

INFLUENCE OF BEHAVIORAL CARBON LOCK- IN ON THE HEALTH OF SOME SELECTED ARTISANS IN KANO METROPOLIS

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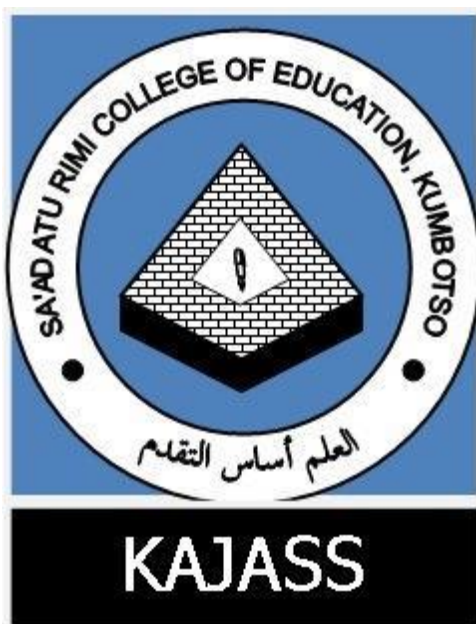
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ABSTRACT

This study investigates the influence of behavioral carbon lock-in on health outcomes among selected artisanal workers (smiths, bakery workers, and Babbaka artisans) in Kano Metropolis, Nigeria. A cross-sectional design was adopted with a population of 400 and a sample size of 180 artisans. Health data were collected using non-dispersive infrared instruments for air quality assessment and structured questionnaires for respiratory symptoms. Workers were grouped into three age categories: 15–30, 30–45, and 45 and above. Age and location distributions were analyzed. Findings indicate increased prevalence of respiratory and cardiovascular health conditions associated with sustained exposure to combustion products and behavioral entrenchment of fossil-fuel-intensive practices. The results highlight the role of behavioral carbon lock-in as a contributor to occupational health hazards in artisanal settings. Policy recommendations include interventions targeting behavioral patterns and improved air quality controls.

Keywords: behavioral carbon lock-in, artisans, respiratory health, occupational safety

INTRODUCTION

Persistent reliance on carbon-intensive behaviors and technologies can entrench air pollution exposures that adversely affect human health. Carbon lock-in refers to the inertia that sustains high-carbon systems through path dependent behaviours, institutions, and technology choices, inhibiting transitions to low-carbon alternatives. ([WHO], 2021). While extensively studied in energy and infrastructure contexts, behavioral carbon lock-in's micro-level implications for health in artisanal work environments remain

underexplored. Behavioral lock-in occurs when individual and social patterns reinforce continued use of carbon-intensive fuels or practices, increasing exposure to harmful emissions. (Seto *et al.*, 2016; Unruh, 2000). Irene & Irene (2023) observed that Nigeria is a good case study for carbon lock-in because it provide a rich context and theoretical perspective of the broader fossil fuel energy setting that advances our understanding of the lock in dynamics in sub Saharan Africa that offer a comparatively slow transition path.

Artisan industries in urban Nigeria, such as smithing and baking, often use combustion processes that emit pollutants (e.g., particulate matter, carbon monoxide). Chronic exposure to such air pollutants has been linked with respiratory conditions, asthma, chronic bronchitis, and cardiovascular morbidity.

This study therefore examines how entrenched high-carbon behaviors influence health outcomes among selected artisan groups in Kano Metropolis. By combining environmental measurements via non-dispersive infrared (NDIR) instruments and health surveys, this research contributes novel empirical insights linking behavioral carbon lock-in with occupational health.

MATERIALS AND METHODS

Study Area and Population

The study was conducted across selected artisan locations in Kano Metropolis, covering:

- a. Smith locations: Fanisau, Kofar Ruwa, Unguwa Uku, Farawa
- b. Bakery types: Halal Bread, Fatima Bread, Excellent Bread, El-Sadiq Bread
- c. Babbaka areas: Abbatior, Bachirawa, Tudun Murtala, Unguwa Uku

The total sampling frame was 400 artisans. A stratified random sampling technique yielded 180 participants (45%) proportional to artisanal categories.

