



### Community Characteristics as Determinants of its Population's Health: Outcomes of a Community Diagnosis in Northwestern Nigeria

*Caractéristiques de la Communauté en Tant que Déterminants de la Santé de sa Population:  
Résultats d'un Diagnostic Communautaire dans le Nord-Ouest du Nigéria*

H. O. Isah\*, S. Thliza, T. Achema

#### ABSTRACT

**OBJECTIVE:** A critical appraisal of a community's profile is a pre-requisite for providing appropriate intervention that addresses prevailing innate health problems and thereby improving its people's health. This survey sought to determine a community's health profile with a view to proffering remedial measures for enhancing its population health.

**METHODOLOGY:** A community diagnosis was carried out in the rural Kaura Local Government Area of Kaduna State, Northwestern Nigeria, through a household-level survey and key informant interview to determine innate health problems and determinant factors.

**RESULTS:** The survey revealed a young population with a female segment of 51.02%, dependency ratio of 3:2 and a fertility rate of 11.6%. Literacy and unemployment rates were 69.9% and 51.1% respectively. Household accessibility to potable water was 85.5% while 97.8% had safe faecal disposal system with open dumping at 57.9% as the commonest refuse disposal method. Low personal income, sub-optimal integration of health provision outlets, low community involvement, unkempt environment and poor drainage system were also identified.

**CONCLUSION:** The survey revealed a community with young population, relative high dependency ratio and high female to male ratio, high fertility, and significant proportion of vulnerable population. Identified environmental concerns include open refuse dumping close to and encroaching vegetation to homesteads, and poor drainage system with potential for communicable disease transmission. Targeted skills acquisition and empowerment programmes, sexual and reproductive health service strengthening, establishment of community social support schemes, inclusion of health education in school curricula, environmental and sanitation management, and health system integration are recommended. **BJM 2020; 2(1): 8–13.**

**Keywords:** Community Diagnosis, Kaura Local Government Area, Community's Health Profile, Northwestern Nigeria.

#### ABSTRAIT

**OBJECTIF:** Une évaluation critique du profil d'une communauté est une condition préalable pour fournir une intervention appropriée qui aborde les problèmes de santé innés courants et améliore ainsi la santé de sa population. Cette enquête visait à déterminer le profil de santé d'une communauté en vue d'offrir des mesures correctives pour améliorer la santé de sa population.

**METHODOLOGIE:** Un diagnostic communautaire a été réalisé dans la zone de gouvernement local de Kaura, dans l'État de Kaduna, au nord-ouest du Nigéria, à travers une enquête au niveau des ménages et un entretien avec des informateurs clés pour déterminer les problèmes de santé innés et les facteurs déterminants.

**RESULTATS:** L'enquête a révélé une population jeune avec un segment féminin de 51,02%, un taux de dépendance de 3:2 et un taux de fécondité de 11,6%. Les taux d'alphabétisation et de chômage étaient respectivement de 69,9% et 51,1%. L'accessibilité des ménages à l'eau potable était de 85,5% tandis que 97,8% avaient un système d'élimination des matières fécales sûr avec un déversement à ciel ouvert à 57,9% comme méthode d'élimination des déchets la plus courante. Un faible revenu personnel, une intégration sous-optimale des points de vente de soins de santé, une faible participation de la communauté, un environnement négligé et un système de drainage médiocre ont également été identifiés.

**CONCLUSION:** L'enquête a révélé une communauté avec une population jeune, un rapport de dépendance relativement élevé et un rapport femmes / hommes élevé, une fécondité élevée et une proportion significative de population vulnérable. Les préoccupations environnementales identifiées comprennent le déversement de déchets à ciel ouvert à proximité de la végétation et l'empiétant sur les fermes, et un mauvais système de drainage avec un potentiel de transmission de maladies transmissibles.

Des programmes ciblés d'acquisition de compétences et d'autonomisation, le renforcement des services de santé sexuelle et reproductive, la mise en place de programmes de soutien social communautaire, l'inclusion de l'éducation sanitaire dans les programmes scolaires, la gestion de l'environnement et de l'assainissement et l'intégration du système de santé sont recommandés. **BJM 2020; 2(1): 8–13.**

**Mots clés:** diagnostic communautaire, région du gouvernement local de Kaura, profil de santé de la communauté, nord-ouest du Nigéria.

## INTRODUCTION

Community diagnosis (CD) is a veritable means of determining a community's health profile and health determinant factors, the outcomes of which pave the ways for improved population's health.<sup>1,2</sup> It involves critical appraisal of a community's characteristics for the purpose of identifying innate factors that determine population health and its profile. In addition to determining innate community factors that affect its population's health, community diagnosis enables the identification of resources available within it that will assist in addressing observed health challenges.

