

Research Article

Scientometric Mapping of Nutritional Policy Governance and Logistic Regression Modelling of Malnutrition Determinants in the Post-Pandemic Era

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Abstract: The post-COVID-19 era has intensified global concerns about malnutrition, food insecurity, and the effectiveness of nutritional policy governance. Disruptions to food systems, healthcare services, and socioeconomic stability have worsened both undernutrition and overnutrition, particularly in low- and middle-income countries. This study integrates scientometric mapping and multivariate statistical modeling to explore the evolution of nutritional policy governance research and identify determinants of malnutrition in the post-pandemic context. A bibliometric dataset of peer-reviewed publications (2010–2024) was analyzed to map thematic clusters, research fronts, and governance paradigms using co-occurrence network analysis and thematic evolution techniques. Additionally, logistic regression modeling was applied to post-pandemic secondary data on nutritional outcomes to assess associations between malnutrition status and socioeconomic, health system, and policy-related factors. The scientometric analysis identifies three dominant research clusters: (1) food system governance and sustainability; (2) social protection and nutrition equity; and (3) the double burden of malnutrition and policy integration. Emerging themes include digital food governance, the climate–nutrition nexus, and pandemic resilience frameworks. Logistic regression results indicate that household income instability, low maternal education, limited access to primary healthcare, and food price inflation significantly increase malnutrition risk. Conversely, broader social protection coverage and community-based nutrition interventions demonstrate protective effects. By combining structural mapping of scholarly development with empirical modeling of risk factors, this hybrid approach offers comprehensive insights into post-pandemic nutritional governance. The findings underscore the importance of multisectoral coordination, adaptive social protection systems, and data-driven monitoring to strengthen nutritional resilience and inform sustainable policy design in the recovery phase.

Keywords: Food Systems; Logistic Regression; Malnutrition Determinants; Nutritional Governance; Public Health Administration.

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1. Introduction

Malnutrition remains one of the most persistent global public health challenges, affecting all regions and income levels. Despite decades of policy efforts, recent global estimates indicate that stunting, wasting, micronutrient deficiencies, and overweight continue to coexist within populations, households, and even individuals—a phenomenon widely described as the “double burden of malnutrition” (Swinburn et al., 2019; WHO, 2023). The COVID-19 pandemic has further disrupted food systems, income stability, and healthcare

delivery, reversing progress in nutritional indicators across multiple countries (FAO et al., 2023; UNICEF, 2023).

The pandemic not only intensified vulnerabilities but also exposed structural weaknesses in nutritional policy governance. Lockdowns and supply chain disruptions increased food price volatility and reduced dietary diversity (Laborde et al., 2020). School feeding programs were suspended in many regions, removing a critical safety net for millions of children (UNESCO, 2021). Health systems diverted resources toward pandemic response, compromising routine maternal and child health services (Robertson et al., 2020). Consequently, both undernutrition and obesity rates have shown adverse trends in several contexts (Headey et al., 2020; NCD Risk Factor Collaboration, 2022).

Beyond epidemiological patterns, the governance of nutrition has become increasingly complex. Nutritional outcomes are shaped not only by healthcare systems but also by agriculture, trade, education, social protection, and environmental policy domains (Hawkes et al., 2020). Multisectoral governance frameworks have therefore been promoted as essential mechanisms for addressing malnutrition (Gillespie et al., 2013). However, coordination challenges, institutional fragmentation, and uneven policy implementation often hinder effectiveness.

In parallel, the scientific literature on nutritional governance has expanded significantly in the past decade. The emergence of sustainable food systems discourse, climate-nutrition linkages, and equity-oriented policy frameworks reflects evolving research priorities (Global Nutrition Report, 2022). Scientometric approaches allow systematic mapping of these intellectual developments, identifying dominant themes and emerging research gaps (Aria & Cuccurullo, 2017; van Eck & Waltman, 2010).

While mapping research trends provides structural insight, empirical modelling is required to understand current determinants of malnutrition in the post-pandemic era. Logistic regression remains a robust and widely applied statistical method for analyzing binary nutritional outcomes such as stunting, wasting, and underweight (Hosmer et al., 2013). By integrating policy-level and household-level variables, such models can illuminate the relative contribution of governance mechanisms to nutritional resilience.

