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**Almajiri Health; A Scoping Review on Disease, Health Literacy and Space for
Participatory Research**

A Thesis Submitted to the Yale University School of Medicine
in Partial Fulfillment of the Requirements for the Degree of Doctor of Medicine

by

Muzzammil Imran Muhammad

Spring 2023

Abstract

Introduction

Almajirai are male children who leave the care of their parents to learn the Qur'an and study Islam under the tutelage of a *Mallam* or *Imam* at a *Tsangaya*. *Almajiranci* refers to the system of education based on this relationship between *almajiri* and *mallam*, and which was the dominant mode of education in precolonial Hausaland – Northern Nigeria and Southern Niger. This system remains widespread and popular in both countries. In recent years, discourse around *almajirai* has featured prominently in media from and about this region, and has associated *almajiranci* with non-participation in formal education, abuse, poverty, and underdevelopment. Despite this, the peer-reviewed literature around health among *almajirai* remains limited. Here, we conduct a scoping review of the academic literature as it concerns *almajirai* health to synthesize evidence for specific health problems, draw links between related findings, identify gaps in the literature, indicate areas for potential intervention, and assess if and how this literature has engaged *almajirai* as partners and participants in research.

Methods

We searched MEDLINE, Embase, OVID Global Health, Scopus, Web of Science and EBSCO's Africa-Wide Information Database for articles that concerned *almajiri* health as operationalized using a framework leveraging the biopsychosocial and socio-ecological models of health to integrate biological, social, and environmental factors that influence health. We included articles in English and French published between 2000 and 2022. For each study we collected information regarding (i) authorship (ii) study year and location(s), (iii) study design and aims, (iv) sample characteristics, (v) findings, and (vi) *almajiri* participation in research design, execution, interpretation and dissemination.

Results

Of 1,944 identified studies, a final set of 17 were deemed relevant for data extraction. These included 14 cross-sectional studies, 2 descriptive articles, and one case-control study. All 17 were conducted in Nigeria, though one included *almajirai* from Niger. Just one study concerned an intervention to improve *almajiri* health, and no study engaged *almajirai* in participatory roles beyond acquiring their consent. Domains evaluated in this set of studies included infectious disease (10 studies), oral health (2 studies), workplace injury, nutrition, general health status, health determinants, and mental health (1 study each). The ages of *almajirai* represented in these studies ranged from as young as 3 years to as old as 28, though some studies did not clearly state participants' ages. Included studies find high rates of malaria, intestinal parasitosis, urinary tract infection, and occupational injury among *almajirai*. Studies comparing *almajirai* to controls find significantly higher rates of cholera, urinary schistosomiasis, and psychiatric disorders, as well as lower levels of rabies awareness and poorer oral hygiene among *almajirai* than in controls ($p < 0.05$). Just one study, concerning nutrition, describes an intervention to improve *almajiri* health, though does not provide health-related outcomes for that intervention.

Conclusion

Our scoping review identifies several notable features of the literature around *almajiri* health. We find that this literature has concerned a wide range of domains, though the number of studies concerned with specific phenomena within each domain remains limited. We further note limitations in the geographic scope of the current literature around *almajiri* health, in the study of interventions meant to improve *almajiri* health, and in the consideration of demographic features, such as age, that may influence *almajirai*'s experiences and health. We stress the need for further study in all these areas, and for participatory approaches to this study, which, by involving *almajirai* in the research process, can help develop trust between *almajirai* and the research enterprise, build interventions tailored to their priorities and preferences, and may be more likely to sustainably and successfully improve *almajiri* health and wellbeing.

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

In the Name of Allah, the Most Gracious, the Most Merciful

I regret that there is not more space on this page.

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For my mother, Nafisah Shittu, I have no words, so I must turn to song.

*Sweet Mother
I no go forget you
For the suffer wey you suffer for me*

Na gode. Na gode. Na gode. A thousand times over and a thousand times more. Na gode.

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Glossary

Selected terms used with high frequency in this manuscript, all of which derive from the Hausa language

Almajiranci: A system of education prevalent in *Hausaland* whereby male children leave their familial homes to study Islam and the Qur'an under the tutelage and guardianship of a *Mallam* in a *Tsangaya*.

Almajiri (plur. **Almajirai**): A male child engaged in *Almajiranci*. Derives from the Arabic *al-muhājirūn* (المهاجرون), meaning migrants, and alludes to the migration of Muhammad (ﷺ) and his followers from Mecca to Medina in the early history of Islam.

Hausa: A West African ethnic group native to *Hausaland* and speaking Hausa, an Afroasiatic language. The largest ethnic group in both Nigeria and Niger by population.

Hausaland: The region of West Africa to which the *Hausa* people are indigenous and/or where Hausa is a predominant language, largely located in Northern Nigeria and Southern Niger.

Mallam (plur. **Mallamai**): A male adult responsible for the care and education of *almajirai* in a *Tsangaya*. Also used as a generic honorific in the *Hausa* language, akin to 'Mister' in English. Derives from the Arabic *Mu'allim* (معلم).

Tsangaya (plur. **Tsangayu**): The schools wherein *Almajirai* learn and often also live.

Introduction

Hausaland; A Historic Overview

Hausaland is a term commonly used to refer to the predominantly Muslim and Hausa-speaking areas of Northern Nigeria and Southern Niger. In the precolonial era, much of this region was organized into loosely associated city-states, and then, after a jihadist reformation movement in the early 19th century, united under a single political entity, the Sokoto Caliphate.¹ The rapid centralization of political authority that shaped this transition also saw a major expansion of Islam, largely through the efforts of this new state, such that Hausaland is thought to have had the largest Muslim population anywhere in West Africa prior to the advent of European colonization.²

The experience of colonialism had profound effects throughout Hausaland. Perhaps most profoundly, it cleaved the region in two, ceding its larger and more populous southern portion to British Nigeria and its northern territories to French Niger. Northern Nigeria would, for much of the colonial period, be governed under a system of indirect rule that enfranchised the ruling elite of the Sokoto Caliphate insofar as they recognized British political and economic authority.¹⁻³ This maintained a degree of autonomy for indigenous systems of governance in exchange for more limited access to Western social institutions, such as Western schools and hospitals, than seen elsewhere in British Colonial Africa. This compromise contributed to staggering disparities in formal educational outcomes between the Northern and Southern regions of the colony. At independence, for example, despite the North being the more populous region, the vast majority of Nigerian civil service posts were staffed by Southerners, and, while the South had produced hundreds of university graduates, the North had produced just one.^{4,5}

During this time, Hausa-speaking southern Niger, the northern fringe of Hausaland, was also undergoing the effects of colonial state formation. The French approach to governance here was considerably more involved than the Northern Nigerian model — so much so that it was sometimes termed *mulkin zafi*, harsh rule, in contrast to the *mulkin sauki*, easy rule, of the British colonial regime. French administration in Niger discounted ethnic difference and applied a uniform, centralized model of control throughout the colony. This model enfranchised French administrators vastly above indigenous governance, and relegated traditional rulers to tax-collection roles in much smaller areas than had been their historic domains.³ Despite the civilizing myth used to justify this infiltrative form of rule, French Niger was governed extractively, with “almost no” investment in human infrastructure, including schools and health facilities. Consequences of this approach may be seen in such outcomes as that at independence, Niger had just 8 secondary schools attended by scarcely over a thousand students.⁶ In 1961, a year after independence, just one in every hundred Nigeriens were enrolled in schools of any kind, one of the lowest rates of school enrollment in Francophone West Africa.⁷

The entry into the postcolonial era heralded new social, political and economic dynamics throughout Hausaland, though under the lingering influence of colonial policy and institutions. Early postcolonial Nigeria was characterized by intense interethnic competition for political power. Much of this occurred along a North-South axis, reflecting religious difference between a Muslim North and Christian South, and coinciding with historic borders of the Sokoto Caliphate.⁸ These tensions culminated in a 1967 civil war following the secession of the country’s South-East region, and that ended decisively in favor of the North, giving Northerners in the ruling elite controlling

influence over the military regimes that governed Nigeria during this period. The access to state resources that power allowed provided a basis for fantastic wealth among the upper rung of the Northern political, military and business classes.^{9,10}

This same access, however, has not been afforded to Northerners en masse. Rampant corruption at all levels of Nigerian government has seen the massive misappropriation of developmental resources.⁹ In Northern Nigeria, this has exacerbated the situation created by British underinvestment in human and physical infrastructure, contributing to dismal outcomes throughout the region.¹⁰ Measures of human development, per capita wealth and population health in Northern Nigeria consistently trail behind those in the South. In 2019, for example, the Northern Nigerian maternal mortality ratio was around 700 per 100,000 live births, one of the highest in the world, and almost twice the figure seen in Southern states.¹¹

Niger's postcolonial experience has also featured considerable barriers to development. The country's independence-era democracy gave way to a succession of military regimes that neglected developmental agendas in favor of other prerogatives.¹² Environmental instability and food insecurity, both worsened by climate change and desertification, further complicate this picture, with recurrent droughts and famine threatening even basic subsistence throughout much of the country.^{13,14}

Children, Education and Almajiranci

Though state and institutions developed differently in Nigerian and Nigerien Hausaland, these processes left similar developmental legacies on both sides of the colonial border. Hausaland is in both countries one of the poorest regions on earth, with some of the world's worst measures of human development and population health. Recent estimates of under-five mortality in Nigeria, for which Northern rates have been

considerably higher than national averages, are the highest anywhere in the world. The same measure in Niger ranks comparably highly.^{15,16}

The consequences of these dynamics for children in Hausaland warrant focused attention. Children, a vulnerable group in any society, may be particularly susceptible to the types of challenges that have shaped this region.¹⁷ Among these, the failure of educational institutions has had particularly far-reaching consequences. Education, a basic human right, is also a crucial facilitator of development that supports many of its other aspects, including health, economic productivity and fundamental social trust. Deficits in education compound with challenges in these other areas, reinforcing the vicious cycles these may create.¹⁸⁻²⁰

Despite governments' various commitments to education as a developmental prerogative in Hausaland, measures of educational access and attainment remain low throughout the region. For example, average literacy rates in Northern Nigeria and Southern Niger sit below 50%. Southern Nigeria, in contrast, has an average literacy rate of around 80%.^{21,22} As parents and communities have sought to provide children with access to education, one unintended consequence of these dynamics has been the persistence and expansion of Hausaland's precolonial system of child education: the almajiranci system.

