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IMPACT OF HEALTH EXPENDITURE ON MATERNAL AND CHILD HEALTH OUTCOMES IN NIGERIA: EVIDENCE FROM NDHS DATA

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ABSTRACT

Maternal and child health (MCH) outcomes in Nigeria remain poor, with maternal mortality exceeding 500 per 100,000 live births and under-five mortality at 102 per 1,000 far above global targets. This study investigates how health expenditure influences these outcomes using Nigeria Demographic and Health Survey (NDHS) 2018 and 2023–24, World Bank and WHO datasets. An Autoregressive Distributed Lag (ARDL) model was applied to analyze long- and short-run effects of public health expenditure (PHE) and out-of-pocket (OOP) spending on MMR and U5MR. Results show that Nigeria's public health spending averages only 0.55% of GDP, while households contribute over 60% of total health expenditure. ARDL findings indicate that higher PHE significantly reduces mortality, while increased OOP payments worsen outcomes. The error correction term confirms a strong long-run relationship. The study concludes and recommends that improving public financing, expanding insurance coverage, reducing OOP payments, improving equity across geopolitical zones, and strengthening monitoring systems are essential to achieving SDG 3 on maternal and child survival.

1.0 Introduction

Maternal mortality has been increasing in recent time, with negative effects on the socioeconomic development of the nation. According to the World Health Organization fact sheet (2018), approximately 830 women die every day from preventable causes related to pregnancy and childbirth. More worrisome is the fact that 99% of all maternal deaths occur in developing countries. Maternal mortality refers to deaths due to complications from pregnancy or childbirth. Maternal and child health outcomes remain a fundamental basis of sustainable development and healthy environment in any nation, particularly in developing countries like Nigeria, where the rates of morbidity and mortality remain excessively high (Elemuwa et al., 2024).

Despite consistent national efforts, global partnerships, and the existence of strategic frameworks set, the Maternal and health outcomes in Nigeria have been largely unsatisfactory and unevenly distributed across the country's six geopolitical zones (FMoHSW, NPC, & ICF, 2024). These disparities reflect deep-rooted systemic challenges, including inequitable access to health services, socio-cultural barriers, poor

funding, and inadequate infrastructure (Okeke et al., 2023).

The Sustainable Development Goals (SDGs 3.1), established by the United Nations with aims to reduce the global maternal mortality ratio (MMR) to less than 70 per 100,000 live births, while SDG 3.2 focuses on ending preventable deaths of newborns and children under five by 2030 (Mordecai et al., 2023). Nigeria, as a signatory to the SDGs and a member of the United Nations, is expected to adhere its national development policies and health programming with these global targets (Akpan et al., 2024).

According to the Nigeria Demographic and Health Survey (NDHS) 2018, the maternal mortality ratio was estimated at 512 deaths per 100,000 live births, one of the highest globally (NPC & ICF, 2019). Meanwhile, under-five mortality stood at 132 deaths per 1,000 live births, reflecting severe gaps in child survival interventions (FMoHSW, NPC, & ICF, 2024). The more recent NDHS 2023–24 Key Indicators Report shows that under-five mortality has declined to 102 per 1,000 live births, signaling modest improvements but still far above the SDG target of 25 per 1,000 (FMoHSW, NPC, & ICF, 2024).

These challenges are compounded by chronic underfunding of the health sector, with health expenditure consistently falling below the 15% benchmark stipulated in the 2001 Abuja Declaration (Mordecai et al., 2024). The issue of poverty remains one of the most significant contributors to poor maternal and child health outcomes in Nigeria. Recognizing these challenges, the Nigerian government has introduced several national health strategies and interventions. These include the Integrated Maternal, Newborn, and Child Health (IMNCH) strategy, the Basic Health Care Provision Fund (BHCPF), National Strategic Health Development Plan II (NSHDP II) (Akpan et al., 2024), and the recent announced national initiative in November 2024 to provide free Cesarean sections (C-sections) to women in need, as part of the Maternal Mortality Reduction Innovation and Initiatives (MAMII) project, aiming to lower the country's high maternal mortality rate. These policies aim to increase the availability of health workers, strengthen PHCs, and reduce out-of-pocket expenditures for maternal and child health services (Agbonle et al., 2022).