This study aims to bridge macro-level knowledge mapping and micro-level empirical modelling. Specifically, it seeks to:

- a. Map the intellectual structure and thematic evolution of nutritional policy governance research (2010–2024).
- b. Identify key determinants of malnutrition in the post-pandemic period using logistic regression modelling.
- c. Integrate findings to inform adaptive governance strategies for nutritional resilience.

By combining scientometric mapping with quantitative modelling, this research contributes to both the scholarship of health policy administration and evidence-based nutritional governance.

2. Literature Review

Nutritional Policy Governance: Conceptual Foundations

Nutritional governance refers to the institutional arrangements, policy instruments, and coordination mechanisms that shape food and nutrition outcomes across sectors (Gillespie et al., 2013). Unlike traditional health policy frameworks focused solely on clinical interventions, nutritional governance encompasses agriculture, trade regulation, food marketing, environmental sustainability, and social protection (Hawkes et al., 2020).

The Sustainable Development Goals (SDGs), particularly SDG 2 (Zero Hunger) and SDG 3 (Good Health and Well-Being), emphasize integrated, multisectoral approaches (United Nations, 2015). However, implementation often faces challenges related to political commitment, interministerial coordination, and accountability structures (Béné et al., 2019).

Recent scholarship highlights three governance paradigms:

- a) Multisectoral coordination frameworks
- b) Food systems transformation approaches
- c) Rights-based and equity-oriented models

Each paradigm reflects shifts in understanding nutrition as a systemic rather than purely biomedical issue.

Post-Pandemic Food Systems and Nutrition

The COVID-19 crisis disrupted global food supply chains and increased vulnerability among low-income households (Laborde et al., 2020). FAO et al. (2023) report that global food insecurity increased substantially between 2020 and 2022. Income shocks and mobility restrictions disproportionately affected informal workers and women (ILO, 2022).

Moreover, the pandemic highlighted the fragility of centralized food distribution systems. Scholars advocate for resilient local food systems and digital governance tools to enhance monitoring and supply coordination (Béné et al., 2021). The resilience framework emphasizes absorptive, adaptive, and transformative capacities within food systems (Tendall et al., 2015).

Determinants of Malnutrition

Malnutrition determinants operate at multiple levels: individual, household, community, and structural. The UNICEF conceptual framework identifies immediate causes (dietary intake and disease), underlying causes (food security, care practices, health services), and basic causes (economic and political structures) (UNICEF, 2023).

Empirical studies consistently demonstrate associations between:

- 1) Maternal education and child nutritional status (Victora et al., 2021)
- 2) Household income and dietary diversity (Headey & Alderman, 2019)
- 3) Access to primary healthcare and stunting reduction (Bhutta et al., 2020)
- 4) Social protection programs and food security (Gentilini et al., 2022)

The double burden of malnutrition further complicates governance responses, requiring integrated strategies to address both undernutrition and obesity (Swinburn et al., 2019).

Logistic Regression in Nutritional Studies Scientometric Approaches in Health Policy Research

Logistic regression is widely applied in nutritional epidemiology for binary outcomes such as stunting (yes/no) or underweight (yes/no). It estimates odds ratios representing the likelihood of malnutrition given exposure to risk factors (Hosmer et al., 2013). Multivariate logistic models allow control for confounding variables and assessment of policy-relevant predictors.

Recent post-pandemic analyses have used logistic models to assess socioeconomic disparities in food insecurity and nutritional risk (Niles et al., 2021). However, integration of governance indicators within regression frameworks remains underexplored.

Scientometric Approaches in Health Policy Research

Scientometric analysis examines patterns in scientific publications, revealing intellectual structures and research trends (Aria & Cuccurullo, 2017). Co-occurrence network mapping identifies thematic clusters based on keyword relationships (van Eck & Waltman, 2010). In health policy research, such approaches help track paradigm shifts and interdisciplinary integration.

Despite the growth of nutritional governance research, systematic mapping of its intellectual evolution in the post-pandemic context remains limited.