The word almajiri is a Hausa term that derives from the Arabic *al-muhājirūn* (المهاجرون), meaning migrants, and alludes to the migration of Muhammad (ﷺ) and his followers from Mecca to Medina in the early history of Islam.²³ This reflects the experience of migration from parental home to Tsangaya that is a core feature of almajiranci.²⁴ In the precolonial era, systems like almajiranci were the dominant mode of education

throughout much of the West African Sahel, and existed in reciprocally reinforcing relationships with the region's Muslim states, receiving their moral and material support while also supplying the administrators, judges, scholars and clerks that these states required to function. That Islam was still a minority and largely urban religion throughout the precolonial era meant that migration formed an integral part of this system from inception, bringing students from rural centers of population to urban areas where they could gain scarce Islamic knowledge.²⁵ The migratory scholar class this system produced further reinforced precolonial states, as these scholars often returned to rural settings where they were able to act as agents of these states, disseminating their values and supporting their legitimacy.^{24,26}

The colonial period, despite placing these nominally Muslim territories under Western rule, may have actually facilitated an expansion of systems such as almajiranci. The abolition of slavery in the region, for example, greatly eased rural-urban migration by eliminating the risk of capture and enslavement during travel, allowing freer movement for Muslim students and scholars throughout Hausaland.²⁷ Abolition also afforded people who had been enslaved the opportunity to become almajirai themselves. Many took this opportunity in pursuit of the prestige and security associated with the Muslim scholarly class, and in pursuit of this class' geographic mobility, which promised greater distance from the major sites of their experiences under slavery.^{26,28,29}

Economic realities lent further support to this expansion, with almajiranci providing rural families a way to offload the subsistence burden of relatives in the system to urban host communities during unproductive agricultural seasons. In these urban spaces, too, almajirai contributed economically, receiving food and shelter in exchange for manual

labor. In the crop-planting season, many of these almajirai would return to their rural communities to help with farm labor.^{30,31}

The colonial era's failure to build Western institutions in Hausaland meant that in inheriting this region, Nigeria and Niger also inherited almajiranci as the region's predominant educational system. Independence, however, also came with increasing concern about the role of almajirai in these fledgling states. This occurred alongside broader concerns about the availability of education to the general public, spawning a wave of initiatives towards universal education in the new countries.³² These initiatives included their efforts towards the goals set at the African Union's 1961 conference on education, and Nigeria's landmark 1979 Universal Basic Education Scheme.^{33,34}

While initiatives like these saw initial successes, unstable political climates meant these were typically not sustained, with military governments limiting their spending on education and other social services in pursuit of other goals. The vacuum created by the withdrawal of state support from education was filled by private entities, including secular style schools, hybrid *Islamiyya* models, where students study varying amounts of both Islamic and secular content, as well as the Tsangayu of the almajirai. Strong demand for education has since seen the massive expansion of these educational models, though barriers to access still lead to differential and often suboptimal outcomes for the children they are intended to serve. While private secular schools, for example, offer good classrooms, well-trained teachers and generally provide good educational outcomes for their students, their costs for tuition, schoolbooks and uniforms can often exceed poorer families' abilities to pay. Islamiyyas, something of a middle road between almajiranci and secular education, may also charge fees that

exclude poorer students from attendance. This leaves many of the region's poor with a choice between the Nigerian public school system and almajiranci.²⁴

Though public schools, with their secular curricula and ostensible government support, may seem the better of these two options, state neglect has caused many to view these with skepticism, due to widespread stories about their teacher's poor training, bribery for academic advantage, and abuse towards students. The questionable educational quality that these settings allow, reflected in such indices as abysmally low rates of literacy among public school attendees, increase this skepticism, causing some to view engagement in public school education as a futile pursuit. For many, this futility means that almajiranci, despite its similar failure to provide adequate educational outcomes, is often viewed as more honest and morally upright system.²⁴ That some almajirai credit almajiranci for "teaching them how to live in peace with people, ...how to honour others", and for preparing them for the trials of life and the "hereafter" reflects this, as well as the perceived moral and spiritual benefits with which almajiranci remains associated.³⁵ Tsangayu also use schedules that are considerably more flexible than those in public schools, and so can better facilitate the rural-urban migration and employment patterns that are crucial sources of income and subsistence for many almajirai, their teachers and their families.²⁴

The size of the almajiranci system is difficult to determine. In 2010, a Nigerian commission on basic education estimated total enrollment in Islamic schools as ten million students.³⁶ How many of these schooled at Tsangayu or more modern Islamiyyas is not further described. The centrality of migration to almajiranci complicates this further, as, depending on the time of year and harvest cycle, any one community of almajirai may be scattered across the rural and urban settings between

which they migrate, and even across national borders, making population counts at any one site unreliable. The flexibility of almajiranci adds to this yet another layer, as some students transition between almajiranci and other modes of schooling over time, and may even attend different types of educational institution concurrently.²⁴ These challenges are further complicated by the wide range of ages seen among almajirai. While the majority of almajirai are children, many of whom enter the system at ages as young as three years old, some almajirai are considerably older, and may continue education at a Tsangaya into late adolescence and even early adulthood.^{16,24} This feature of almajiranci makes it difficult to determine which age groups to consider in work around almajirai.

Almajirai and Disparity

While the size of the almajiri population may yet be undetermined, the risks to which almajirai are exposed are somewhat more clear. Some of these may be apparent from even simple observation. Almajirai are ubiquitous in urban spaces throughout Hausaland, and spend the bulk of their time outside the Tsangaya on the street, playing, working odd jobs for people in their communities, and, very often, begging, much like populations of street children in other parts of the world. Life on urban streets has been associated with a myriad many poor outcomes, including greater exposure to abuse and violence, poorer mental health, malnutrition and greater risk of communicable disease.^{37,38} Though many of these findings are specific to certain populations of street children, and while these populations themselves may display marked heterogeneity in their experiences and exposures, they still reflect the type of impact living on the street can have.

A substantial body of literature has considered these dynamics among almajirai, demonstrating their exposure to considerable harm. In urban settings, Almajirai live and learn in crowded, often unhygienic conditions, and often sleep on the street, exposed to the elements and vectors of infectious diseases like malaria. The odd jobs that they take on in their communities may expose them to considerable occupational hazard, particularly given the lack of enforcement seen for child labor restrictions throughout much of West Africa.³⁹ Almajirai often have limited access to complete nutrition, and in times of desperate hunger may even resort to spoiled food. Almajirai on the street may be at higher risk of motor vehicle accidents.^{24,40} Proponents of economic deprivation theory, whereby situations of extreme strife push people towards extremes of behavior, argue that the social marginalization almajirai experience may render them vulnerable to recruitment on the part of criminal organizations. The proliferation of such organizations throughout the Sahel over the last two decades, and particularly the growth of terrorist groups such as Boko Haram and the Islamic State in West Africa, has brought this prospect to the forefront of discourse around almajirai, with considerable concern in academia and lay media about almajirai's propensity to join these types of groups.^{41,42} Though there remains considerable uncertainty around what demographic groups these organizations recruit from, and despite a lack of any evidence demonstrating a higher likelihood of recruitment among almajirai, these concerns still persist, contributing to some degree of moral panic around almajiranci. That Boko Haram's second and most notorious leader, Abubakar Shekau, spent his childhood as an almajiri himself adds fuels to these feelings.⁴³

Almajiri Health

An increasingly prominent concern has been the health of almajirai. As mentioned before, strong evidence exists suggesting that street children in various settings experience context-specific health disparities with real bearing on these children's quality of life and ability to thrive. A growing body of literature has sought to evaluate this picture among almajirai, with findings that suggest increased risk of cholera, urinary schistosomiasis, and identifiable psychiatric diagnoses among almajirai than in control populations.⁴⁴⁻⁴⁶ The COVID-19 pandemic has also contributed to some distress around almajiri health, as their perceived susceptibility to infectious diseases and high geographic mobility have caused them to be seen as a population at heightened risk of viral infection and transmission.⁴⁷ Despite this, the peer-reviewed literature around health among almajirai remains limited. Stakeholders involved in research and policymaking around almajiranci have noted a lack of literature around the health of almajirai, as well the challenges that this lack of literature create for intervention and partnership towards supporting these communities (Dr. Hadiza Kere Abdulrahman & Mr. Abdulrahman Leme, Personal Communication, July 2022).⁴⁶

Lastly, almajirai, street children and children more broadly have often been portrayed in the literature as “vulnerable, incompetent and ... powerless in society”.⁴⁸ These portrayals strip these children of their agency and resilience, and lead to the exclusion of their voices from work intended to provide them support. Attention has been increasingly paid to these children's agency and their roles as “social actors” capable of effective engagement with their roles and surroundings to protect their own interests and wellbeing. That many almajirai view their involvement in almajiranci as a temporary hardship endured for the sake of gaining knowledge, developing social resilience, and

establishing strong spiritual and moral foundations, reflects this type of engagement.²⁴

