

Analysis of nutrition research networks in West Africa

Application of social network analysis to co-authorship data to understand and enhance collaboration



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Introduction

Despite limited progress to date, we now see a growing political commitment to addressing the high rates of maternal and child undernutrition in West Africa. Such commitment needs to be effectively translated into appropriate policy choices and effective program action in order to generate large-scale, sustained change.

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High-quality knowledge and evidence is critical for supporting effective and coherent programs and policies. Strengthening research networks can help support collaboration, cross-pollination, sharing of best practices, and innovation. An understanding of which researchers and institutions are well connected and highly collaborative provides clues as to who are the thought leaders most able to mobilize knowledge and galvanize researchers around a set of evidence-based solutions. Identifying those who are somewhat less connected provides critical information on where to prioritize developing and strengthening communities of practice. Finally, because connectedness in a research network also suggests some ability to shape the narrative, understanding who has this power and who does not is a critical consideration.

This analysis builds on a systematic review of peer-reviewed literature on the problems, policies, and programs related to World Health Assembly (WHA) indicators in West Africa from 2009 to 2017 (see [World Health Assembly 2025 targets and drivers of malnutrition in West Africa](#)). It applies social network analysis (SNA) techniques to authorship and affiliation data to illuminate the patterns of collaboration and the structures of collaborative networks.



Methods

Social network analysis (SNA) examines the social relationships among a set of actors that together make up a network. SNA focuses on analyzing the patterns of relationships—thought of as connections, ties, or links—among actors (Wasserman and Faust 1994).

Data and analysis

Co-authorship data were downloaded from the life-science and biomedical database MEDLINE. The data include 406 peer-reviewed publications on problems, programs, and policies related to each WHA target in the West Africa region. The search was limited to studies published in English and French. A date restriction was applied so as to include only studies published after 2010 (the launch date of the Scaling Up Nutrition (SUN) movement). The search was first done in April 2018 and then updated in February 2020. Details about the screening and extraction process can be found [online](#).

The data were imported into Excel, cleaned, and formatted. Authors were linked to one another if they co-authored a paper (when there were more than 10 co-authors, only the first 10 names were kept in the dataset). For each author, their most recent affiliation was kept, and the location and primary language of the organization were also included as author attributes. In cases where the organization has more than one office, division, or school, its head office was selected (for instance, separate schools under a university would be given the name and location of the main university campus).

The cleaned data were uploaded into UCInet 6 for analysis. Data were formatted as co-authorship ties—links among authors who published together—and institute ties—links among co-authors' respective organizations. The network data are valued, meaning that multiple collaborations show up as a higher value link.

Actors' roles and positions in the network as well as network structures were analyzed. The connectedness of each actor was calculated using centrality measures including both degree centrality and betweenness centrality (defined below).

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We first examined the structures of collaboration of individual researchers. The network of co-authors publishing in the field of nutrition focused on West Africa since 2009 consists of 1,622 unique authors who have published a total of 403 peer-reviewed publications that met the search criteria. Of these authors, 40% are affiliated with a West African institution, and 16% of author affiliations are francophone while 73% are anglophone (Table 1).