Providing the foundation for improving and promoting the health of community members, community diagnosis involves the conduct of a socio-demographic, economic and health survey, assessment and determination of health problems of the community culminating into a set of community health actions, the purpose for which this survey was carried out.<sup>1</sup>

## SUBJECTS, MATERIALS, AND METHODS

This exercise was carried out in Kaura Local Government Area, one of the 23 Local Government Areas in Kaduna State, in Northwestern Nigeria. It has an estimated area, population and population density of 485km<sup>2</sup>, 222,579 and 485.0/km<sup>2</sup> respectively.<sup>3</sup> It is linked by roads to Jema'a LGA to the South, Zango Kataf LGA to the North and West, Kauru LGA to the North-East all in Kaduna State, and Riyom LGA in Plateau State to the East, and has a rail line traversing and connecting it to north and south of Nigeria. Despite its rural nature, the LGA plays host to other Nigerian ethnic groups. It is a predominantly agricultural setting producing varieties of grains, fruits and vegetables, and is endowed with varying forms of local commercial and traditional industries among which are the famous Attakar pottery industry, mats, basket weaving, leather works, wood and calabash carving. It is home to various educational institutions including the renowned ECWA College of Health Technology and Seminary School, and health institutions which

include the ECWA Comprehensive Health Centre, a Rural Hospital and various PHC facilities, private hospitals and clinics. It is a tourist delight with its attractive Kagoro and Attakar hills which provide sources of natural streams and refreshing beautiful springs, the scout camp in Agban Kagoro, Water Board intake Kagoro and KAJIM Water intake in Manchok.

Of the 5808 houses in Kauru LGA, a value of 1452 (25%) was taken as the minimum sample size and rounded up to 1,500 to allow for a robust sample size. Through a multistage selection process, the 1500 houses were proportionately allocated to 1 randomly selected settlement clusters with each house as enumeration unit using the Local Government Immunization map and details. The house in the centre of each settlement cluster was identified and used as starting enumeration point as each settlement had no defined orderliness in outlay. From there the direction of movement of enumerator was determined using a spinned bottle (an adaptation of the EPI method for selecting the starting point.<sup>4</sup> Where the bottle points to when it stopped spinning was taken as the direction for the household enumeration. This was followed till the end of that settlement cluster after which the enumerator would turn right and continue the exercise until the allotted number of houses for that settlement was attained. Where a house was found to have been surveyed, based on marking on the wall, it was skipped to avoid re-enumeration.

The survey was through a house-level interviewer-administered structured questionnaire and key informant interview. The questionnaire served to collect information on household-level socio-demographic characteristics, environment and sanitation, social amenities and services, perception on health and health service utilization, and observation of homesteads. Key informant interview with question guides that dwelt on community's common health problems, health seeking behavior and common challenges in health provision and uptake within the community, was administered to facility managers of ECWA CHC (a faith-based/private) and PHC Fada Kagoro (public), a leading

trado-medical practitioner, a leading traditional birth attendant, and a foremost patent medicine vendor. Responses were summarized to illustrate key health and service issues.

Community-level permission and consent for the survey were obtained from both the traditional community leaders and local government office following detailed explanation of survey. At each house level, explanation was further provided, and consent of head of house additionally obtained. Though each house was marked and assigned codes to avoid double enumeration and for ease of return for further information should there be any need, actual identification of household members was avoided thereby ensuring privacy and confidentiality of collected information. All data were secured within protective custody of the lead researcher thereby further ensuring privacy and confidentiality.

Each questionnaire was checked for completeness before leaving the field daily and data immediately entered into SPSS version 22 database for end-of-enumeration analysis. Frequency tables with proportions in percentage forms were generated and used to illustrate outcomes. Mean age, dependency ratio, proportions of male and female populations, crude birth, crude death, fertility and under-5 mortality rates as well as socio-economic and demographic attributes were determined to illustrate community demographic profiles.

## RESULTS

The survey revealed a young population with 51.1% of the population of the community below 25 years of age, a mean age of  $27.7 \pm 20.1$  years, more females (51.1%) than males (48.9%) and dependency ratio of 1.07 (Fig. 1).

Crude birth rate, crude death rate, fertility rate and under-five mortality rate were found to be 3.0%, 2.4%, 11.6% and 12.7% respectively. The socio-demographic characteristics (Table 1) reveal a predominantly Christian community (94.1% v Moslems 5.9%). A large population segment, have never been married (58.4%), while those married, widowed and separated/divorced constituted 34.8%. 6.3% and 0.6%