Some work has engaged almajirai in participatory roles, having them work as coproducers on a film about almajiranci, and has found that, given this type of opportunity, almajirai effectively and enthusiastically identify and advocate for their concerns and interests. These opportunities, however, are not always without complication, as even this collaboration was impacted by differing perspectives around material compensation, as well as suspicions of exploitation that required intentional effort from all parties involved to reach resolution.⁴⁹ This experience demonstrates that participatory approaches hold great promise for engagement with almajirai communities, as has been demonstrated for many other marginalized groups, where participatory approaches “promote equitable engagement of residents, community-based organizations, governmental and service-providing agencies, and academic institutions in the process of designing and implementing efforts” to improve these groups’ health, but also require care to ensure that all parties’ interests are protected in participatory work and its outcomes.⁵⁰ This type of approach may be of particular importance in contexts like Hausaland, where feelings of distrust for modern medical institutions are common. Many of these feelings stem from medical institutions’ abuse of public trust, such as Pfizer’s illegal 1996 trial of a meningitis drug in Kano, Northern Nigeria’s largest city, that left at least 11 children dead.⁵¹ The consequences of this distrust have often been dire, with widespread medical skepticism throughout Hausaland that has sometimes erupted into fatal violence.⁵²

Statement of Purpose

Here, we present a scoping review of the academic literature regarding the health of almajiri communities. For neglected groups, such as almajirai, with concern for severe,

population-wide health challenges, work reviewing extant research may support efforts towards addressing these issues by synthesizing evidence for specific health problems, drawing links between related findings, identifying gaps in the literature, and indicating areas for potential intervention. We additionally consider the means and extent to which almajirai and their communities are involved as participants in this type of work, to highlight space for collaboration with these communities around almajiri health, as well as principles that guide the effective use of this collaboration.

Methods

Study Design, Rationale and Aims

Scoping reviews are "preliminary assessment of potential size and scope of available research literature" which help "identify the nature and extent of research evidence".⁵³

Scoping reviews are particularly appropriate "when a body of literature has not yet been comprehensively reviewed, or exhibits a large, complex, or heterogeneous nature not amenable to a more precise systematic review".⁵⁴ They differ from more common systematic review designs in that scoping reviews concern broader research questions, and take "exploratory and descriptive" approaches to literature, as opposed to the "explanatory or analytical" lens typically used for systematic reviews. Scoping reviews may also be used as precursors to systematic reviews, helping to assess knowledge in a research area that may then receive more targeted treatment through a systematic review.⁵⁵

Scoping review designs have been of value in health research at the population and community levels, and in a variety of contexts. They have been used to assess advancements in and unresolved barriers to healthcare provision for Hispanic communities in the United States, associations between spirituality and HIV prevention

measures in the US and Africa, and immigrant experiences around health care barriers in Canada.⁵⁶⁻⁵⁸ In these and other examples, a strength of this research design has been its ability to use evidence of various types to provide detailed reflections on current knowledge and help map areas for research, partnership and intervention.

We use a scoping review on the health of almajiri populations to leverage this strength, and help better define this research space, following guidelines around the conduct of scoping reviews outlined in literature.⁵⁹⁻⁶¹ The question that motivates this review is the following: “What is known about the health of almajirai, what interventions have been considered or implemented to help improve health in almajiri communities, and to what extent has this work engaged almajirai and their communities as participants?”. Our specific aims are to

- Synthesize evidence for specific health findings among almajirai
- Draw links between related health findings for almajirai
- Identify specific gaps in the literature around health in almajiri populations
- Indicate areas for potential intervention in improving health in almajiri populations
- Assess if and how almajirai and their communities have been engaged as participants in research and interventions around almajiri health

Geographic Scope

We consider almajiri communities throughout historic Hausaland, in Northern Nigeria and Southern Niger. This contrasts with other approaches to almajiranci seen in literature, which have mostly concerned communities and populations in Northern Nigeria, which hosts most of the region’s population. We take our approach to represent the fullest possible breadth of almajirai and their experiences, and in recognition of generally porous borders of the West African Sahel, which has fostered the creation and maintenance of a myriad many transnational communities throughout

Hausaland and the Sahel more broadly, including but certainly not limited to almajirai.⁶²

Among a sample of almajirai in Nigeria's North-West Sokoto state, for example, one-fourth reported their citizenship as Nigerien.⁶³

Despite the presence of Quranic schools and other institutions that bear various degrees of semblance to almajiranci throughout many parts of Muslim West Africa, we do not extend our search to settings beyond Hausaland. This reflects differences in history, culture, religious perspective, political dynamics and economic circumstance that may have profound impacts on the shapes of these institutions and the experiences of their students.^{2,64} While these same differences also exist within Hausaland, reflecting distinct experiences of colonization and independence, the profound linguistic, cultural and personal connections within this region, as well as evidence demonstrating the movement of almajirai between Nigeria and Niger, support an approach that considers almajiri communities in both countries.³

Operationalizing 'Almajiri Health'

Health, a human right, may sometimes be difficult to define. This is particularly so for the deep connections that exist between health and other human needs, like shelter, social belonging, and self-actualization. The World Health Organization's 1949 constitution defines health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity", and a 1984 elaboration further describes the concept as "the extent to which an individual or group is able to realize aspirations and satisfy needs and to change or cope with the environment" as well as "a resource for everyday life, not the objective of living".^{65,66}

One theoretical model that helps us organize our study and contextualize our findings is Engel's biopsychosocial formulation of health. This model, a response to the earlier and

more narrowly-concerned biomedical model of health, posits that health exists under the influence of biological factors, such as age, gender and physiology, psychological factors, including mental health and people's own understandings and experiences around health, and social factors, such as access to care and social supports, as well as systems-level social dynamics.⁶⁷

We supplement our use of this model with other conceptual tools. The social ecological model uses systems theory to argue that communities exist in interdependent and mutually-shaping relationships with their environments that resemble ecological relationships observed in nature. These social-ecological relationships may be reciprocally reinforcing, but also considerably multifaceted, creating space for agency through individual differences in these relationships.⁶⁸ This framework has been used to enrich use of the biopsychosocial model elsewhere in the literature around the health of marginalized populations.⁵⁷

We integrate these frameworks into a unified model that places health outcomes among almajirai under the influence of multidirectional relationships between biologic factors, including medical history and specific disease risks, social factors, such as shelter, employment, education and income, and psychological factors, such as almajirai's own understanding of their role and the ways they engage society, effectively and not, to protect and advance their own interests, aspirations and wellbeing, enabling a thorough approach to the question of almajiri health

Inclusion Criteria, Search Strategy & Data Extraction

We obtained English- and French- language studies in the academic literature regarding almajiri health, as previously conceptualized, in Nigeria and Niger, and published between January 1, 2000, and September 16, 2022. Our search strategy was

developed through consultation with an academic librarian. Databases used to perform our search were MEDLINE, Embase, OVID Global Health, Scopus, Web of Science and EBSCO’s Africa-Wide Information Database. Though we considered performing searches on Google Scholar to capture studies in the grey literature, this database was ultimately excluded for concerns regarding search syntax modularity and result reproducibility. Studies published in French were screened and reviewed using the Google Translate service, which evidence suggests “is a viable, accurate tool for translating non–English-language trials for the purpose of conducting systematic reviews”.⁶⁹ A protocol for this review was registered on the Open Science Foundation’s open registries network. A sample of our full search strategy, as formatted for Ovid MEDLINE, Embase and Global Health, is shown in Table 1. Our search was conducted on the 17th of September, 2022.

1	street children.mp. or exp Homeless Youth/ [mp=ti, bt, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, sy, tn, dm, mf, dv, dq, cw]	2679
2	exp nigeria/ or Niger/	120792
3	1 and 2	52
4	(almajiri or almajirai).af.	29
5	("street child*" and "niger*").mp. [mp=ti, bt, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, sy, tn, dm, mf, dv, dq, cw]	58
6	(homeless* and child* and niger*).mp. [mp=ti, bt, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, sy, tn, dm, mf, dv, dq, cw]	33
7	(neglect* and child* and niger*).mp. [mp=ti, bt, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, sy, tn, dm, mf, dv, dq, cw]	518
8	("out of school" and "child*" and "niger*").mp. [mp=ti, bt, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, sy, tn, dm, mf, dv, dq, cw]	125
9	(enfant* and niger*).mp. [mp=ti, bt, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, sy, tn, dm, mf, dv, dq, cw]	186
10	((quran* or koran* or qur'an* or kor'an*) and school* and niger*).mp. [mp=ti, bt, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, sy, tn, dm, mf, dv, dq, cw]	23
11	(health* or disease* or illness* or sante* or maladie*).mp. [mp=ti, bt, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, sy, tn, dm, mf, dv, dq, cw]	28323246
12	3 or 4 or 5 or 6 or 7 or 8 or 9 or 10	930
13	11 and 12	794
14	limit 13 to yr="2000 -Current"	685

Table 1: Search Strategy Sample as Formatted for Ovid MEDLINE, Embase and Global Health

Titles and abstracts identified through our search strategy were screened by a team of seven reviewers such that each study was screened by two independent reviewers.

Conflict resolution and full-text review were performed by two reviewers (Muhammad & Abdulsalam) with previous experience conducting literature reviews, lived experience in Hausaland, and linguistic proficiency in Hausa. Data extraction was performed by the primary investigator. Specific pieces of information collected for each study included (i) author, (ii) study year and location(s), (iii) study design and aims, (iv) study sample characteristics, (v) key findings, and (vi) almajiri participation in research design, execution, interpretation, and dissemination.