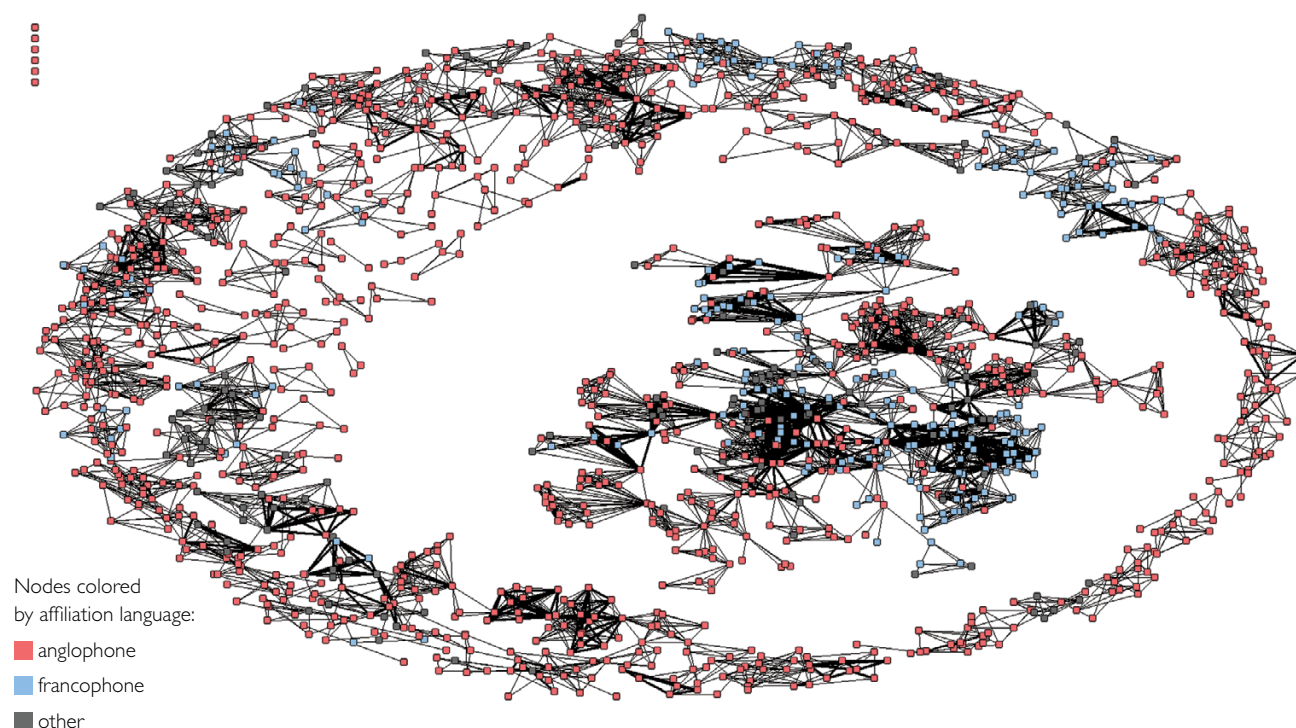
Network of nutrition researchers for West Africa

Table 1: Breakdown of all co-authors and high-degree centrality co-authors, by language and region

Co-authors	All	Top 30 degree centrality
N=1622		
LANGUAGE		
Francophone	16%	47%
Anglophone	73%	40%
Other	11%	13%
REGION		
North-affiliation	55%	67%
South-affiliation	45%	33%
West Africa	40%	30%

NOTE: Region refers whether the author is affiliated with a “northern” institute or one based in a high-income country. Of the “southern”-based institutes, the share based in West Africa are also displayed. Source: Author calculations based on network data using UCInet (Borgatti, Everett, Freeman 1992).

Figure 1: Co-authorship network, by affiliation language



SOURCE: Authors' calculations of network data using UCInet (Borgatti, Everett, and Freeman 1992).

NOTE: Institutes are colored by the continent they are based in, separating West Africa from the rest of Africa. Isolates are in the top left corner. Institutes with the top 30 betweenness centrality scores are sized according to their score.

Figure 1 depicts the network of co-authorship for the literature on nutrition in West Africa. The network is highly fragmented and is composed of 158 subcomponents, including 6 isolates (unconnected authors). The main component—or the component with the most co-authors connected (shown in the center of the network in Figure 1)—includes 497 authors. Due in part to the high number of components, the overall network is characterized by low density of connections; only 0.5% of all possible links between researchers are present.

“Degree centrality” is a measure of how many links an author has. In this context, it is a count of the number of different co-authors with whom a researcher has published (if two authors co-published more than one paper together, each paper is counted). Looking at only the authors with the 30 highest degree centrality scores, **Table 1** provides a breakdown of their characteristics: 47% are from francophone institutions and 33% are based in “southern” institutions, largely in West Africa.

We also assessed the density of connections within and between different groupings of co-authors. We grouped co-authors by language, by country, and by continent and assessed homophily—the tendency to collaborate with others within your groups—and heterophily—the tendency to collaborate with those outside your group—by calculating the E-I (external–internal) index score. We find a greater tendency to collaborate within language groups than within the same continent. Where -1 indicates perfect homophily and 1 indicates perfect heterophily, the E-I index score within language groups is -38 . However, there is a stronger tendency for francophone institutes to collaborate with anglophone institutes than with each other. On the other hand, we found an E-I index score of 0.46 by country and 0.29 by continent, suggesting a greater tendency for cross-country collaboration.