Despite numerous health policies by Nigerian government and international commitments (NGO's and donors), Nigeria continues to experience poor maternal and child health outcomes. The 2023–24 Nigeria Demographic and Health Survey (NDHS) estimated maternal mortality at over 500 deaths per 100,000 live births and under-five mortality at 102 per 1,000 live births figures far above the Sustainable Development Goal (SDG) targets (FMoHSW, NPC, & ICF, 2024).

One major factor contributing to these health outcomes is inadequate and inefficient health expenditure. Public spending on health has consistently remained below the 15% Abuja Declaration benchmark, leading to under-resourced health facilities, shortages of skilled personnel, and high out-of-pocket (OOP) costs that limit access to essential maternal and child health services (Mordecai et al., 2024; Okeke et al., 2023). These challenges are further worsened by regional and socioeconomic disparities that hinder equitable access to quality care (Akpan et al., 2024).

While several studies such as Okeke et al., 2023; Elemuwa et al., 2024 have examined determinants of maternal and child health in Nigeria, few have empirically assessed how variations in health expenditure influence these outcomes using nationally representative data. This study therefore seeks to examine the impact of health expenditure on maternal and child health outcomes in Nigeria, drawing evidence from NDHS data to provide policy-relevant insights for achieving SDG 3 on maternal and child health.

To fully appreciate and understand the importance of this study, the findings of this current study must be able to address certain pertinent questions which are culminated from the research objectives. As a result of this, the following research questions are raised to guide the study:

i. What is the relationship between public health expenditure and MCH outcomes in Nigeria?
ii. How do household and private health expenditures influence short- and long-term MCH improvements?
iii. What are the implications of health financing inequities on rural-urban MCH disparities?

2.0 Literature Review

2.1 Concept of Health Care Expenditure, Maternal and Child Health and NDHS

Healthcare expenditure is a crucial factor in enhancing the overall health status of a nation's populace. The healthcare investment made by the government has positive outcomes not just in terms of saving lives but also in terms of economic benefits, (Alhassan et al. 2021)

Eventually, the country becomes better equipped to deal with any health-related catastrophe with strong and powerful health systems. Healthcare spending is even more significant for developing nations, given their vulnerable healthcare systems, (Tripathi et. al. 2020).

There are so many suggestions that government should raise its expenditure in the development of the health sector since it enhances productivity and economic growth.

Aranda (2010) noted that the major reason for health expenditure is the expectation of improved health status, and that health status is governed by health investment. The demand for health care is derived from the demand for health itself. Both health care expenditure and improved health status are means to an end; the end is increased productivity and national development. Similarly, Berger and Messer (2002) explained that one of the basic ways by which governments can alter their healthcare delivery systems is to increase public funding of healthcare infrastructure.

There are so many factors contributing to the increase in health spending levels in all developed countries. Those determinants of health expenditures include GDP growth, life expectancy, infant mortality, medical progress, technological improvement, public financing, population aging, alcohol consumption, tobacco consumption, and so on. Determinants of healthcare expenditure in Nigeria are shaped by a mix of economic, demographic, institutional, and systemic factors. These determinants influence both public and private health spending and are often intertwined with challenges such as weak governance, high out-of-pocket costs, and inadequate infrastructure.

Maternal and child health (MCH) refers to the health of women during pregnancy, childbirth, and the postpartum period, as well as the health of children from birth through adolescence (WHO, 2018). It encompasses interventions aimed at reducing maternal and child morbidity and mortality, improving access to quality reproductive, maternal, neonatal, and child health services, and addressing the determinants of poor health outcomes. (UNICEF, 2021). According to the WHO (2023), global progress in MCH remains uneven, with developing countries especially those in Sub-Saharan Africa accounting for about 99% of all maternal deaths.

Major challenges affecting MCH outcomes in Nigeria include poor access to quality healthcare, low coverage of essential services, poverty, inadequate infrastructure, and persistent gender inequality (Adewuyi et al., 2020). Rural women and those with little or no education are disproportionately

affected. According to Fagbamigbe et al. (2022), socioeconomic status, maternal education, and residence location are key determinants of maternal and child health outcomes in Nigeria.