Student Contributions

Here, the student (Muhammad) independently conceptualized this study, and was primarily responsible for the research design, with support and input from research mentors (Paintsil & Ransome) and an academic librarian. The student managed all aspects of project administration, including funding acquisition, independently, and recruited the research team, consisting of four medical students, one undergraduate student, and an expert in the Nigerian public health sector, conducting the literature search and review in collaboration with this team. The student conducted formal analysis, original draft writing and visualization independently, with manuscript review and editing support from research mentors.

Ethical Considerations

This study did not require IRB review as it did not involve human subjects. This work was funded by the Yale School of Medicine Office of Student Research.

Results

Our search identified 1,944 studies across our six databases, of which 781 were duplicates. Of 1,163 studies included in title and abstract screening, 25 were included for full-text review. After full-text review, a final set of 17 studies were deemed relevant

for data extraction. Of 8 studies included in full-text review but not in data extraction, 6 did not concern almajirai, one did not report health-related outcomes, and another did not present data. A PRISMA flow-chart depicting the outcomes of our screening and review processes is shown in Figure 1.

Our 17 studies included 14 cross-sectional studies, 2 descriptive articles, and one case-control study. Just one study concerned an intervention to improve almajiri health. No study engaged almajirai in participatory roles beyond acquiring their consent. All 17 studies were conducted in Nigeria, though one included almajirai from Niger.⁶³ Studies reporting original data represented 6 of Northern Nigeria's 19 states. These were Adamawa, Bauchi, Borno, Kaduna, Kano, and Sokoto. A map depicting study locations is shown in Figure 2. While most studies focused on almajirai or compared almajirai to control samples of secular school students, one study concerning almajirai employed as waste-pickers considered them alongside others engaged in this work and did not disaggregate data for specific groups.⁷⁰ The ages of almajirai represented in these studies ranged from as young as 3 years to as old as 28, though some studies did not clearly state participants' ages. Table 2 shows the results of our data extraction process for our final set of 17 studies.

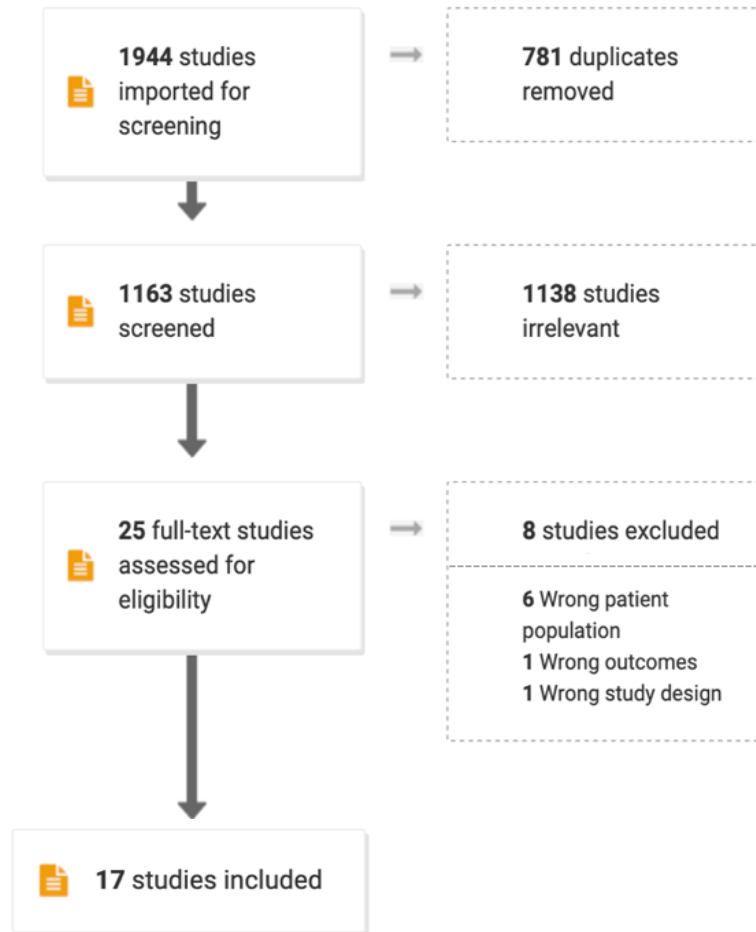



Figure 1: PRISMA Flow-Chart for Included Articles. Of 1944 studies identified through our search strategy, 25 were included in full-text review, and 17 were eligible for inclusion in this study.

Legend

-  Northern Nigeria
-  Southern Niger
-  Study Sites in Northern Nigeria
-  Other Nigeria/Niger

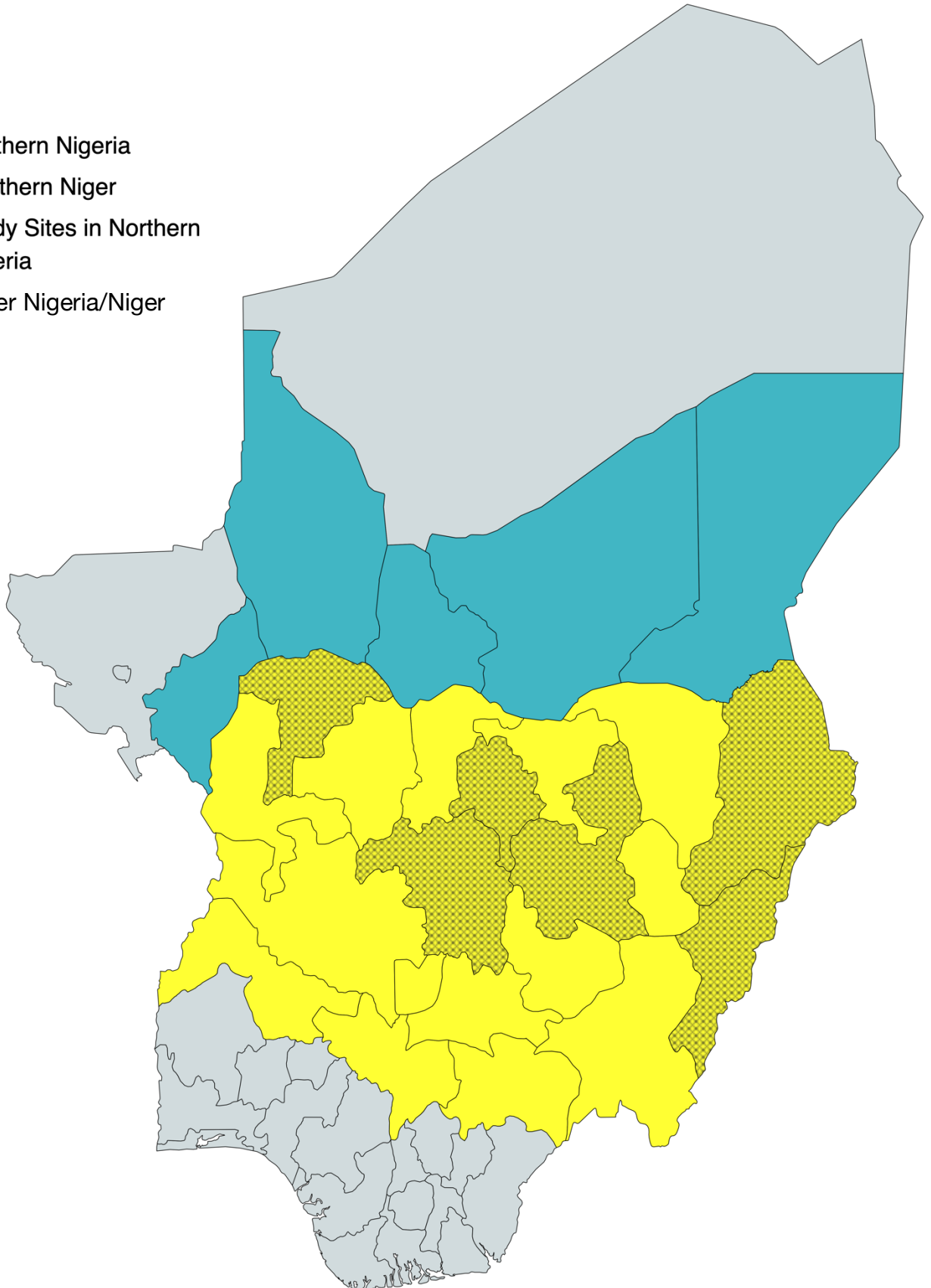


Figure 2: Map of Study Sites. States and Regions encompassing Northern Nigeria and Southern Niger are shaded in yellow and blue respectively. Study sites represented in this review are indicated with a crosshatch pattern. Other parts of Nigeria and Niger are shaded in grey. Areas represented in this review were the Northern Nigerian states of Adamawa, Bauchi, Borno, Kaduna, Kano, and Sokoto. No study was conducted in Niger.

Table 2: Final Articles Included in this Review

Author (Year)	Title	Year	Location	Study Design	No. of Participants	Participant Ages	Main Findings	Notes on Participation	Other Notes
Dimas 2017	The Drivers Of The Cholera Epidemic In Bauchi, Northeast Nigeria 2014	2014	Bauchi City, Bauchi State, Nigeria	Case control study assessing cholera risk factors around a 2014 Cholera outbreak in Nigeria's North-East Bauchi State	124 cases and 124 controls. 26 cases and 6 controls were almajirai.	Not disclosed explicitly.	“Contact with a diarrhoea case, being an ‘Almajiri’ and unhygienic behaviors are major risks factors for the spread of the disease”	None disclosed. Recommend teaching hand washing to almajirai in Tsangayu.	
Adeleke 2008	Dermatophytosis Among Itinerant Quranic Scholars In Kano (Northwest) Nigeria	2006	Tarauni Local Government Area, Kano State, Nigeria	Cross-sectional study using physical exams and skin sample testing to determine the prevalence of dermatophytosis among almajirai	2,150 almajirai	Range: 5 – 25	Dermatophyte infections were seen in 9.5% of participants, though most infections were mild.	Consent obtained from mallamai. Recommend periodic skin examinations for dermatophytosis among almajirai.	