Network of institutes publishing on nutrition in West Africa

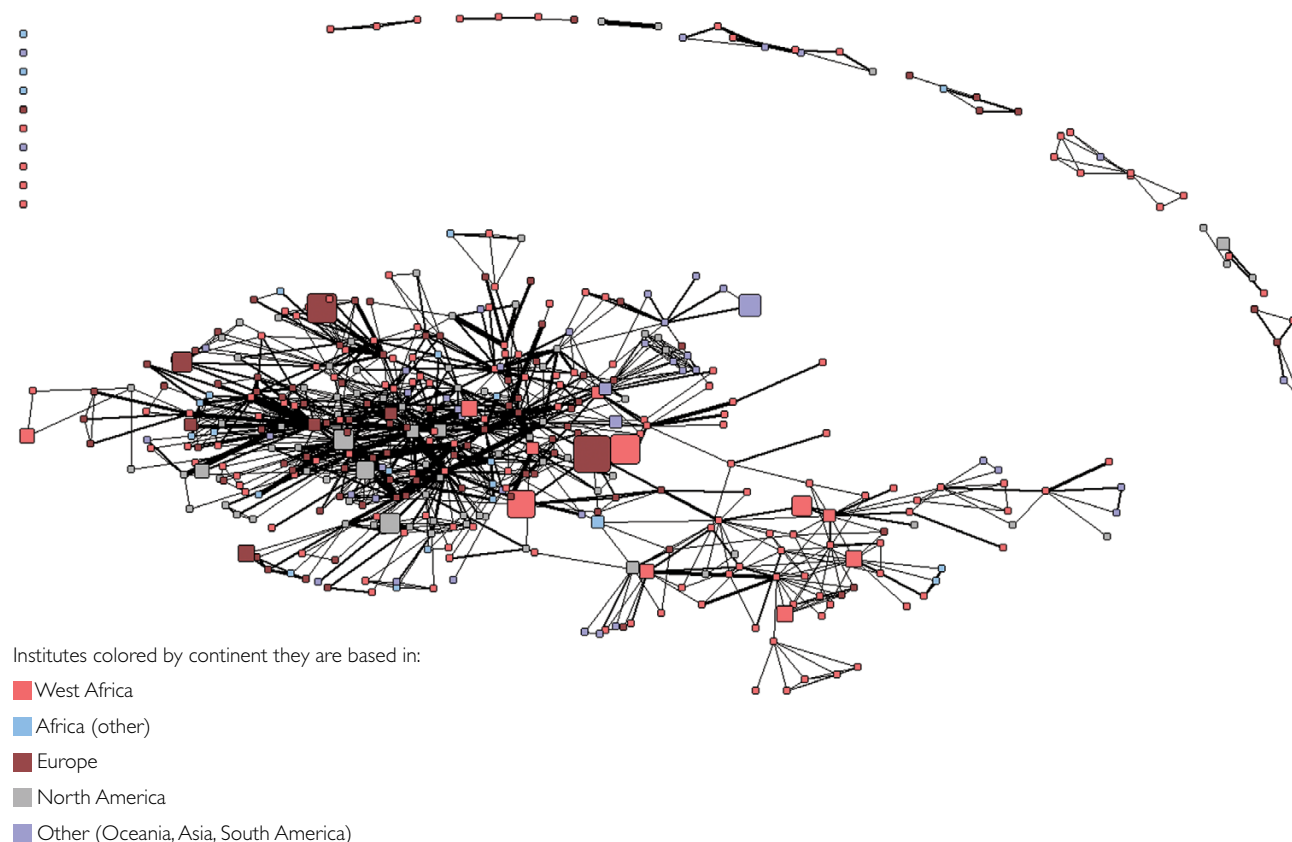
Table 2: Breakdown of all institutes and high-betweenness centrality institutes, by language, region, and continent

Institutes	All	Top 30 betweenness centrality
N=414		
LANGUAGE		
French	15%	17%
English	67%	67%
Other	18%	17%
REGION		
North-affiliation	49%	57%
South-affiliation	51%	43%
CONTINENT		
West Africa	40%	37%
Africa (other)	6%	3%
North America	19%	27%
Europe	24%	37%
Other	11%	10%

SOURCE: Author calculations based on network data using UCInet (Borgatti, Everett, and Freeman 1992).

NOTE: Region refers whether the author is affiliated with a “northern” institute, that is one based in a high-income country. Under “Continent,” institutes based in West Africa and those based in other countries in Africa are presented separately, and “Other” includes Oceania, Asia, and South America.

Figure 2: Network of institutes, by continent and sized by betweenness centrality



SOURCE: Author's analysis of network data in UCInet (Borgatti, Everett, and Freeman 1992).

NOTE: Institutes with the top 30 betweenness centrality scores are sized according to their score.

Figure 2 shows the network of institutes and their patterns of collaboration by collapsing co-publishing ties by affiliation. The network includes 413 institutes and has 23 components, including 10 isolates. The main component connects 361 institutes. The network has higher density than the co-author network, with 5% of possible institutional connections present.