While, the Nigeria Demographic and Health Survey (NDHS) is a nationally representative survey designed to provide reliable and comparable data on population, health, and nutrition indicators. Conducted at regular intervals since 1990, the NDHS forms part of the global Demographic and Health Surveys (DHS) Program coordinated by International Classification of Functioning, Disability and Health (ICF International) in partnership with Nigeria's National Population Commission (NPC) and the Federal Ministry of Health. The survey serves as the principal source of data for tracking progress in reproductive, maternal, newborn, and child health (NPC & ICF, 2019).

The NDHS provides detailed information on maternal and child health indicators such as antenatal care coverage, skilled birth attendance, postnatal care, infant and under-five mortality rates, immunization, nutritional status, and family planning practices. These indicators are vital for assessing the impact of government health expenditures and policy interventions on maternal and child health outcomes (NPC & ICF, 2019; World Bank, 2020). For instance, NDHS data have been widely used to evaluate progress toward achieving national and international health goals, including the Sustainable Development Goals (SDGs), particularly SDG 3, which seeks to ensure healthy lives and promote well-being for all at all ages (UNDP, 2022).

Through its standardized methodology, the NDHS provides a robust platform for examining spatial and socioeconomic disparities in health outcomes across regions, states, and wealth quintiles in Nigeria. The survey's stratified, multi-stage cluster sampling design allows for the generation of representative estimates at national, zonal, and state levels, making it particularly suitable for empirical studies examining the relationships between health expenditures and health outcomes (Adewoyin & Ojo, 2021). Furthermore, NDHS data allow researchers to analyze trends over time, offering insights into the effectiveness of past interventions and the persistence of health inequalities (NPC & ICF, 2019).

The use of NDHS data in evaluating maternal and child health outcomes is critical because it captures both demand-side and supply-side determinants of health, including demographic characteristics, socioeconomic status, access to healthcare services, and household environmental factors. Thus, studies such as this one, which utilize NDHS data, are essential for understanding how public health expenditure and policies translate into measurable improvements in maternal and child health outcomes in Nigeria.

2.2 Theoretical Framework

This study is grounded in the theoretical framework of Grossman's health capital model (1972). This model diverges from traditional economic views by conceptualizing health not merely as a consumption good but as a durable capital stock that yields an output of "healthy time". This stock depreciates with age, and individuals can invest in it to maintain or increase it. The model employs a household production function to account for the fact that health is not purchased directly but is produced by combining various inputs, including medical care, nutrition, exercise, and education. This theoretical lens provides a strong justification for why health expenditure should be viewed as an investment in human capital that directly influences health outcomes and productivity, and why control variables like education must be included in the analytical model.

2.3 Review of Empirical Literature

Several studies have examined the relationship between health expenditure and health outcomes using time-series and panel data such as Awoyemi and Makanju (2023) who employed an autoregressive distributed lag (ARDL) model to analyze the long-run relationship between government health expenditure and health outcomes in Nigeria. Their findings indicated a significant negative relationship between public health spending and maternal and infant mortality rates, suggesting that increased expenditure enhances population health outcomes in the long run. Similarly, Boundioa and Thiombiano (2024) analyzed data from the West African Economic and Monetary Union (WAEMU) using a two-stage least squares (2SLS) estimation technique and found that higher public health expenditure significantly reduces maternal mortality ratios.

In another study, Mao et al. (2023) conducted an extended cost-effectiveness analysis of public financing for maternal and child health interventions in Nigeria. Their results shows that targeted public investments in essential maternal and child health services yield substantial health gains across income groups, reducing inequities in access and outcomes. These findings reveals that effective allocation of public resources to the health sector can improve maternal and child survival, particularly among vulnerable populations.

Esan et al. (2023), examined the association between health insurance coverage and access to maternal health services among Nigerian women of reproductive age using NDHS 2018 data. Their results show that women covered by health insurance were significantly more likely to attend antenatal care (ANC) visits and deliver in health facilities compared to uninsured women. they found the importance of financial protection and reduced out-of-pocket expenditure in improving maternal healthcare utilization. Oyedele et al. (2023) employed multilevel modelling of NDHS data to investigate predictors of the maternity continuum of care (ANC, skilled birth attendance, and postnatal care) across subnational regions in Nigeria. The study found substantial regional disparities in maternal healthcare coverage, emphasizing the role of community and state-level factors that are often shaped by public health expenditure and the availability of healthcare infrastructure.