Table 2: Final Articles Included in this Review

Author (Year)	Title	Year	Location	Study Design	No. of Participants	Participant Ages	Main Findings	Notes on Participation	Other Notes
Sarkingobir 2019	Assessment Of Selected Health Determinants Among Almajiri Students In Gwadabawa Local Government, Sokoto State, Nigeria	Not explicitly disclosed	Gwadabawa Local Government Area, Sokoto, Nigeria	Cross sectional study using semi-structured questionnaires to evaluate school building quality, potable water access, safe toilet use, hygiene, nutrition and exposure to violence among almajirai	40 almajirai.	Range: 7 – 17	50% of almajirai schooled in mud- or corrugated-metal buildings. 66% of Tsangayu did not have close access to potable water, and 50% were situated around refuse dumps and open wastewater gutters.	None disclosed.	30 almajirai reported their citizenship as Nigerian, and 10 reported their citizenship as Nigerian.
Damen 2011	Prevalence Of Intestinal Parasites Among Pupils In Rural North Eastern, Nigeria.	2006	Konduga Local Government Area, Borno State, Nigeria	Cross-sectional study using stool sample testing to determine the prevalence of intestinal	257 almajirai	Range: 5 – 16	208 (80.9%) almajirai had intestinal parasites.	Ethical clearance and consent obtained from an Imam at a local mosque, and mallamai at each	

Table 2: Final Articles Included in this Review

Author (Year)	Title	Year	Location	Study Design	No. of Participants	Participant Ages	Main Findings	Notes on Participation	Other Notes
				parasitosis among almajirai				participating Tsangaya. Recommends 'public engagement' to prevent and control pediatric parasitic infections, but does not specify these for almajirai.	
Sclama 2017	Mainstreaming Nutrition In A School-Based Feeding Programme In Northeast Nigeria.	Not explicitly disclosed	Yola City, Adama State, Nigeria	Article about an American University of Nigeria (AUN)-designed intervention providing almajirai	Total number of participants unclear, but article references plans to "reach over 1,000	Not explicitly disclosed but describes almajirai as "typically between the	In 2016, an assessment of 200 boys graduated from the program "found that they had made a significant improvement	Mentions efforts to attain "of the children's parents, guardians, mallams, other community	No outcomes yet reported. Of note, program has also

Table 2: Final Articles Included in this Review

Author (Year)	Title	Year	Location	Study Design	No. of Participants	Participant Ages	Main Findings	Notes on Participation	Other Notes
				with daily meals, basic education and connection to vocational training	students”, though this number may include girls who are not almajirai.	ages of 6 and 25”	t based on the Early Grade Reading Assessment (EGRA) and Early Grade Mathematics Assessment (EGMA) exams.”	members and state government officials” largely through the Adamawa Peace Initiative, a collaboration between the AUN and local religious leaders	been extended to girls.
Aminu 2017	Carriage Rate Of Neisseria Meningitides Among Pupils Of Islamic Boarding Schools (Tsangaya	2016	Kano State, Nigeria	Cross-sectional study using nasal sample testing to estimate the prevalence of Neisseria meningitides among almajirai	150 almajirai	Range: 5 – 10	23 (15.3%) almajirai had nasal samples that were positive for N. meningitides, around half of whom (52.2%) were positive for N.	Ethical clearance and consent for the study were obtained from t he Kano State Board of Islamiyya and	

Table 2: Final Articles Included in this Review

Author (Year)	Title	Year	Location	Study Design	No. of Participants	Participant Ages	Main Findings	Notes on Participation	Other Notes
	Almajirai) In Kano, Nigeria.						meningitides serotype B	Quranic education, and from “head teachers” at each Tsangaya.	
Hamma 2017	Malaria Occurrence And Awareness Amongst Almajirai In Some Selected Traditional Qur'anic Centres Of Kano Municipal And Gwale Local Government	2017	Kano Municipal & Gwale Local Government Areas, Kano State, Nigeria	Cross-sectional study using blood sample microscopy to estimate the prevalence of malaria among almajirai, and speciate prevalent strains.	454 almajirai	Range: 9 – 28	162 (35.7%) almajirai had blood samples that were positive for malaria. P falciparum was the only malarial species represented in the sample.	Ethical approval was obtained from an Islamiyya school boards, and verbal consents were obtained from each participating almajirai. Authors recommend that “[c]ommunity mobilization and	

Table 2: Final Articles Included in this Review

Author (Year)	Title	Year	Location	Study Design	No. of Participants	Participant Ages	Main Findings	Notes on Participation	Other Notes
	Areas Of Kano State.							health education regarding importance of ITNs [insecticide-treated nets] should be considered”.	
Shuaibu 2011	Assessment Of Socioeconomic, Demographic And Health Problems Of Al-Majiri In Sokoto State, North-Western Nigeria	2011	Sokoto City, Sokoto State, Nigeria	Cross sectional study using semi-structured interviews, physical examinations and urine testing to “assess the demographic profile, socioeconomic	377 almajirai	Not disclosed explicitly.	225 (59.7%) almajirai had features of urinary tract infection, out of which 116 (51.6%) yielded culture-positive E. coli, sensitive to siprosan, gentamycin and	None disclosed.	

Table 2: Final Articles Included in this Review

Author (Year)	Title	Year	Location	Study Design	No. of Participants	Participant Ages	Main Findings	Notes on Participation	Other Notes
				backgrounds and health status” of almajirai in Sokoto state			levoxin. 50 (13.3%) had dry skin and 40 (10.6%) had symptoms of upper respiratory infection. Skin lesions, diarrheal disease, eye discharge and bodily wounds were each seen in under 5% of the sample.		
Dzikwi 2012	Knowledge, Attitude And Practice About Rabies Among Children Receiving	2010	Samaru Ward, Sabon Gari Local Government Area, Zaria City, Kaduna	Cross sectional study using self-administered questionnaires to compare rabies	77 almajirai and 400 children from secular primary and secondary schools	Range: 5 – 20	203 (50.8%) children in secular schools and 25 (32.5%) almajirai had any knowledge about rabies. Of	Consent for the study was obtained from ‘responsible authorities’.	Authors

Table 2: Final Articles Included in this Review

Author (Year)	Title	Year	Location	Study Design	No. of Participants	Participant Ages	Main Findings	Notes on Participation	Other Notes
	Formal And Informal Education In Samaru, Zaria, Nigeria.		State, Nigeria	knowledge and risk-related behaviors between children attending secular schools and almajirai			those who recognized rabies, 127 children in secular schools (65.7%) and 2 almajirai (8%) were aware that dog bites could transmit the disease.	“recommend rabies education for parents and school teachers in both the formal and informal setting” for better recognition, prevention and treatment of rabies.	
Akintunde 2020	Public Health Implication Of Displacement Of Almajiri Children In Specific States Of Northern	2020	N/A	Text and opinion piece using descriptive analysis and “various sources such as government documents,	N/A	N/A	States returned up to thousands of almajirai to their putative states of origin during the early phase of the COVID-19	N/A	

Table 2: Final Articles Included in this Review

Author (Year)	Title	Year	Location	Study Design	No. of Participants	Participant Ages	Main Findings	Notes on Participation	Other Notes
	Nigeria Amidst COVID-19 Pandemic			websites, and blogs” to evaluate the efforts many Nigerian states undertook to repatriate almajirai to their communities of origin in the face of the COVID-19 pandemic.			pandemic, despite limited evidence of widespread COVID-19 infection among almajirai. Few if any measures were taken to quarantine and provide care for almajirai who experienced this displacement.		
Ali 2021	Prevalence Of Injuries Among Waste Pickers. A Case Study In Nigeria	2019	Bauchi City, Bauchi State, Nigeria	Cross sectional study using questionnaires to estimate the prevalence of work-related physical injury, and	313 participants, of whom the number that were almajirai is not disclosed.	Not disaggregated for almajiri participants	246 respondents (78.5%) reported having experienced work-related injury. Reported injuries, in order of prevalence, were	None disclosed.	Authors note that “most of those waste pickers are

Table 2: Final Articles Included in this Review

Author (Year)	Title	Year	Location	Study Design	No. of Participants	Participant Ages	Main Findings	Notes on Participation	Other Notes
				commonly used means to treat these injuries, among waste-pickers in Bauchi city.			laceration (37.8%), musculoskeletal injury (23.7%), rashes (14%), animal bites (13.5%), piercing injuries (10.6%) and burns (8.3%). Almajirai and workers without experiences of secular education were more likely to report having experienced injury. 54% of waste pickers do not pursue medical treatment for wound, and		Internally Displaced Persons (IDPs) and Almajiri children". Results are not, however, disaggregated by worker type.

Table 2: Final Articles Included in this Review

Author (Year)	Title	Year	Location	Study Design	No. of Participants	Participant Ages	Main Findings	Notes on Participation	Other Notes
							instead pursue alternative means of management. Such means included the use of procaine powder, ash, sand, salt, grass fluid, hydraulic, kerosene, battery acid, and herbal medicines.		
Balogun 2016	Asymptomatic Falciparum Malaria And Genetic Polymorphisms Of Pfcrt K76T And Pfmdr1	2010	Maiduguri City, Borno State, Nigeria	Cross sectional study using blood sample testing to estimate the prevalence of asymptomatic Plasmodium	440 almajirai	3 – 12 (Range)	The prevalence of asymptomatic falciparum parasitemia and gametocytemia were 12.7% (56/440) and 8.6%	Ethical approval and research permission was obtained from the Borno State Ministry of	

Table 2: Final Articles Included in this Review

Author (Year)	Title	Year	Location	Study Design	No. of Participants	Participant Ages	Main Findings	Notes on Participation	Other Notes
	N86Y Among Almajirai In Northeast Nigeria			falciparum malaria, as well as malarial mutations conferring resistance to chloroquine, among almajirai.			(38/440), respectively. Among almajirai with parasitemia, 3 (5.4%) had one of two malarial mutations conferring chloroquine resistance (Pfcrt K76T). Another resistance- conferring mutation (Pfmdr1 N86Y) was not seen in this sample.	Religious Affairs, and consent was obtained from participating almajirai.	