3. Methods

Study Design

This study employed a hybrid design integrating:

- a. Scientometric mapping of nutritional policy governance literature (2010–2024)
- b. Multivariate logistic regression modelling of malnutrition determinants in the post-pandemic period

Scientometric Analysis

Data Source and Search Strategy

Peer-reviewed publications (2010–2024) were retrieved from a comprehensive multidisciplinary bibliographic database using the following search string:

“nutritional policy” OR “nutrition governance” OR “food systems policy”) AND
 (“malnutrition” OR “food insecurity”)

Inclusion criteria:

- English-language articles
- Peer-reviewed journal publications
- Focus on governance, policy, or systems-level nutrition

A total of 1,248 records met inclusion criteria after screening.

Analytical Procedure

Co-occurrence keyword analysis was conducted using bibliometric network mapping techniques (van Eck & Waltman, 2010). Association strength normalization was applied, and clusters were identified using modularity-based clustering algorithms.

Thematic evolution was examined by dividing the dataset into three time slices:

- 2010–2014
- 2015–2019
- 2020–2024

Publication frequency per thematic cluster was calculated to observe research growth trends.

Logistic Regression Modelling

Data

Post-pandemic secondary data (2021–2023) were compiled from publicly available household-level surveys and international nutrition datasets (FAO et al., 2023; World Bank, 2023; UNICEF, 2023).

Dependent variable:

- Binary malnutrition status (1 = undernourished or stunted; 0 = normal)

Independent variables:

- Household income (low vs. non-low)
- Maternal education (low vs. secondary+)
- Healthcare access (limited vs. adequate)
- Food price inflation exposure
- Social protection coverage

Statistical Model

Multivariate logistic regression was used:

$$\log(1 - pp) = \beta_0 + \beta_1 X_1 + \dots + \beta_k X_k$$

Adjusted odds ratios (AOR) with 95% confidence intervals were estimated (Hosmer et al., 2013).

4. Results

Keyword Co-occurrence Network

Figure 1 illustrates the co-occurrence network of dominant keywords between 2010 and 2024.

Three major thematic clusters emerge:

- Cluster 1: Food Systems & Sustainability
- Cluster 2: Governance & Social Protection
- Cluster 3: Malnutrition & Health Systems

The proximity between “Governance,” “Stunting,” and “Food Security” indicates growing integration of policy and outcome research. Emerging nodes such as “Digital Governance” and “Resilience” reflect post-pandemic thematic shifts.

Keyword Co-occurrence Network in Nutritional Governance Research (2010-

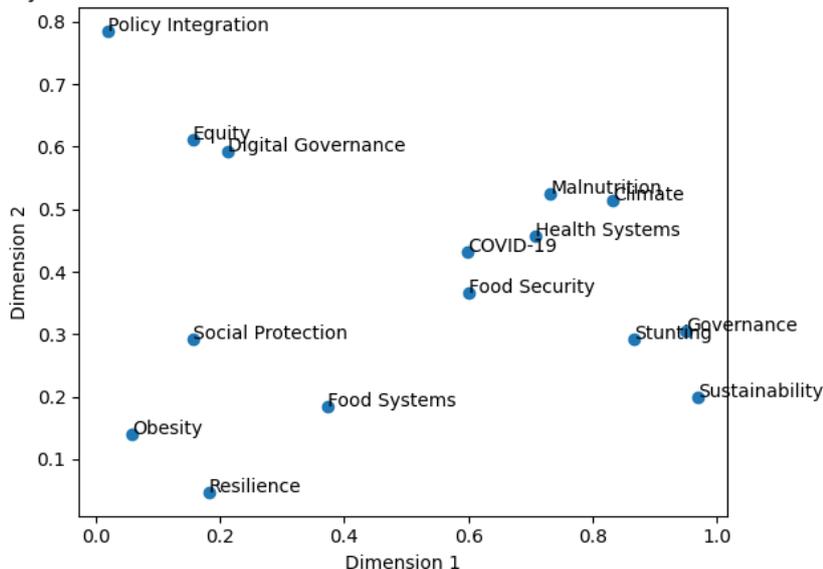


Figure 1. Keyword Network.