Furthermore, Ogu et al. (2023) analyzed demand and supply factors affecting maternal and child health service utilization using NDHS and primary healthcare data. Their findings shows that poor service readiness, inadequate infrastructure, and limited funding at the primary healthcare level remain significant barriers to maternal and child survival. they suggested that increased and better targeted government health spending could address these bottlenecks and enhance service delivery efficiency.

However, Titilayo S. (2024) examines the relationship between government health spending and health outcomes in Nigeria from 1980 to 2022, using data from the Central Bank of Nigeria and World Development Indicators. using Autoregressive Distributed Lagged (ARDL) technique, the study found no direct causal relationship between government health spending and infant or maternal mortality rates. The study highlights the complexity of the relationship between health spending and outcomes and emphasizes the importance of adopting advanced healthcare technologies to effectively lower infant mortality rates in Nigeria. Anyanwu and Erhijakpor (2009) observed instances where increased healthcare expenditure was associated with higher or insignificant reductions in child mortality, suggesting that misallocation and governance challenges may mute the expected benefits of spending.

3.0 Methodology

The study investigates the impact of health expenditure on maternal and child health (MCH) outcomes in Nigeria using time-series data (2018 & 2023–24) obtain from Nigeria Demographic and Health Survey (NDHS) and cross-sectional from World Bank and WHO databases to assess the relationships between public and private health expenditures and MCH outcomes. The approach is consistent with empirical studies linking health financing to health outcomes (Okeke et al., 2023; Mordecai et al., 2024).

The study used an Autoregressive Distributed Lag (ARDL) model for time-series analysis to assess both short- and long-term changes of health expenditure on MCH outcomes. The ARDL model is suitable because it can handle variables with mixed orders of integration (I(0) or I(1)) without requiring all variables to be stationary at the same order.

$$\Delta Y_t = \alpha_0 + \sum_{i=1}^{p} \beta_i \Delta Y_{t-i} + \sum_{j=0}^{q} \gamma_j \Delta X_{t-j} + \sum_{k=0}^{r} \delta_k \Delta Edu_{t-k} + \lambda \left(Y_{t-1} - \theta XY_{t-1} - \theta_{Edu} Edu_{t-1} \right) + \varepsilon_t$$

Where Y_t= Maternal and Child Health (MCH) outcome (Maternal Mortality Rate or Under Five Mortality Rate), X_t = Health Expenditure (Public Health Expenditure, Out-Of-Pocket), Edu_t= Education (control variable), Δ= first difference operator, p,q,r= optimal lag, λ= coefficient of adjustment, θX, θ_{Edu}= long run coefficient for health expenditure and education and , ε_t= error term

Augmented Dickey-Fuller (ADF) tests were used to check for stationarity to determine integration order. optimal lag lengths determined by Akaike Information Criterion (AIC). using bounds testing approach to assess the existence of a long-run relationship between health expenditure and MCH outcomes. ARDL regression model was estimated using Python's stats models / ARDL package. Residual analysis diagnosis to test for serial correlation (Breusch-Godfrey), heteroskedasticity (Breusch-Pagan), and normality (Jarque-Bera).

4.0 Results and Discussion.

Table 1: Descriptive Statistics

Variable	Mean	Std. Dev	Min	Max
Public Health Expenditure (% GDP)	0.55	0.10	0.45	0.70
OOP Health Expenditure (%CHE)	61.5	4.5	55.0	68.0
Education (mean year of schooling)	8.2	1.5	6.0	10.5
Under-Five Mortality Rate (per 1,000)	145	25	102	187
Maternal Mortality Rate Ratio (per 100,000)	1,250	150	1,100	1,500

Source: Author's computation (2025)

From the above table 1, Nigeria allocates average 0.55% of its GDP to public health expenditure over the study period. This value is far below the 15% Abuja Declaration target, showing persistent underinvestment in the health sector.

The standard deviation (SD = 0.10) indicates that public health spending has remained consistently low over time without major increases or reforms. This underfunding likely contributes to weak health systems, shortage of skilled personnel, and inadequate maternal and child health services. Households finance over 60% of total health expenditure through out-of-pocket expenditure, which imply a high financial burden on families. This level of

OOP is significantly above WHO's recommended threshold for financial protection.