Table 2: Final Articles Included in this Review

Author (Year)	Title	Year	Location	Study Design	No. of Participants	Participant Ages	Main Findings	Notes on Participation	Other Notes
Gambo 2021	A Comparative Study On The Prevalence And Intensity Of Urinary Schistosomiasis Among Primary (Formal) And Almajiri (Informal) School Pupils In Kura Local Government Area Of Kano State, Nigeria	Not explicitly disclosed	Kura Local Government Area, Kano State, Nigeria	Cross sectional study using urine sample testing to compare the prevalence of urinary schistosomiasis between almajirai and secular primary school students.	200 almajirai and 200 secular primary school students	Mean: 10.7 (Almajirai) Mean: 10.3 (Secular)	Urinary schistosomiasis was seen in 86 secular school students (43%) and 111 almajirai (55.5%), a statistically significant difference (p<0.05).	Written informed consent signed or thumb printed was obtained from parents, guardians or mallamai. Older pupils aged 7 years and above gave their assent. Authors "recommend that control programmes should target more on Almajiri school pupils in addition to the	

Table 2: Final Articles Included in this Review

Author (Year)	Title	Year	Location	Study Design	No. of Participants	Participant Ages	Main Findings	Notes on Participation	Other Notes
								primary school pupils."	
Yandoma 2019	Risk Factors For Intestinal Parasitosis Among Almajiri Pupils In Zaria, North Western Nigeria	Not explicitly disclosed	Zaria City, Kaduna State, Nigeria	Cross sectional study using questionnaires and stool samples to evaluate the prevalence of intestinal parasitosis among almajirai, as well as risk factors associated with parasitic infection.	262 almajirai	Range: 4 – 12	218 almajirai (83.2%) had intestinal parasites. Intestinal parasitosis was significantly associated with older age, poor hand washing after defecation, fingernail-biting and thumb-sucking, sharing food from a plate	Permission for the study was obtained from the local authority overseeing the schools. Assent for participation was obtained from individual pupils and consent obtained from their mallamai.	

Table 2: Final Articles Included in this Review

Author (Year)	Title	Year	Location	Study Design	No. of Participants	Participant Ages	Main Findings	Notes on Participation	Other Notes
							and belonging to a polygamous family ($p < 0.05$).	Authors recommend that "proper sewage disposal and personal and environmental hygienic practices should be inculcated in the Almajiri system."	
Abubakar-Abdullateef 2017	A Comparative Study Of The Prevalence And Correlates Of Psychiatric Disorders In Almajiris And Public Primary	Not explicitly disclosed	Zaria City, Kaduna State, Nigeria	Cross sectional study using the Schedule for Affective Disorders and Schizophrenia for School aged Children-	213 almajirai and 200 students at secular public primary schools	Range: 5 – 19 Mean: 13.1 (Almajirai) Mean: 10.9 (Secular)	The prevalence of depression, general anxiety disorder, enuresis, substance use and PTSD were significantly higher among almajirai	Consent for study was obtained from mallamai, and assent was obtained from all participating almajirai.	The mean ages in the almajiri and secular school groups

Table 2: Final Articles Included in this Review

Author (Year)	Title	Year	Location	Study Design	No. of Participants	Participant Ages	Main Findings	Notes on Participation	Other Notes
	School Pupils In Zaria, Northwest Nigeria			Present and Lifetime Version (K-SADS-PL), a validated semi-structured diagnostic interview tool, to compare the prevalence of psychiatric disorders between almajirai and secular primary school children.			than among students at secular schools. Almajirai were significantly less likely than secular school students to have separation anxiety. Significant associations were found between psychiatric diagnoses and maternal education, personal experience of malnutrition, serious injury, fighting, bullying		were significant ly different in this study (p<0.05).

Table 2: Final Articles Included in this Review

Author (Year)	Title	Year	Location	Study Design	No. of Participants	Participant Ages	Main Findings	Notes on Participation	Other Notes
							within the last month and visiting home less than 3 times per year.		
Idowu 2016	Oral Health Knowledge And Practice Of 12 To 14-Year-Old Almajaris In Nigeria: A Problem Of Definition And A Call To Action	Not explicitly disclosed	Nasarawa Local Government Area, Kano State, Nigeria	Cross sectional study using a questionnaire to assess oral health knowledge, behaviors and medical history among almajirai, and a simplified Oral Hygiene Index (OHI-S) to evaluate their oral hygiene.	186 almajirai	Mean: 12.7	104 almajirai (56%) reported practicing oral hygiene to prevent mouth odor and 12 (6.4%) practiced oral hygiene to prevent dental caries and periodontal disease. 6 per cent practiced oral hygienemeasures for the prevention of dental caries		

Table 2: Final Articles Included in this Review

Author (Year)	Title	Year	Location	Study Design	No. of Participants	Participant Ages	Main Findings	Notes on Participation	Other Notes
							and periodontal diseases well. 156 (84%) reported daily teeth cleaning. 67% of almajirai reported using water and a finger to clean their teeth, with 4% using toothpaste and a toothbrush, and 29% using either a toothbrush or chewing stick without toothpaste. The OHI-S revealed 'good' oral hygiene for 2 almajirai (1%), with the remaining 184		

Table 2: Final Articles Included in this Review

Author (Year)	Title	Year	Location	Study Design	No. of Participants	Participant Ages	Main Findings	Notes on Participation	Other Notes
							(99%) equally split between 'poor' and 'fair' oral hygiene. Just 3% of respondents were familiar with dental floss and 2% aware of the need for regular dental visits to maintain oral health.		
Idowu 2020	Nigeria's Street Children, Epitome Of Oral Health Disparity And Inequality	2020	Nasarawa Local Government Area, Kano State, Nigeria	Cross sectional study using a questionnaire and simplified Oral Hygiene Index (OHI-S) to compare oral health knowledge,	200 almajirai and 200 students at private secular secondary schools	Mean: 12.7 (Almajirai) Mean: 13.05 (Secular)	6% of almajirai and 70% of secular students identified that oral hygiene prevents both mouth odor and oral disease. 5% of almajirai and 90%	Consent for study was obtained from mallamai. Authors recommend that "both the mallams	

Table 2: Final Articles Included in this Review

Author (Year)	Title	Year	Location	Study Design	No. of Participants	Participant Ages	Main Findings	Notes on Participation	Other Notes
				behaviors, and oral hygiene between almajirai and students at private and secular secondary schools.			of secular students used a toothbrush and toothpaste for teeth cleaning. 65% of almajirai performed teeth cleaning with their fingers and water alone. 4 almajirai (2%) and 128 secular students (64%) had 'good' oral health on the OHI-S.	and the second ary school teachers should be specially educated on oral hygiene practices" and that "oral health care delivery should be made more accessible to the Nigerian children through the establishment of mobile dental clinics that will pay periodic visits to	

Table 2: Final Articles Included in this Review

Author (Year)	Title	Year	Location	Study Design	No. of Participants	Participant Ages	Main Findings	Notes on Participation	Other Notes
								Quranic and formal schools”	

These studies may be grouped into domains reflecting their content and focus. Ten articles concerned infectious disease, the most of any domain in this review, while other articles concerned such topics as workplace injury, nutrition, general health status, health determinants, oral health and mental health. We use these domains to present these studies and their main findings below.

Infectious Disease

Malaria

Hamma et al., in a 2017 study conducted in the Kano Municipal and Gwale Local Government Areas of Nigeria's Kano State, use blood microscopy in a sample of 454 almajirai, aged 9 to 28 years old, to assess the prevalence of malaria and speciate prevalent strains. The prevalence of malaria in this sample was 35.7%, and *P. falciparum* was the only malarial species found in the sample. Here, the authors recommend that "community mobilization and health education regarding importance of ITNs [insecticide-treated nets] should be considered".⁷¹

Balogun et al., in their 2010 study based in Maiduguri, Borno State, hypothesize that almajirai's poor shelter disproportionately exposes them to mosquito bites, and that this exposure may induce pre-immunity to, and asymptomatic infection with *falciparum* malaria. They further consider trends in chloroquine resistance in Nigeria, and use blood microscopy and genetic testing, respectively, to determine the prevalence of asymptomatic malarial infection and two malarial mutations conferring resistance to chloroquine among a sample of 440 almajirai. Almajirai in the sample ranged from 3 to 12 years of age. The prevalence of asymptomatic *falciparum* parasitemia and gametocytemia were 12.7% (56/440) and 8.6% (38/440), respectively. Among almajirai with parasitemia, 3 (5.4%) had one of two malarial mutations conferring chloroquine resistance (*Pfcr*t K76T). Another resistance-conferring mutation (*Pfmdr*1 N86Y) was not seen in this sample. These authors argue that almajirai "should be

incorporated into various malaria control programs to ensure the success of the fight against malaria in Nigeria at large.”⁷²