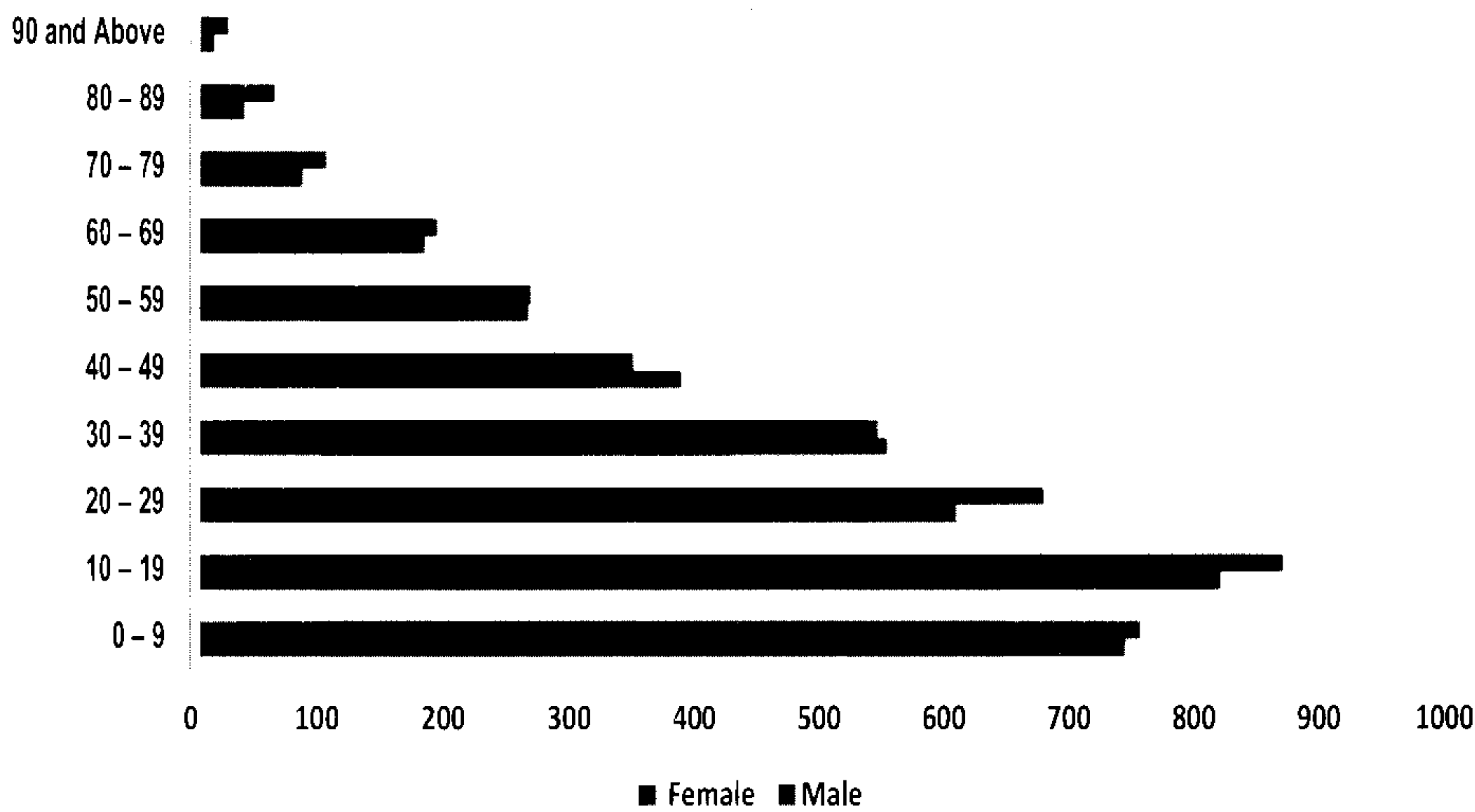


Fig. 1: Population Structure of Study Site

Table 1: Population Characteristics and Attributes

	N (%)
<b>Religion</b>	
Christianity	7014 (94.1)
Islam	440 (5.9)
<b>Total</b>	<b>7454 (100)</b>
<b>Marital Status</b>	
Single	4351 (58.4)
Married	2591 (34.8)
Widowed	466 (6.3)
Divorced/Separated	46 (0.6)
<b>Total</b>	<b>7454 (100)</b>
<b>Education</b>	
None	2244 (30.1)
Literacy (Primary, Secondary & Tertiary)	5210 (69.9)
<b>Total</b>	<b>7454 (100)</b>
<b>Occupation</b>	
None	3807 (51.1)
Farming	1187 (15.9)
Self-Employed income (trading, artisanship)	1074 (14.4)
Employee (public & private sectors)	965 (13.0)
Others (retirees etc)	421 (5.7)
<b>Total</b>	<b>7454 (100)</b>

respectively. Proportions with formal education and those unemployed were respectively 69.9% and 51.1%, and 15.9% were into farming, while 14.4% and 13.0% were either self-employed or paid employees, with a proportion of 5.7% as retirees.