Instrumentation

Environmental assessment used non-dispersive infrared (NDIR) analyzers to quantify Carbon Monoxide and other combustion-related gases at artisan sites during peak operational hours, following standard procedures. NDIR is preferred for accurate quantification of gaseous pollutants in occupational studies.

Data Collection and Health Assessment

Structured questionnaires and medical interviews collected data on symptoms such as cough, breathlessness, chest pain, and long-term respiratory disease, categorized by age group.

Ethical clearance and informed consent were obtained.

Data Analysis

Age distribution tables were compiled for each artisanal sector. Health outcomes were cross-tabulated by age groups. Descriptive statistics, chi-square tests, and bar charts were generated to identify associations between age, workplace exposure, and health conditions.

RESULTS AND DISCUSSION

Age Distribution of Artisans

The age distribution of smith, bakery, and babbaka workers is presented in Tables 1–3. Across all occupational categories, the 30–45 years age group constituted the largest proportion of workers, indicating that artisanal activities in Kano Metropolis are predominantly undertaken during peak productive years.

Smith Workers

As shown in Table 1 and Figure 1, smith workers aged 30–45 years accounted for 43 out of 60 workers (71.7%), followed by those aged 15–30 years (20.0%) and those aged 45 years and above (8.3%). This distribution suggests sustained occupational engagement among middle-aged workers and declining participation among older individuals. Age-related attrition in physically demanding and carbon-intensive occupations has been documented in previous occupational health studies (Unruh, 2000; World Health Organization [WHO], 2021).

Table 1: Distribution of Smith workers by location and Age Group in Kano Metropolis

Location	Less than 30 Years	30-45 Years	above 45 years	Total
Fanisau	4	10	2	16
Kofar Ruwa	5	20	1	26
Unguwa uku	2	5	0	7
Farawa	1	8	2	11
Total	12	43	5	60

Source: Field Survey, 2025

Bakery Workers

The age distribution of bakery workers is presented in Table 2. Workers aged 30–45 years constituted 58.3%, those aged 15–30 years accounted for 26.7%, while workers aged 45 years and above represented 15.0% of the sample. The relatively higher proportion of younger workers suggests early occupational entry into bakery-related activities characterized by continuous exposure to combustion by-products. Early exposure to indoor air pollution has been associated with increased risks of long-term respiratory morbidity (Smith *et al.*, 2014; Pope *et al.*, 2020).

Table 2: Distribution of Bakery workers by Bakery Type and Age Group

Location	Less than 30 Years	30-45 Years	above 45 years	Total
Halal Bread	3	5	0	8
Fatima Bread	7	15	4	26
Excellent Bread	2	9	1	12
El-Sadiq Bread	4	6	4	14
Total	16	35	9	60

Source: Field Survey, 2025

Babbaka workers

Among Babbaka workers, the 30–45 years age category is again predominant, followed by the Less than 30 years group. The least represented group is 45 years and above, possibly due to declining physical strength and increased health challenges associated with prolonged exposure to carbon-based emissions.

Table 3: Distribution of Babbaka workers by location and Age Group

location	Less than 30 Years	30-45 Years	above 45 years	Total
Abbatiar	8	25	1	34
Bachirawa	2	5	1	8
Tudun Murtala	1	5	3	9
Unguwa Uku	1	7	1	9
Total	12	42	6	60

Source: Field Survey, 2025

Comparative Age Distribution of Artisans

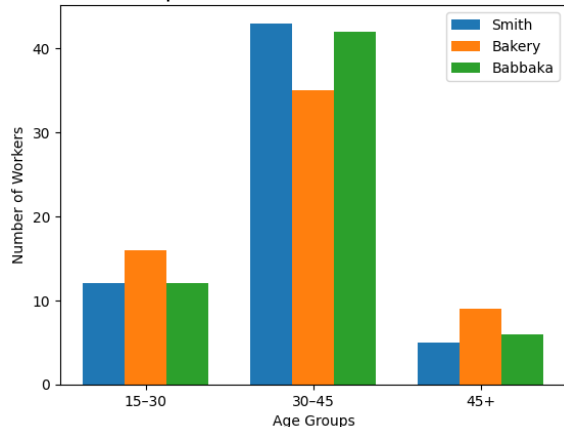
A comparative analysis of age distribution across smith, bakery, and babbaka workers is illustrated in Table 3. The 30–45 years age group consistently dominates across all occupational categories, followed by the less than 30 years group, while the 45 years and above category remains the least represented. This uniformity suggests comparable exposure duration and occupational engagement across artisanal sectors.