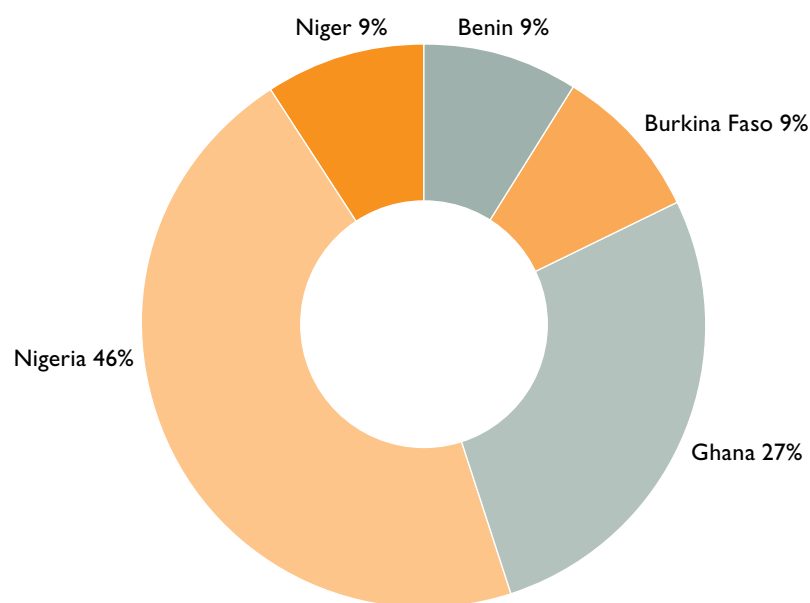
“Betweenness centrality” is a measure of reach, based on the number of times an actor is on the shortest path to reach others. Within a research network, high betweenness centrality suggests strong control over communication flows and collaborative endeavors. Among the institutions with the top 30 betweenness centrality scores, only 5 are francophone (**Table 2**). In addition, just over a third of the institutes are based in West Africa. However, Nigeria- and Ghana-based institutes make up the vast majority (73%) of these well-connected West African institutes. The only other countries represented are Benin, Burkina Faso, and Niger.

We continue to find a strong tendency to collaborate across regions and countries. Institutes showed a strong tendency toward heterophily by country (0.75) and continent (0.43). There was also a weak tendency toward collaboration between “northern” and “southern” institutes, with an E-I index score of 0.015. By language, we found a weak tendency toward homophily, with an E-I index score of -0.09.

Discussion

Analysis of the social networks of researchers and research institutes publishing on nutrition in West Africa yields some insights into the active and influential actors. Researchers are generally affiliated with anglophone institutes and we find a tendency to collaborate within language groups, especially for researchers based in anglophone institutes. Despite lower representation based on the degree centrality scores, 47% of the most active and connected authors are based in francophone institutes, suggesting that these researchers are thought leaders in the research community. Analysis of both networks suggests a tendency for cross-region and cross-country collaboration.

Figure 3: Share of West African institutes with high betweenness centrality by country