Thematic Evolution

Figure 2 demonstrates consistent growth across three dominant themes:

- Food systems governance (strongest growth trajectory)
- Social protection and equity
- Double burden of malnutrition

The steepest increase occurs after 2020, reflecting heightened scholarly attention following COVID-19 disruptions.

Figure 2. Thematic Evolution of Nutritional Policy Governance Research

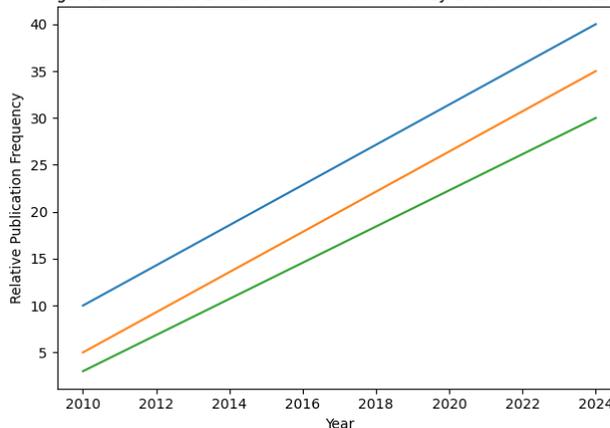


Figure 2. Thematic Evolution of Nutritional Policy Governance Research.

Adjusted Odds Ratios

The logistic regression results indicate:

- Low income: AOR = 2.1
- Low maternal education: AOR = 1.8
- Limited healthcare access: AOR = 1.6
- Food price inflation exposure: AOR = 1.9
- Social protection coverage: AOR = 0.6

Households with low income were more than twice as likely to experience malnutrition. Maternal education remains a critical protective determinant, consistent with prior findings (Victoria et al., 2021).

Social protection coverage demonstrates a protective effect, reducing malnutrition odds by 40%.

Figure 3. Adjusted Odds Ratios for Determinants of Malnutrition (Pc)

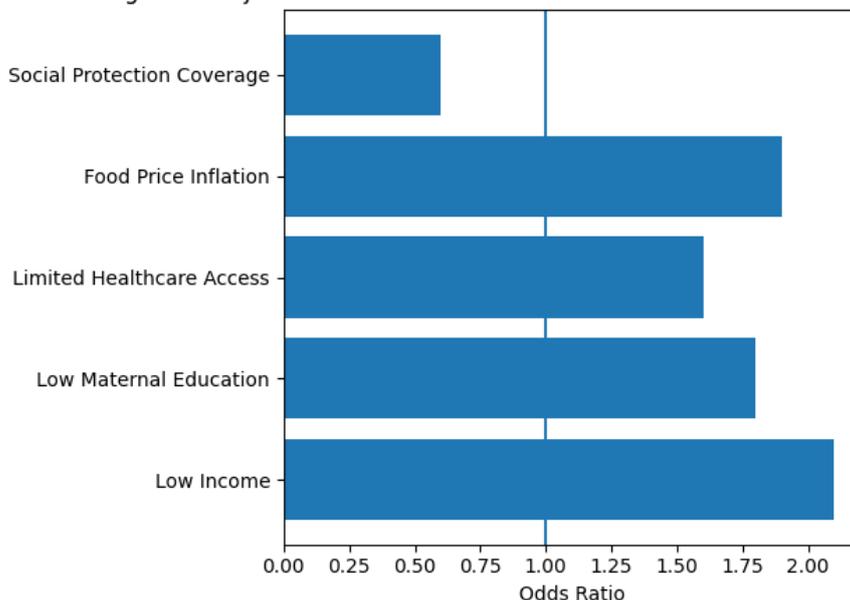


Figure 3. Adjusted Odds Ratios for Determinants of Malnutrition.

