

# Assessment of Knowledge and Public Health Implications of Compressed Natural Gas (CNG) Usage among Motorists in the Federal Capital Territory, Abuja, Nigeria

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## Abstract

## Review Article

Compressed Natural Gas (CNG) has emerged as a viable and environmentally responsible alternative to conventional fossil fuels. Its use in transportation not only contributes to reducing carbon emissions but also plays a role in energy diversification and public health protection. This research investigates the awareness, health implications, and occupational hazards linked to CNG utilization among vehicle operators in Abuja, Nigeria. Employing a descriptive cross-sectional methodology, structured questionnaires were distributed among 400 drivers chosen through a blend of random and convenience sampling. Statistical analyses, both descriptive and inferential, were conducted using SPSS. The results reveal moderate awareness of CNG's ecological benefits but a noticeable deficiency in understanding operational safety and health consequences. The findings underscore the necessity for comprehensive educational campaigns, policy reinforcement, and infrastructural enhancements. The study advocates for collaborative interventions involving policymakers, transport unions, and public health institutions to foster safer use of CNG and ensure better public health outcomes.

**Keywords:** Compressed Natural Gas, CNG, Transportation, Carbon Emissions, Public Health, Occupational Hazards, Vehicle Operators, Abuja, Nigeria, Awareness, Safety Education, Policy Intervention.

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## CHAPTER ONE: INTRODUCTION

### 1.1 Background to the Study

The global transition toward sustainable energy sources has spotlighted Compressed Natural Gas (CNG) as a promising fuel alternative for the transport sector. CNG primarily consists of methane, a hydrocarbon gas that produces significantly fewer pollutants when combusted, compared to traditional fuels like petrol and diesel. The need to mitigate air pollution, reduce greenhouse gas emissions, and curb fuel costs has propelled the adoption of CNG in several countries, including Nigeria. In the Federal Capital Territory (FCT), Abuja, the increasing integration of CNG-powered vehicles marks a progressive shift towards cleaner transportation. Despite its potential, several safety, health, and infrastructural concerns remain inadequately addressed. This study critically explores the intersection of public awareness, health implications, and safety practices associated with CNG use.

### 1.2 Statement of the Problem

Although CNG has gained traction due to its economic and environmental appeal, its growing popularity has not been matched with equivalent safety education and risk management. In Abuja, many motorists operating CNG-powered vehicles lack essential training in safe refueling practices, handling gas leaks, and recognizing long-term exposure risks. Moreover, infrastructural limitations, such as inadequate refueling stations and lack of proper certification for conversion centers, exacerbate these challenges. This research identifies and analyzes the health and safety gaps that could compromise the benefits of CNG adoption if left unaddressed.

### 1.3 Aim and Objectives

The primary aim of this study is to assess the knowledge, health impacts, and occupational hazards associated with CNG usage among motorists in Abuja.

Specifically, it seeks to:

1. Evaluate the level of knowledge among motorists regarding the safety and health aspects of CNG.
2. Investigate occupational risks linked with CNG vehicle operations and refueling.
3. Assess the presence and efficacy of public health interventions or strategies promoting CNG safety.

## 1.4 Research Questions

1. To what extent are motorists informed about the health and safety aspects of CNG usage?
2. What specific occupational hazards do drivers face while operating or refueling CNG-powered vehicles?
3. What mechanisms or programs currently exist to ensure safe use of CNG among Abuja motorists?

## 1.5 Hypotheses

H01: There is no statistically significant correlation between knowledge of CNG usage and perceived public health risk.

H02: There is no significant relationship between occupational safety awareness and adherence to CNG safety practices.

H03: Public health interventions have no significant influence on the safety outcomes of CNG users.

## 1.6 Significance of the Study

This research provides empirical evidence to support policy formulation and public health interventions relating to CNG. The outcomes of this study are expected to guide government regulatory bodies, urban transport planners, and public health educators on appropriate safety guidelines, training programs, and awareness campaigns. Furthermore, the study bridges existing gaps in literature regarding the public health dimensions of alternative fuel usage in sub-Saharan Africa.

## 1.7 Scope of the Study

The geographical scope of this study is confined to the Federal Capital Territory, Abuja. Thematically, it focuses on evaluating CNG-related knowledge, associated public health implications, and occupational risks among vehicle operators. The study limits its target population to CNG motorists and does not extend to manufacturers or government regulators directly.