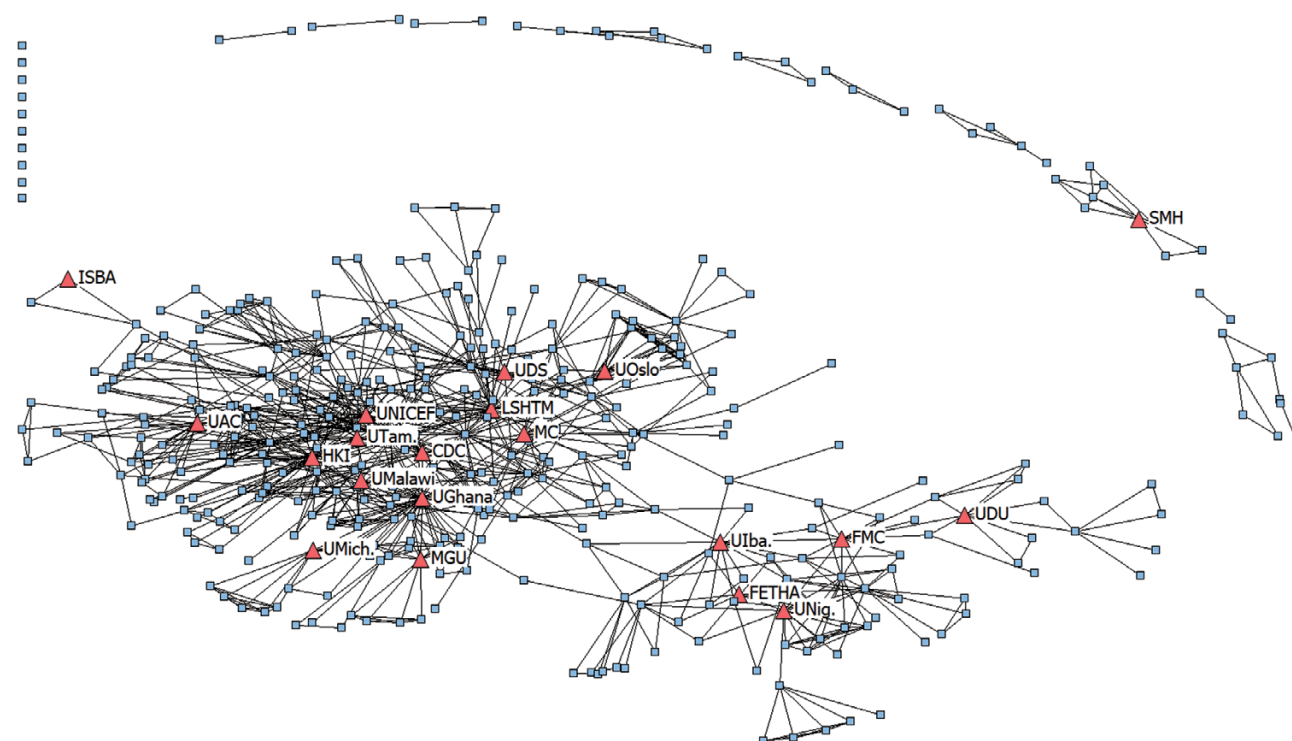


SOURCE: Authors' analysis of network data.

Our analysis of research institutes considers who in the network is able to control the research and evidence narrative and drive collaborative relationships. We utilize the measure of betweenness centrality to examine this and find that more than a third of research institutes with high betweenness centrality are based in West Africa, suggesting regional control and ownership. However, looking more deeply at the countries represented, we find that anglophone institutes based in Ghana and Nigeria make up most of these high-betweenness actors. Only Burkina Faso, Benin, and Niger have high-betweenness francophone research institutes.

Equity in the creation and validation of evidence on nutrition in West Africa is an important concern. We therefore consider network strategies to support greater voice and control for a broader set of actors within the network. To this end, we assess which institutes can be strategically leveraged to collaborate with less central institutes. A “key player” analysis is undertaken, which identifies a set of actors positioned for optimal diffusion through the network (Borgatti 2006). In this case, we suggest that the set of key players identified—20 institutes that can reach 50% of the network within two steps—can be supported to engage a broader set of institutes in the generation, debate, and dissemination of evidence.

Figure 4: Network of institutions, showing key players



CDC	=	Centers for Disease Control and Prevention	UDU	=	Usmanu Danfodiyo University
FMC	=	Federal Medical Centre	UGhana	=	University of Ghana
HKI	=	Helen Keller International	UIba.	=	University of Ibadan
ISBA	=	Institut des sciences biomédicales appliquées	UMalawi	=	University of Malawi
LSHTM	=	London School of Hygiene & Tropical Medicine	UMich.	=	University of Michigan
MC	=	Morehouse College	UNICEF	=	United Nations Children's Fund
MGU	=	McGill University	UNig.	=	University of Nigeria
SMH	=	Sunyani Municipal Hospital	UOslo	=	University of Oslo
UAC	=	Université Abomey Calavi	UTam.	=	University of Tampere
UDS	=	University for Development Studies			

SOURCE: Author's analysis of network data in UCInet (Borgatti, Everett, and Freeman 1992) and KeyPlayer.

NOTE: Key players are denoted by pink triangles and institute name is labelled.

Conclusions

The network of nutrition researchers in West Africa is highly fragmented yet shows a tendency toward cross-regional and cross-country collaboration. Overall, the network includes more anglophone institutes than others, and within West Africa the anglophone countries are better represented and networked. There are important benefits to strengthening evidence-sharing and deliberation with the less represented countries. First, cross-country evidence on optimal policy solutions may strengthen the case for researchers and others advocating within their own countries, galvanizing researchers around a set of high-impact policy solutions. Second, to support more context-specific evidence throughout the region, a strong local research network is ideal. Finally, beyond the practical and policy implications, there are equity concerns when many countries and their local institutes are left out of the evidence generation and deliberation process. Key players can be targeted to communicate cross-country learning throughout the network and to facilitate broader collaboration. This analysis lays out an approach to assessing and strengthening research networks by identifying a set of key players who can be leveraged to broaden participation and increase the voice of less active members.

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