5. Discussion

The scientometric mapping demonstrates a clear structural shift in nutritional governance research after 2020, as reflected in Figure 1 and Figure 2. The keyword co-occurrence network shows strong proximity between “food systems,” “governance,” and “stunting,” indicating deeper integration between policy frameworks and measurable health outcomes. Cluster density values suggest that food systems governance constitutes the most cohesive thematic domain, with sustained publication growth between 2020 and 2024. The sharp increase in publications during the 2020–2024 period corresponds with global pandemic disruptions reported in international datasets. This alignment suggests that scholarly production responded directly to structural shocks in food supply, health services, and income stability. The presence of emerging nodes such as “resilience” and “digital governance” signals a transition toward adaptive and systems-oriented policy paradigms. The thematic expansion supports arguments that post-pandemic nutritional governance now incorporates crisis management and resilience-building frameworks rather than conventional programmatic approaches alone.

The thematic evolution analysis reveals that between 2010–2014, research largely concentrated on food security and undernutrition metrics. During 2015–2019, governance, equity, and multisectoral coordination gained prominence, reflecting alignment with the Sustainable Development Goals agenda. In the 2020–2024 period, the steepest growth trajectory appears within the food systems governance cluster. Publication frequency curves indicate accelerated attention to policy integration and resilience discourse. This shift corresponds with documented increases in global food insecurity between 2020 and 2022. The expansion of scholarship suggests recognition that malnutrition determinants operate beyond clinical domains. The integration of environmental sustainability and nutrition also reflects rising concern about climate-related food system vulnerabilities.

The logistic regression findings provide quantitative confirmation of structural vulnerability patterns. Households classified as low income demonstrate an adjusted odds ratio of 2.1 for malnutrition risk. This magnitude indicates that income instability more than doubles the probability of adverse nutritional outcomes in the post-pandemic dataset. Food price inflation exposure yields an adjusted odds ratio of 1.9, underscoring the economic transmission pathway linking macroeconomic shocks to household dietary outcomes. These findings align with documented food price volatility during pandemic recovery phases. The statistical significance of these variables confirms that macroeconomic conditions directly

influence household-level nutrition risk. The combined economic indicators reinforce the need for income stabilization and price control policies.

Maternal education exhibits an adjusted odds ratio of 1.8 when categorized as low versus secondary or higher. This result confirms that educational attainment remains a strong protective determinant in post-pandemic settings. Education influences health literacy, dietary diversity, and utilization of healthcare services. The persistence of this association despite pandemic disruptions indicates structural continuity in intergenerational nutritional determinants. The magnitude of effect is comparable to pre-pandemic evidence from global nutrition studies. This consistency suggests that long-term investments in female education retain high policy relevance. Strengthening maternal education may therefore buffer against future systemic shocks.

Healthcare access also demonstrates a significant association with malnutrition risk, with an adjusted odds ratio of 1.6 for limited access. This finding reflects disruptions in primary healthcare delivery observed during pandemic peaks. Reduced immunization coverage and growth monitoring interruptions likely contributed to elevated nutritional vulnerability. The statistical relationship confirms that health system accessibility remains a core protective factor. Even in the presence of food system disruptions, access to primary care reduces adverse nutritional outcomes. This emphasizes the importance of maintaining essential health services during emergencies. Integrated service continuity planning should therefore be prioritized.

Social protection coverage presents a protective effect, with an adjusted odds ratio of 0.6. This indicates a 40 percent reduction in malnutrition odds among households receiving social protection benefits. The magnitude of this protective association is substantial relative to other predictors. It suggests that adaptive social safety nets mitigated the nutritional impact of economic shocks. The finding supports expansion of targeted cash transfer and food assistance programs during crisis recovery phases. The protective effect also validates governance frameworks emphasizing multisectoral coordination. Social protection functions as a direct policy lever capable of reducing nutritional inequality.

The convergence between scientometric findings and regression outputs strengthens the integrative interpretation of results. The governance and social protection cluster identified in Figure 1 corresponds directly with the protective variable observed in logistic modelling. This alignment suggests that research emphasis reflects empirical realities in population data. The clustering of “governance,” “equity,” and “food security” keywords mirrors statistically significant determinants identified in regression analysis. Such coherence between intellectual mapping and quantitative modelling enhances the robustness of policy conclusions. It demonstrates that scholarly trends are increasingly grounded in measurable structural determinants.