Intestinal Parasitosis

Damen et al., in a 2006 study in Borno State’s Konduga Local Government Area, use stool sample testing to determine the prevalence of intestinal parasitosis among 257 almajirai, and find that 208 (80.9%) had intestinal parasites. Similarly, Yandoma et al. (2019) use stool microscopy and a health behavior survey to assess the prevalence of, as well as risk factors for, intestinal parasitosis in a sample of 262 almajirai from Zaria city in Kaduna state. This study finds that 218 almajirai (83.2%) had intestinal parasites, and that intestinal parasitosis was significantly associated with older age, poor hand washing after defecation, fingernail-biting and thumb-sucking, sharing food from a plate and belonging to a polygamous family ($p < 0.05$). The authors recommend ‘public engagement’ to prevent and control pediatric parasitic infections, but does not specify this for almajirai.⁷³

Other Infectious Disease

Dimas et al. (2017) evaluate risk factors associated with cholera infection following a 2014 outbreak of cholera in Maiduguri, Borno State in a case-control study. This study’s sample included 124 cases and 124 controls, of whom 26 cases and 6 controls were almajirai. Their evaluation finds an odds ratio (OR) of 5.2 (Confidence Interval [CI] 1.94 – 14.78) for cholera infection among almajirai, and the authors recommend that almajirai are taught effective hand washing techniques at their Tsangayu to help prevent and control cholera.⁴⁴

Adeleke et al. (2008), in a 2006 study of 2,150 almajirai in Kano State’s Taurani Local Government Area, argue that the crowded conditions in which many almajirai live and learn predispose almajirai to dermatophytosis, and use physical exams and mycological studies to evaluate the presence of dermatophytosis among almajirai. This study finds dermatophytosis in

9.5% of participants, though the authors report that “most infections were mild”. These authors argue for periodic skin examinations to evaluate dermatophytosis among almajirai.⁷⁴

Aminu et al. (2017) consider the prevalence of *Neisseria meningitidis* in a sample of 150 almajirai, aged 5 to 10, from Kano State, and use nasal sample tests to determine this prevalence and speciate prevalent strains. They find that 23 (15.3%) almajirai had nasal samples that were positive for *N. meningitidis*, around half of whom (52.2%) were positive for *N. meningitidis* serotype B.⁷⁵

Gambo et al. (2021) use urine microscopy to compare the prevalence of urinary schistosomiasis between 200 almajirai and 200 secular primary school students in Kura Local Government Area, Kano State. The mean ages in these groups were 10.7 and 10.3 years, respectively. Urinary schistosomiasis was seen in 86 secular school students (43%) and 111 almajirai (55.5%), a statistically significant difference ($p < 0.05$). Here, authors “recommend that [schistosomiasis] control programmes should target ... Almajiri school pupils in addition to the primary school pupils”.⁴⁵

In another comparative study, Dzikwi et al. (2012) use self- and interviewer-administrated surveys to compare rabies knowledge and risk-related behaviors between almajirai and children attending secular schools. Their sample included 77 almajirai and 400 children in secular primary and secondary schools from the Samaru Local Government Area in Zaria City, Kaduna State, with ages between 5 and 20 years. They find that 203 (50.8%) children in secular schools and 25 (32.5%) almajirai had any knowledge about rabies. Of those who recognized rabies, 127 children in secular schools (65.7%) and 2 almajirai (8%) were aware that dog bites could transmit the disease. These authors “recommend rabies education for

parents and school teachers in both the formal and informal setting” for better recognition, prevention and treatment of rabies.⁷⁶

Akintunde et al. (2020) consider anxieties around almajiranci in the context of the COVID-19 pandemic in Nigeria, where almajirai’s mobility and exposure to communicable diseases caused them to be seen as particularly vulnerable to viral infection and transmission. These anxieties caused some state governments to consider repatriating almajirai to their places of origin, to limit the risk they perceived almajirai as bringing to their host states. This study performs descriptive analysis on “various sources such as government documents, websites, and blogs” to evaluate if and how this repatriation occurred, and consider its impact on almajirai and Nigerian public health more broadly. They find that various states returned up to thousands of almajirai to their putative states of origin during the early phase of the COVID-19 pandemic, despite limited evidence of widespread COVID-19 infection among almajirai. Few if any measures were taken to quarantine and provide care for almajirai who experienced this displacement. The authors use this evidence to argue that repatriation “may not be the best course of action because it will increase the possibility of infecting people with the virus”, and that a more effective means of management may be for governments to establish camps for almajirai in their host states with “shelter for the children, provision of food and ultimately medical care”.⁴⁷

Other Topics

Oral Health

Idowu et al. (2016) use a questionnaire to survey 186 almajirai in Kano State’s Nasawara Local Government Area about their oral health knowledge, behaviors and dental history, and a simplified Oral Hygiene Index (OHI-S) to evaluate their oral hygiene. They find that 104 almajirai (56%) reported practicing oral hygiene to prevent mouth odor and 12 (6.4%) practiced oral

hygiene to prevent dental caries and periodontal disease. Additionally, while 156 (84%) almajirai reported daily teeth cleaning, just 4% of this figure reported using a toothbrush and toothpaste, with the remainder using their fingers, chewing sticks or toothbrushes with water. The OHI-S revealed 'good' oral hygiene for 2 almajirai (1%), with the remaining 184 (99%) equally split between 'poor' and 'fair' oral hygiene. Just 3% of respondents were familiar with dental floss and 2% aware of the need for regular dental visits to maintain oral health.⁷⁷

These same authors, in a 2020 study, compare oral health behaviors and oral hygiene between almajirai and students attending private secondary schools. Their sample consisted of 200 almajirai and 200 secondary school students, with mean ages of 12.7 and 13.05 years, respectively. This analysis finds that 6% of almajirai and 70% of PSS students identified that oral hygiene prevents both mouth odor and oral disease, 5% of almajirai and 90% of secondary school students used a toothbrush and toothpaste for teeth cleaning, and that 4 almajirai (2%) and 128 secondary school students (64%) had 'good' oral health on the OHI-S. Here, authors recommend that "both the mallams and the secondary school teachers should be specially educated on oral hygiene practices" and that "oral health care delivery should be made more accessible to the Nigerian children through the establishment of mobile dental clinics that will pay periodic visits to Quranic and formal schools".⁷⁸

Nutrition

Sclama (2017) considers an intervention to improve nutrition for almajirai in Yola, the capital of Nigeria's Adamawa State. This intervention, designed and implemented by the American University of Nigeria (AUN), based in Yola, provides almajirai with daily meals, basic education and connection to vocational training. The program's total number of participants is not stated explicitly, but this article references plans to "reach over 1,000 students". Though growth- and nutrition-related outcomes of this intervention have not yet been reported, an assessment of

200 boys graduated from the program “found that they had made a significant improvement based on the Early Grade Reading Assessment (EGRA) and Early Grade Mathematics Assessment (EGMA) exams”. The article further discusses efforts to gain support for the program from “children’s parents, guardians, mallams, other community members and state government officials” through the Adamawa Peace Initiative, a collaboration between the AUN and local religious leaders. Of note, while this intervention was initially designed for almajirai, it has since been extended to include girls who are not almajirai but demonstrate similar needs.⁷⁹

Health Determinants

Sarkingobir et al. (2019) use a semi-structured survey to evaluate a broad range of environmental health determinants in a sample of 40 almajirai, ages 7 to 17, in Sokoto State’s Gwadabawa Local Government Area. Their study finds that 50% of almajirai schooled in mud- or corrugated-metal buildings, 66% of Tsangayu did not have close access to potable water, and 50% were situated around refuse dumps and open wastewater gutters. Of note, in this sample, 30 almajirai reported their citizenship as Nigerian, and 10 reported their citizenship as Nigerien.⁶³

General Health Status

Shuaibu et al. (2011) use semi-structured interviews, physical examinations and urine testing to “assess the demographic profile, socioeconomic backgrounds and health status” of 377 almajirai in Sokoto, the capital city of Sokoto State. They find that 225 (59.7%) almajirai had features of urinary tract infection, out of which 116 (51.6%) yielded culture-positive E. coli on urine testing, that was sensitive to siprosan, gentamycin and levoxin. 50 (13.3%) had dry skin and 40 (10.6%) had symptoms of upper respiratory infection. Skin lesions, diarrheal disease, eye discharge and bodily wounds were each seen in under 5% of the sample.⁸⁰

Work-Related Injury

Ali et al. (2021), in a 2019 study set in Bauchi city, Bauchi State, consider workplace injury among people employed in waste-picking, which “involves the collection, purchase, and recovery of materials for economic benefit” from waste and refuse dumps. Here, authors identify that, of their 313 participants, most were “Internally Displaced Persons (IDPs) and Almajiri children”, but do not disaggregate their findings by participant type. They find that 246 respondents (78.5%) reported having experienced work-related injury. Reported injuries, in order of prevalence, were laceration (37.8%), musculoskeletal injury (23.7%), rashes (14%), animal bites (13.5%), piercing injuries (10.6%) and burns (8.3%). Almajirai and workers without experiences of secular education were more likely to report having experienced injury. 54% of respondents reported not pursuing medical treatment for wounds, and instead pursue alternative means of management. Such means included the use of procaine powder, ash, sand, salt, grass fluid, hydraulic, kerosene, battery acid, and herbal medicines. These authors recommend that waste-pickers receive “medical check-ups and immunization against tetanus and other ... infections”, that the middlemen to whom they sell recovered materials provide waste-pickers with PPE, that local governments take measures to protect waste-pickers by separating hazardous waste from other types of waste, and that waste-pickers “form a union in order to protect their labor rights”.⁷⁰

Mental Health

In a 2017 study set in Zaria city, Kaduna State, Abubakar-Abdullateef et al. (2017) use the Schedule for Affective Disorders and Schizophrenia for School aged Children-Present and Lifetime Version (K-SADS-PL), a validated semi-structured diagnostic interview tool, to compare the prevalence of psychiatric disorders between almajirai and secular primary school children. Their sample consisted of 213 almajirai and 200 public school students, aged 5 to 19.