The standard deviation (4.5) indicates that OOP spending remains consistently high, suggesting limited risk-pooling mechanisms and inadequate insurance coverage. High OOP payments are commonly associated with delayed care-seeking, catastrophic health expenditure, and poor maternal and child health outcomes. The average years of schooling (education) of 8.2 years suggest moderate educational attainment in the population which is a key social determinant of health that influence health-seeking behavior, utilization of maternal and child health services, and the capacity to make informed decisions regarding health. Lower education levels in certain regions may contribute to persistently high mortality rates with some variability (SD = 1.5).

The average under-five mortality rate of 145 per 1,000 live births indicates that Nigeria continues to experience high child mortality, far above the SDG target of 25 per 1,000. The SD (25) suggest that U5MR has declined over time, but the reduction has not been fast enough. Periods of sharper declines likely correspond to health interventions, improved immunization coverage, or increased access to care. While, the MMR of 1,250 per 100,000 live births underscores the severe maternal health crisis in Nigeria. This figure is among the highest globally, far exceeding the SDG target of below 70. The SD of 150 shows moderate fluctuation, indicating that while some progress has occurred, it has been uneven and insufficient. Persistent challenges such as weak referral systems, inadequate emergency obstetric care, and financial barriers contribute to these high mortality levels.

Table 2: Bound Test for Cointegration

Test Statistics	**Value**
F-stat	6.05
K	3

Source: Author's computation (2025)

Table 3: Critical Values (Pesaran, Shin & Smith, 2001)

Significance Level	I(0) Bound	I(1) Bound
10%	2.63	3.35
5%	3.10	3.87
1%	4.13	5.00

Source: Author's computation (2025)

From the above table 2 & 3, the computed F-value (6.05) exceeds the upper bound at the 5% level (3.87), the null hypothesis of no long-run relationship is rejected. Therefore, there is evidence of cointegration, implying the presence of a stable long-run relationship between health financing indicators and mortality.

Table 4: Estimated Long-Run ARDL Coefficients

Variable	Coefficient	Std. Error	t-Statistics	P-value
PHE	-0.45	0.12	-3.75	0.002
OOP	0.32	0.10	3.20	0.005
EDU	-0.25	0.08	-3.13	0.006

Source: Author's computation (2025)

The results indicate that a 1% increase in public health expenditure (PHE) is linked with a 0.45% reduction in maternal and child mortality, stressing the positive impact of government investment on health outcomes. Equally, a 1% increase in out-of-pocket (OOP) spending corresponds to a 0.32% rise in mortality, showing the adverse effect of heavy reliance on household payments and limited access to essential healthcare. However, Education level (EDU) reveals a significant negative effect with a 1-year increase in average schooling reducing 0.25% maternal and child mortality rate. These findings highlight the need of government to strengthen public health financing, alleviating the financial burden of private health expenditures on households while encouraging attainment of higher education level that improve health literacy and proper utilization of maternal and child health services.

Table 5: Short-Run ECM Results

Variable	Coefficient	Std. Error	t-Statistics	P-value
Δ PHE	-0.18	0.07	-2.57	0.018
Δ OOP	0.11	0.05	2.20	0.034
Δ EDU	-0.10	0.04	-2.50	0.020
ECT(–1)	-0.60	0.15	-4.00	0.001

Source: Author's computation (2025)

In the short run, increases in public health expenditure continue to reduce mortality (–0.18), while increases in out-of-pocket spending raise mortality (0.11). Additionally, improvements in education (ΔEDU) reduce mortality by 0.10% per additional year of schooling, highlighting the role of education in shaping health-seeking behaviors even in the short run. The error correction term (ECT = –0.60) is negative and statistically significant, indicating that approximately 60% of deviations from the long-run equilibrium are corrected each year. This confirms a strong, stable, and rapid long-run adjustment mechanism linking health financing to health outcomes.

Table 6: Diagnostic Tests

Test	Statistic	P-value	Decision
Serial Correlation (Breusch-Godfrey)	1.52	0.22	No serial correlation
Heteroskedasticity (Breusch-Pagan)	0.94	0.41	Homoscedastic
Normality (Jarque-Bera)	1.88	0.39	Residual normally distributed
Functional Form (Ramsey RESET)	0.67	0.51	Correct functional form

Source: Author's computation (2025)

The diagnostic tests reveal that the estimated model is statistically sound. No serial correlation, heteroskedasticity, or violation of normality assumptions detected, and the functional form is correctly specified. These results show that the coefficient estimates from the model are unbiased, efficient, and reliable for inference.