Bakery workers recorded the highest number of workers aged less than 30 years, suggesting early entry into occupations characterized by exposure to combustion-related emissions. Smith and babbaka workers exhibit similar patterns, with moderate participation of younger workers but significantly higher concentration in the 30–45 years group.

The 45 years and above category is least represented across all artisan groups, though bakery workers show relatively higher numbers in this age group compared to smith and babbaka workers. This may reflect cumulative health effects and reduced physical capacity resulting from prolonged exposure to carbon emissions.

Overall, the comparative analysis highlights a consistent age-related exposure pattern, reinforcing the concept of behavioral carbon lock-in, where artisans remain trapped in carbon-intensive occupations due to economic dependency, habitual practices, and limited access to cleaner technologies.

Figure 3. Comparative age distribution of artisans in Kano Metropolis.



Health Conditions by Age Group

Reported health outcomes demonstrated a clear age-related gradient consistent with cumulative exposure effects.

Workers aged less than 30 years frequently reported recurrent cough, mild breathing difficulties, eye and throat irritation, headaches, and fatigue. These symptoms are indicative of early-stage respiratory irritation associated with repeated exposure to airborne pollutants (Brook et al., 2010).

Among workers aged 30–45 years, more severe health conditions were observed, including chronic bronchitis, asthma, persistent respiratory infections, chest pain, reduced work performance, and frequent tiredness. These findings align with evidence linking prolonged exposure to combustion-related air pollution with progressive respiratory impairment (Pope & Dockery, 2006; WHO, 2021).

In the 45 years and above category, reported conditions included chronic obstructive pulmonary disease, severe lung disease, cardiovascular complications, premature ageing, and physical weakness. Long-term exposure to carbon-intensive occupational environments has been strongly associated with irreversible respiratory and cardiovascular damage in older populations (Burnett et al., 2018).

Behavioral Carbon Lock-In and Occupational Health

The observed age distribution and health outcomes provide empirical support for the concept of behavioral carbon lock-in, defined as the persistence of carbon-intensive practices driven by habitual behavior, economic dependence, and limited access to cleaner alternatives (Seto et al., 2016; Unruh, 2000).

Artisans in Kano Metropolis remain engaged in combustion-based production methods throughout their working life span, resulting in sustained exposure to harmful emissions. The dominance of the 30–45 years age group across all artisan categories reflects prolonged entrenchment in carbon-intensive occupational behaviors during economically productive years. Younger workers entering these occupations inherit similar exposure pathways, reinforcing intergenerational continuity of high-carbon practices. This is in line with the findings of Zakari (2019).

The reduced representation of workers aged 45 years and above suggests occupational exit driven by declining health and physical capacity, a pattern commonly observed in polluted work environments (WHO, 2021).

Integrated Interpretation of Tables

Integration of Tables 1–3, and reported health conditions reveals a progressive exposure–health relationship. Early occupational exposure is associated with mild respiratory symptoms, sustained exposure corresponds with chronic respiratory conditions and reduced productivity, and cumulative exposure results in severe cardiopulmonary disease. These findings indicate that behavioral carbon lock-in functions as a health risk amplifier among artisans in Kano Metropolis.

CONCLUSION

The study reveals that behavioral carbon lock-in significantly influences health outcomes among

artisan groups in Kano Metropolis, with respiratory and cardiovascular conditions associated with chronic exposure to combustion by-products. Age-dependent trends reflect cumulative effects. To mitigate these impacts, policy interventions should target behavioral change, adoption of cleaner fuels, and occupational health monitoring.

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