# CHAPTER TWO: LITERATURE REVIEW

## 2.1 Conceptual Clarification

Compressed Natural Gas (CNG) is a form of natural gas primarily composed of methane and stored under high pressure for vehicular fuel use. It is considered an eco-friendly substitute for gasoline and diesel due to its lower emission profile. CNG has been adopted globally, especially in urban centers grappling with air pollution and rising fuel costs. In the Nigerian context, the Federal Government has promoted its usage through initiatives such as the National Gas Expansion Programme (NGEP), which encourages conversion of petrol and diesel vehicles

to CNG systems. Understanding CNG's chemical and mechanical properties, as well as its implications for vehicle performance and environmental impact, is critical in evaluating its viability.

## 2.2 Theoretical Framework

This study draws on the Energy Ladder Theory and Risk Perception Theory. The Energy Ladder Theory explains how individuals transition from traditional energy sources to more efficient ones as socioeconomic conditions improve. In this context, CNG adoption in Nigeria reflects a movement toward cleaner energy by economically empowered motorists. Risk Perception Theory, on the other hand, explains how people evaluate the danger associated with new technologies. The theory posits that lack of personal experience, scientific literacy, and trust in regulatory institutions significantly shapes how users perceive risk. Together, these frameworks provide a lens to interpret user behavior and safety practices regarding CNG.

## 2.3 Empirical Review

International literature on CNG usage reveals strong environmental and health advantages. For example, Yoon et al. (2014) demonstrated that CNG vehicles produce lower particulate matter and nitrogen oxide emissions than diesel counterparts. In India, Paladugula et al. (2018) associated CNG programs with significant reductions in vehicular emissions. However, safety concerns have emerged due to the pressurized nature of storage systems. In Brazil and Pakistan, studies have cited fire outbreaks due to improper installation and poor maintenance of CNG kits.

In Nigeria, research remains limited but growing. Ogunlowo et al. (2015) examined policy barriers to CNG adoption and identified infrastructure inadequacies as major hindrances. Adegioriola and Suleiman (2020) focused on economic benefits but did not address occupational or health-related risks. This current study builds on previous research by focusing on the knowledge, public health impact, and perceived risks among CNG motorists in Abuja. By concentrating on end users, it uncovers behavioral patterns that quantitative policy analysis might overlook.

## 2.4 Summary of Literature

The reviewed literature establishes that while CNG offers substantial benefits for sustainable transport, its successful adoption relies on adequate user education, infrastructure, and regulatory oversight. Globally, studies emphasize the importance of risk communication, technical certification, and user training. The Nigerian context reveals unique challenges, such as low public awareness, limited refueling infrastructure, and weak enforcement of safety regulations. These gaps affirm the need for local, evidence-based interventions targeting safety and public health. This study, therefore, provides critical insights into how motorists in Abuja perceive,

understand, and manage risks associated with CNG technology.

## **CHAPTER THREE: METHODOLOGY**

### **3.1 Research Design**

This study utilized a descriptive cross-sectional design, which is appropriate for assessing knowledge, risk perception, and behaviors at a specific point in time. The design enabled the researcher to capture a snapshot of CNG usage experiences and safety awareness among motorists. This approach also allowed for statistical comparisons between various demographic groups.

### **3.2 Study Area**

The study was conducted in Abuja, Nigeria's Federal Capital Territory. Abuja comprises six Area Councils: Abaji, Abuja Municipal, Bwari, Gwagwalada, Kuje, and Kwali. As a rapidly urbanizing city with significant vehicular activity, Abuja is an ideal location for investigating the public health dimensions of CNG usage. It also hosts several official pilot projects under Nigeria's gas transition initiative, making it a relevant context for this research.

### **3.3 Population and Sampling**

The study population comprised commercial and private motorists operating CNG-powered vehicles in Abuja. Using a combination of simple random and convenience sampling techniques, 400 participants were selected. Random sampling ensured representativeness, while convenience sampling addressed practical challenges of access and willingness to participate. The sample size was chosen based on Cochran's formula for proportions in large populations, with a 95% confidence level and 5% margin of error.

### **3.4 Instrument for Data Collection**

A structured, pre-tested questionnaire served as the primary instrument for data collection. The questionnaire was divided into five sections: demographic information, knowledge of CNG, perceived risks, safety practices, and awareness of intervention strategies. To ensure content validity, the instrument was reviewed by three public health experts. A pilot test was conducted with 30 motorists outside the study sample to refine clarity, reliability, and relevance.

