interview respondents employed diverse strategies, including adopting digital tools for business, managing available food, engaging in farming, and sourcing local daily jobs. One respondent shared, "I had to cut costs and shift to selling online" (Ugbo-E 3); another stated, I had to depend on my farm produce during the COVID-19 pandemic. My neighbors were also part of the Survival plan.") Iki 1., while the third said: " I had to help my neighbour at her shop whenever she opened, to help her sell and manage. That was how I got food and money" Ugbe 1. Such adaptive behaviors highlight the ingenuity and resilience of individuals in navigating unprecedented challenges.

Through livelihood diversification, social cohesion and reliance on informal supports, residents demonstrate their ability to adapt and thrive within their urban environment. The slum dwellers by engaging in multiple sources of income, mitigate the risks associated with unemployment and irregular wages, thereby enhancing their economic resilience. This study agrees with Ma et al. [16] study that illuminate the creation of community-centered groups and social connections aimed at addressing mutual challenges. A study also corresponds with this study, they noted that the slum dwellers developed and relied on multiple income-generation activities, which helped them to mitigate the risk associated with unemployment and fluctuating income [4].

5. Conclusions

The findings of this study highlight the multifaceted impacts of the COVID-19 pandemic on slum dwellers in Enugu Urban, revealing how social, economic, and environmental dimensions were deeply affected. Socially, the absence of government social protection, increased poverty and crime, and some level of marginalization were felt. Lockdowns strained broader physical social networks while fostering tighter local bonds and increased reliance on local support systems. Yet, access to formal assistance

was uneven, and the absence of institutional safety nets exposed systemic inequities. Economically, the pandemic dealt a severe blow to livelihoods. Loss of income, job insecurity, inflated costs of basic needs, and inability to meet housing and utility expenses intensified vulnerabilities. These economic hardships were compounded by movement restrictions that limited work opportunities and access to goods and services, escalating poverty levels and aggravating social instability. Environmentally, while initial lockdowns brought temporary improvements in air quality and reduced pollution, these gains were short-lived. Post-pandemic economic pressures and increased waste generation reversed many of these environmental benefits, reflecting the delicate balance between environmental sustainability and socio-economic recovery. Despite these challenges, slum dwellers exhibited notable adaptability. Through livelihood diversification, adoption of digital tools, and strong informal local support, they demonstrated resilience in confronting the crisis. These adaptive practices highlight the critical role of community solidarity and informal systems in navigating urban vulnerability.

Overall, the study highlights the interconnectedness of health, economic, social, and environmental dimensions. This then calls for inclusive, equity-focused policy interventions that strengthen institutional support, improve access to basic services, and enhance the adaptive capacity of slum communities. The study further identified key priorities for future interventions which can include: a. strengthening healthcare access: there is an urgent need to expand diagnostic and treatment services within slum communities. This could entail increasing the availability of primary healthcare facilities, mobile health units, and trained personnel to ensure early detection and management of diseases, not just COVID-19 but endemic illnesses like malaria and respiratory infections. Community health education programs should also be intensified to raise awareness about prevention, hygiene practices, and available services for endemic diseases and pandemics. Bridging the digital divide through telemedicine and e-health solutions should also be considered, especially for slum areas with limited physical access to care. The main aim should be to make policies that prioritize sustained healthcare investments in informal settlements to reduce health inequalities and build system-wide resilience. b. Enhancing economic resilience: financial assistance such as cash transfers, subsidized loans, and micro-grants should be directed toward vulnerable households and micro-enterprises in slum areas. Capacity-building programs can also be introduced to help residents upskill or diversify income sources in areas such as agriculture, digital commerce, or local production. This will not only serve as a response mechanism but also a poverty alleviation strategy. c. Promoting social inclusion: Community networks and grassroots organizations should be empowered and strengthened to lead inclusive initiatives, such as mutual aid groups, local task forces, and neighborhood watch teams. Moreover, as a continuous process of empowerment, social platforms for information dissemination and participatory governance should be established to ensure slum residents can meaningfully access health information, access to help and contribute to planning and policy decisions affecting their wellbeing. d. Advancing environmental sustainability: Local leadership in slums, in collaboration with community groups (women, youth, men etc.), can co-design and implement low-cost, context-sensitive waste management solutions, including recycling schemes, composting programs, and community clean-up drives, while enforcing a curb on illegal dumping and providing accessible waste disposal facilities. Additionally, policies should ensure the upgrading and equitable extension of urban facilities to all areas of the city, regardless of location, in future development plans [24], while making greening initiatives (community and individual gardens, green walls and roofs, etc.), for ecological and health balance. These recommendations can be adopted by local authorities, the government, and NGOs interested in improving the lot of the vulnerable individuals found in Enugu slums.

Author Contributions

C.A.J.: conceptualization, data curation, formal analysis, writing—original draft. G.C.I.: conceptualization, data curation, formal analysis, Original draft, project management. E.C.E.: validation, writing—original draft, writing—revision and editing. G.O.C.: writing—revision and editing. All authors have read and agreed to the published version of the manuscript.

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The data for this study is not available due to privacy pledge.

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Conflict of Interests

The authors declare that there is no conflict of interest.

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