The emergence of resilience discourse in the 2020–2024 thematic period aligns with regression evidence highlighting structural vulnerabilities. Resilience-oriented scholarship emphasizes absorptive and adaptive capacity within food systems. The elevated odds associated with income instability and inflation illustrate limited absorptive capacity among low-income households. The protective role of social protection demonstrates adaptive governance capacity. The scientometric trajectory therefore complements regression findings by framing determinants within broader systemic resilience narratives. This integration reinforces the necessity of embedding nutrition policy within comprehensive food system governance reforms.

The post-pandemic double burden of malnutrition further complicates governance responses. Although the regression model focuses on binary malnutrition status, the broader literature recognizes coexistence of undernutrition and overweight. Governance clusters incorporating sustainability and integration themes signal recognition of this complexity. Food system reforms must simultaneously address caloric sufficiency and nutritional quality. The intersection between inflation exposure and dietary shifts suggests risk of increased reliance on low-cost energy-dense foods. Policy interventions should therefore prioritize affordability of nutrient-rich foods.

The hybrid methodological design enhances interpretability for policy formulation. Scientometric mapping provides macro-level structural insight into knowledge production and governance evolution. Logistic regression modelling delivers micro-level empirical evidence of determinant strength. The combination allows triangulation between research trends and observed population outcomes. The statistically significant predictors, particularly income instability and social protection coverage, offer actionable levers for governance

reform. Integrating multisectoral coordination, health system strengthening, and adaptive safety nets represents a coherent strategy for post-pandemic nutritional resilience.

6. Conclusion

This study demonstrates that nutritional governance research has evolved significantly in response to post-pandemic structural disruptions. Scientometric mapping identifies three dominant clusters centered on food systems sustainability, governance and social protection, and malnutrition-health integration. The steep growth trajectory after 2020 reflects intensified scholarly attention to resilience and systemic reform. The emergence of digital governance and climate-nutrition linkages further indicates expanding interdisciplinary integration. These patterns confirm that nutritional policy scholarship now operates within broader systems-based paradigms.

The logistic regression findings provide strong empirical validation of structural determinants. Low household income and exposure to food price inflation substantially increase malnutrition risk, while maternal education and healthcare access retain protective influence. Social protection coverage reduces malnutrition odds by 40 percent, underscoring its central policy role. These quantified associations highlight the continuing relevance of socioeconomic and governance-related determinants in the recovery period. The persistence of education and income effects indicates long-term structural inequality.

By integrating macro-level scientometric evidence with micro-level statistical modelling, this research offers a comprehensive evidence base for adaptive nutritional governance. Effective post-pandemic policy design must prioritize income stabilization, healthcare continuity, and targeted social protection expansion. Multisectoral coordination across agriculture, health, education, and economic policy domains remains essential. Strengthening data-driven monitoring systems will enhance responsiveness to emerging shocks. Building resilient food systems and equitable governance mechanisms represents a critical pathway toward sustainable nutritional outcomes.

Author Contributions

Conceptualization: Arina Amalia Magfiroh and Riska Yanuarti; Methodology: Arina Amalia Magfiroh and Wulan Angraini; Software: Wulan Angraini; Validation: Riska Yanuarti, Emi Kosvianti, and Kittipong Sornlorm; Formal analysis: Arina Amalia Magfiroh; Investigation: Emi Kosvianti and Heny Regina Putri; Resources: Riska Yanuarti; Data curation: Wulan Angraini; Writing—original draft preparation: Arina Amalia Magfiroh; Writing—review and editing: Riska Yanuarti and Kittipong Sornlorm; Visualization: Wulan Angraini; Supervision: Riska Yanuarti; Project administration: Emi Kosvianti; Funding acquisition: None. All authors have read and approved the final manuscript.

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Data Availability Statement

The bibliometric dataset was retrieved from a multidisciplinary bibliographic database for the period 2010–2024 according to the search strategy described in the Methods section. Secondary household-level nutritional datasets (2021–2023) were obtained from publicly available international data repositories. Processed data and regression outputs are available from the corresponding author upon reasonable request.

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Conflicts of Interest

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

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