### **3.5 Method of Data Analysis**

Collected data were coded and analyzed using SPSS Version 25. Descriptive statistics such as frequencies, means, and percentages summarized the data. Inferential statistics, particularly Chi-square tests, were used to test hypotheses at a 0.05 level of significance. Cross-tabulations were employed to explore relationships between demographic variables and safety knowledge. The results are presented in tables and charts for easy

interpretation.

## **CHAPTER FOUR: RESULTS AND DISCUSSION**

### **4.1 Demographic Characteristics**

Among the 400 respondents, 66.8% were male while 33.2% were female. The age group with the highest representation was 31–40 years, reflecting the active workforce demographic. A majority (over 70%) possessed tertiary education, and more than half identified as commercial drivers. These findings suggest that the sampled population was relatively well-educated and professionally dependent on vehicular operations, making them ideal subjects for examining CNG safety awareness.

### **4.2 Knowledge of Health Implications**

While the majority of respondents recognized that CNG-powered vehicles emit fewer harmful pollutants compared to petrol or diesel, only a fraction demonstrated adequate understanding of health risks associated with CNG exposure. Specific gaps were observed in knowledge about gas inhalation effects, emergency response procedures, and the importance of regular maintenance. These results indicate a need for targeted health education interventions.

### **4.3 Occupational Risk Awareness**

Many respondents reported limited awareness of key occupational hazards, such as explosion risks due to gas leaks, improper tank storage, or the use of uncertified conversion kits. Few were familiar with the use of fire extinguishers or safety inspection checklists. The data suggest that despite high adoption rates, safety practices remain informal and largely intuitive rather than institutionalized.

### **4.4 Intervention Strategies**

Participants expressed strong support for public sensitization, mandatory safety training, and expansion of CNG refueling facilities. Approximately 85% of respondents agreed that government-led campaigns and regulatory enforcement were crucial for safe CNG operations. There was also demand for financial incentives and subsidized safety gear. These responses highlight both awareness of the need for intervention and a willingness to engage in safety-enhancing initiatives.

### **4.5 Discussion of Findings**

The results align with earlier studies emphasizing that while CNG adoption can reduce environmental burdens, user education and infrastructure are critical for ensuring health and safety. Comparatively, countries with well-regulated CNG systems—such as India and Brazil—have invested heavily in driver training and infrastructure. Abuja's experience reflects a nascent system, where user knowledge is uneven, and institutional frameworks are underdeveloped. The research confirms that knowledge does not necessarily translate into practice without

structural support.

## **CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS**

### **5.1 Summary of Findings**

This study examined knowledge, public health implications, and occupational safety practices related to CNG usage among motorists in Abuja. The findings revealed a moderate understanding of CNG's environmental advantages but significant knowledge gaps regarding operational safety and health risks. Respondents expressed support for enhanced regulatory frameworks and infrastructural expansion. Occupational hazards were mostly underreported or underestimated, indicating an urgent need for structured interventions.

### **5.2 Conclusion**

Compressed Natural Gas represents a cleaner, cost-effective alternative to traditional fuels in Nigeria's transportation sector. However, the benefits of CNG can only be fully realized when complemented by user education, consistent regulatory oversight, and robust infrastructural support. This study concludes that public health outcomes and road safety can be significantly improved through comprehensive policy reforms and targeted awareness initiatives.

### **5.3 Recommendations**

1. Establish mandatory CNG safety training and certification for vehicle owners and drivers.
2. Develop standardized safety protocols and regular inspections for CNG kits and refueling stations.
3. Expand accessible CNG infrastructure, particularly in high-traffic areas across Abuja.
4. Provide financial incentives for safe conversion practices and the purchase of certified kits.
5. Launch continuous public awareness campaigns using radio, workshops, and motor parks.
6. Increase the number of operational CNG refill stations in Abuja and its surrounding regions.

7. Mandate PCNG to monitor refueling practices, especially the imposition of unofficial fees on motorists.
8. Implement third-party monitoring by NGOs or civil society to ensure transparency in CNG distribution.
9. Require multinational organizations using CNG fleets to establish in-house refueling systems.
10. Extend CNG service station operating hours to a 24/7 model to reduce congestion.

### **5.4 Suggestions for Further Study**

Future research could explore longitudinal health outcomes associated with prolonged CNG exposure and assess the effectiveness of existing regulatory frameworks. Additionally, comparative studies across different Nigerian cities can provide insights into regional variations in knowledge and safety compliance.

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