These authors use multivariate logistic regression to find significantly higher odds of depression (OR 2.93, CI 1.27 – 6.76), enuresis (OR 3.42, CI 1.59 – 7.36), substance use (OR 10.05, CI 1.20 – 84.06), post-traumatic stress disorder (OR 6.20, CI 1.90 – 20.19), and any psychiatric diagnosis (OR 3.11, CI 1.79 – 5.41) among almajirai than among students at secular schools ($p < 0.05$). The odds of general anxiety disorder were significantly higher for almajirai in a univariate model, but were not significantly different from the odds observed for secular school students in the full multivariate model (OR 2.16 vs. 1.92, CI 1.15 – 4.05 vs. 0.79 – 4.70). Almajirai also had significantly lower odds than secular school students to have separation anxiety in the multivariate model (OR 0.14, CI 0.03 – 0.64; $p < 0.05$). Among almajirai, significant associations were found between psychiatric diagnoses and poor maternal education, personal experience of malnutrition, serious injury, fighting, bullying within the last month and visiting home less than 3 times per year. Of note, the mean age among almajirai was significantly higher than the mean age for secular school students (13.1 vs 10.9; $p < 0.05$). Authors here recommend “efforts towards improving [almajirai’s] socio-economic status and providing them with formal education”, government action to “promote physical and mental health, including general health education, screening, early detection and management of pupils at risk of developing psychiatric disorders”, and the abolition of migration as a feature of almajiranci, which the authors argue diminish “the protective family unit and parent-child interaction”, making almajirai more vulnerable.⁴⁶

Discussion

This review highlights several notable features of the literature around almajiri health. One particularly striking finding is the limited geographic area represented in this literature. No study was conducted in Niger, and Northern Nigerian representation was limited to just 6 of that region’s 19 states. Additionally, just two Northern Nigerian states, Kano and Kaduna, made up

over half of all studies identified in this review. All this comes despite almajiranci being a region-wide phenomenon, in practice throughout Hausaland in Nigeria and Niger, and one where almajirai's intraregional migration remains a key feature. We see some of the true range of this system in that one study's sample of almajirai included ten who reported their citizenship as Nigerien. While this type of inclusion is encouraging, much more study is needed that includes almajirai throughout their true geographic scope, to more fully represent their experiences in the different spaces in which they live, work and learn.

Another finding of note here is the wide range of represented ages. Almajirai included in these studies ranged from as young as 3 to as old as 28 years, representing individuals in both very early childhood and established adulthood. This large difference in age may further reflect profound differences in experience, perspective and priorities requiring intentional analysis to avoid going unseen. Some studies with samples with particularly large age differences did evaluate outcomes by age, finding, for example, higher prevalence of dermatophytosis among almajirai in their early teenage years than in other age groups, and greater burdens of intestinal parasitosis among younger almajirai than among their older peers. These findings suggest that future studies around almajiri health may benefit from making more explicit the reasons that inform the ages of almajirai they choose to recruit, as well as disaggregating outcome measures by age.

We find that infectious disease studies and studies using cross-sectional designs made up particularly large portions of the literature around almajiri health. The number of cross-sectional designs seen here may reflect the relative inexpensive of such research designs, as well as the value these add to the nascent literature around almajiri health in providing evidence for specific health problems in this population.⁸¹ The preponderance of infectious disease among these studies may reflect broader trends in the global health literature, where communicable

disease has historically been a major area of research and health investment, as well as the heightened exposure to communicable diseases and their vectors that many believe exist among almajirai. We see this belief reflected in the studies identified here, with authors arguing that almajirai's "overcrowded living conditions ... easily allow the dissemination of microorganisms" and that the "poor hygienic practice and sanitary environment" in which almajirai live predispose them to contracting and transmitting infectious disease.^{73,75}

Despite the pervasiveness of such beliefs, just three studies compare infectious disease among almajirai to control samples, finding higher rates of cholera and urinary schistosomiasis, as well as lower levels of rabies awareness among almajirai. Beyond infectious disease, two studies use control samples to find higher rates of psychiatric disorders and poorer oral hygiene in almajirai than in controls. While some other studies that do not include control samples in their designs compare their findings for almajirai to those seen for other child populations in similar contexts, the lack of means to assess the direct comparability of these groups to almajirai limit the utility of these comparisons.

Additionally, though studies that make use of control groups provide valuable insights into health disparities for almajirai, we find considerable variety in the types of groups these studies select as controls. Of four cross-sectional studies with control groups, we find two using either public or private school students as controls, and two that did not specify the types of schools from which their control samples were obtained. While mean ages for almajirai and control groups were significantly different just one of these studies, the previously discussed differences between private and public schools in Northern Nigeria, where private schools' fees have excluded poorer children, may be cause for some concern about the comparability of these studies' findings. Comparisons to well-resourced students in private schools may exaggerate the true size of disparities between almajirai and general populations in the places

they live, while comparisons to students in public schools, who may also experience socioeconomic deprivation, may impede study of best-case outcomes for health among almajirai. Future research around almajiri health may find benefit in making reasoning around control group selection more explicit, to allow better assessment of how research findings reflect reality.

Another finding of interest is that just two outcomes — oral hygiene and intestinal parasitosis — were evaluated in more than one study. Findings for these outcomes were largely consistent between studies, with the prevalence of intestinal parasitosis estimated at around 80% in two studies, and similar trends in almajirai's oral hygiene behaviors, knowledge and outcomes seen in another two studies. This agreement is encouraging, and suggests that the findings of research around almajiri health may accurately reflect real conditions, though more study is needed that demonstrates this kind of congruence in other areas of concern.

We further note a dearth of research considering interventions to improve health among almajirai, and a complete absence of almajiri participation in helping to guide goals, strategies and interpretation in the study of their health, with almajiri participation in all studies limited to their provision of consent. Just one study identified in this review concerned a health intervention, providing almajirai in Yola city daily hot meals and connection to educational and vocational opportunities. While this study provides evidence that this intervention has helped improve educational attainment among almajirai, health and nutritional outcomes associated with this intervention have not yet been reported. This study, too, though referencing strategies to gain support for the program from almajirai and members of their communities, makes no mention of any input from these partners on the intervention's design, and does not state explicitly what strategies have been used to develop these partnerships.

While the lack of study around interventions to improve almajiri health may reflect the fledgling state of this literature, the lack of participatory approaches to this research is somewhat more concerning. As previously mentioned, participatory approaches hold great promise for delivering sustainable solutions to community health problems, and, outside of health research, participatory work with almajirai has demonstrated this group's enthusiasm and capacity for meaningful contribution to the discourse around their experiences.^{49,50} Additionally, 11 of the 17 studies included here, while not using participatory approaches themselves, stress the need for future work directly engaging almajirai to improve their health. Participatory approaches may be of particular importance in Hausaland, where distrust of modern medical practice remains widespread, and where partnership between health researchers and local communities may help navigate this distrust. That many almajirai are not just young children but adolescents and even young adults strengthens prospects for participation, as these older students may be more able to place their experiences in context by virtue of their greater maturity. This should, however, certainly not exclude younger almajirai from participatory roles, as input from almajirai at all ages enriches research, allowing insights into their perspectives and aspirations across these ages, as well the factors that influence how these may change over time.

We suggest that future research around almajiri health may find value in the adoption of participatory approaches. Participatory work may, for example, be used to develop interventions for known health disparities that almajirai face, such as in infectious disease, oral health and mental health, evaluate potential disparity for conditions highly prevalent among almajirai, such as intestinal parasitosis, or pursue new areas of health research of particular concern to almajirai and their communities, altogether strengthening this field of research. These approaches, beyond holding the promise outlined above, may help inform and strengthen the literature as research moves from data-gathering work to interventions meant to

improve almajiri health, ensuring that these interventions benefit from the insight of the communities they intend to support. Participatory approaches would also help build partnerships between almajirai and the research enterprise, creating opportunities for longitudinal relationships between researchers and almajirai, and more intuitive transitions between data-gathering and intervention-deployment phases of research. Work is needed that outlines effective strategies to develop these types of partnerships with almajirai, their mallamai, and their communities more broadly, and that highlights potential areas of conflict that may arise in these relationships. All of these may help develop a common set of ethical standards for research around almajiri health that strengthens this research while protecting and advancing almajirai's interests in society.

Limitations

The major limitation of this work is a lack of representation of studies in the grey literature. A considerable amount of research in Low- and Medium-Income Countries, such as most of the countries on the African continent, faces barriers to publication in the peer reviewed literature, with limited access in many of these contexts to the resources, financial and otherwise, required to disseminate research findings in this literature, and so may be limited to publication as theses and other formats in the grey literature.⁸² Though we initially intended to include Google Scholar among our literature databases to include sources from the grey literature, a lack of search syntax options to narrow down search results, and general concerns regarding search reproducibility prevented our use of this database. Future study around the almajiri health literature may benefit from recruiting research personnel to systematically work through and include sources from this database, to better represent potential studies in the grey literature.

Conclusion

Our scoping review, the first review of any kind around almajiri health, identifies several key findings in this area of research. We find that this research has concerned a wide range of domains, including infectious disease, workplace injury, nutrition, general health status, health determinants, oral health and mental health, though the number of articles concerned with specific phenomena within each domain remains limited. We further note limitations in the geographic scope of the current literature around almajiri health, in the study of interventions meant to improve almajiri health, and in consideration of demographic features, such as age, that may influence almajirai's experiences and health. We stress the need for further study in all these areas, and for participatory approaches to this study, which, by involving almajirai in the research process, can help develop trust between almajirai and the research enterprise, build interventions tailored to their priorities and preferences, and may be more likely to sustainably and successfully improve almajiri health and wellbeing.

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