4.3 Discussions

The findings show that Nigeria's health financing structure remains critically inadequate, with public health expenditure averaging 0.55% of GDP far below the 15% Abuja Declaration benchmark and insufficiently to maintain and sustain effective health systems (WHO, 2023; World Bank, 2024). The consistently low variation in public spending (SD = 0.10) shows continues underinvestment, which goes along with the studies linking low public expenditure to inadequate service delivery, shortages of skilled personnel, and weak maternal and child healthcare infrastructure (Okeke et.al, 2023). consequently, households contribute an average of 61.5% of total health spending through out-of-pocket payments, a level significantly above WHO's recommended financial protection threshold, reinforcing the system's heavy reliance on direct household payments (WHO, 2023). This high OOP burden, with minimal fluctuation over the years (SD = 4.5), indicate limited insurance coverage and weak risk-pooling mechanisms, which identifies as major drivers of delayed care, catastrophic health expenditure, and poor survival outcomes for mothers and children (Esan et al., 2023).

The under-five mortality rate (145 per 1,000) and maternal mortality ratio (1,250 per 100,000) remain among the highest globally, far beyond the SDG targets (UNICEF, 2022). Although both indicators show gradual decline over time, the fluctuations suggest inconsistent progress influenced by uneven implementation of health interventions, weak emergency obstetric care, and financial barriers that limit timely access to services. Education, a key social determinant of health, also plays a crucial role; the ARDL results show that a one-year increase in average schooling reduces maternal and child mortality by 0.25%, highlighting the importance of education in promoting

health-seeking behaviors and proper utilization of MCH services.

The ARDL results confirms a significant long-run relationship between health financing and mortality outcomes. Public health expenditure employs a strong negative effect, with a 1% increase in PHE associated with a 0.45% reduction in maternal and child mortality, consistent with evidence that higher government spending improves health infrastructure and access to quality care (Awoyemi & Makanju, 2023). Conversly, a 1% rise in OOP spending increases mortality by 0.32%, reinforcing global findings that excessive household payments reduce timely care-seeking and survival outcomes. In the short run, the effects are consistent: increases in PHE reduce mortality (–0.18), while increases in OOP raise it (0.11), and improvements in education reduce mortality by 0.10% per additional year of schooling. The error correction term (ECT = –0.60) indicates rapid adjustment toward long-run equilibrium, suggesting that changes in health financing have immediate and sustained effects on maternal and child health outcomes.

5.0 Conclusion

The study examined the impact of health expenditure on maternal and child health (MCH) outcomes in Nigeria using NDHS data and an ARDL modeling approach. The results show that public health expenditure significantly reduces maternal and under-five mortality, while high out-of-pocket (OOP) payments worsen mortality rates. The error correction term indicates that the health system adjusts relatively quickly to changes in expenditure, showing a stable long-run relationship between financing and outcomes. These findings highlight that Nigeria's persistently low public investment in healthcare, coupled with heavy reliance on household payments which remains a major barrier to achieving the Sustainable Development Goals (SDG 3.1 and 3.2). Strengthening public financing and reducing household financial burdens are therefore important in improving maternal and child survival. Based on these findings, the following recommendations are proposed:

1. The government should progressively raise health spending toward or beyond the 15% Abuja Declaration target, prioritizing maternal and child health services, primary healthcare infrastructure, and skilled workforce development.
2. Government should expand financial protection mechanisms, including health insurance coverage, targeted subsidies, and risk-pooling schemes, to decrease household expenditure on essential maternal and child health services.
3. Ensure equitable distribution of funds across Nigeria's six geopolitical zones to reduce rural-urban and socioeconomic disparities in access to quality maternal and child healthcare.
4. Implement robust tracking systems for health expenditures and outcomes to ensure funds are efficiently used, reduce misallocation, and improve the effectiveness of interventions.
5. Invest in programs such as the IMNCH strategy, BHCPF, and initiatives like free C-sections (MAMII), while regularly evaluating their impact on MCH outcomes to inform future policy decisions.

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