On community sanitation (Table 2), accessibility of household members to water for domestic use was 85.5% through in-house supplied pipe-borne water, boreholes and nearby public tap

water supply, while wells and stream-pond/river provided water to 12.0% and 2.5% of the houses respectively. Fecal disposal methods for respective houses were water closet system (53.9%), VIP and pit latrines (43.9%) and open space (2.2%). Refuse disposal methods found were open dumping (57.9%), burning (31.4%) and burying/composting (10.7%).

On housing (Table 3), 63.5% were built with durable concrete blocks and roofed with zinc while those with mud

but roofed with zinc constituted 35.8%.; while 0.7% were of mud and thatched roofs. Overcrowding was found comparatively minimal as 57.4% of houses had between 1- 2 members sleeping in a room, while 23.8% and 11.6% had 3 and 4 persons per room respectively. However, 7.2% had upward of 5 per room.

Several forms of social amenities and services were found available to households (Table 4). Approximately 96.5% of houses had electricity supply, either through the national grid or personal generating sets. Mobile communication gadgets, televisions and radios were present in 88.4%, 77.3% and 67.7% of houses respectively, while 39.3% had refrigeration system for home use. Household-owned means of transportation included motor cycles, motor cars and bicycles 29.3%, 20.1% and 6.4% respectively. While the health facilities remain the main sources of health care for households (84.2%), other identified outlets for health service utilization were patent medicine vendors (12.0%), faith homes (2.6%) and tradition medicine service (1.2%).

Varieties of common health problems were identified (Table 5). Among adult house members, these were enteric fever (51.5%), malaria (50.8%), peptic ulcer disease (29.3%) and high blood (23.4%). There were a variety of others (34.6%) consisting of musculo-skeletal disorders, probably from ageing and physically stressful vocations engaged in. Hepatitis (7.7%) and non-communicable disorders such as "sugar disease" or diabetes mellitus (6.5%) and visual defects (4.1%) were other health problems among the adult population. Among the children, these were malaria (56.8%), enteric fever (34.0%) and respiratory infections (20.6%), with fever, diarrheal disorders and miscellaneous others (epilepsy, cerebral palsy, birth-related disorders etc.) constituting 15.3%, 6.1% and 10.1% respectively.

Key Informant Interview provided deeper insight into the community's health and related issues, as well as reiterating community's use of health facilities as the dominant sources, with recognition of other community-based health service delivery outlets such as patent medicine shops and other

**Table 2: Household's Domestic Water Supply and Waste Management**

Predominant & Common Sources of Domestic Water Use	Portable water (in-house pipe water, public water tap, borehole and rain water)	1282 (85.5)
	Household well	180 (12.0)
	Stream/Pond/River	38 (2.5)
	<b>Total</b>	<b>1500 (100)</b>
Sewage Disposal Methods	Water System Toilet	808 (53.9)
	Latrine (VIP & Pit)	659 (43.9)
	Bush/Open Space	33 (2.2)
	<b>Total</b>	<b>1500 (100)</b>
Refuse Disposal Methods	Burning	471 (31.4)
	Burying/Composting	161 (10.7)
	Open Dumping	868 (57.9)
	<b>Total</b>	<b>1500 (100)</b>

**Table 3: Household's Housing Type and Habitation**

Type of House		
House built with cement blocks		952 (63.5)
House built with mud but with zinc roofing		537 (35.8)
House built with mud but with thatched roofing		11 (0.7)
<b>Total</b>		<b>1500 (100)</b>
No. of Persons/Room		
1-2		861 (57.4)
3		357 (23.8)
4		174 (11.6)
>4		108 (7.2)
<b>Total</b>		<b>1500 (100)</b>

**Table 4: Household's Accessibility to Social Amenities**

Power Supply	Access to electricity	1448 (96.5)
Communication means	Mobile phone	1326 (88.4)
Information media	Television	1160 (77.3)
	Radio	1016 (67.7)
Refrigeration system	Refrigerator	590 (39.3)
Personal transportation system	Motor car	302 (20.1)
	Motor cycle	440 (29.3)
	Bicycle	96 (6.4)
Sources of Health Care	Health facilities	1263 (84.2)
	Patent medicine vendor	180 (12.0)
	Traditional medicine (bone setters and TBAs)	18 (1.2)
	Faith homes	39 (2.6)

traditional medicine practitioners. It re-emphasized prevailing health challenges (Table 6), significant community social problems which are teenage pregnancy, substance abuse, unemployment and limited personal finances.

#### DISCUSSION

The survey provided an insight into the health, socio-economic and development profile of Kaura LGA within the context of its innate and environmental characteristics. It revealed a

community with characteristically young population with high fertility and relative high dependency ratio with consequent non-economically productive population segment as economic burden for the community. The relative higher female to male ratio, inconsistent with the country's national figure, portends high fertility potential.<sup>5</sup> Worthy of note is the large proportion of those never married and particularly in their youthful age, a fuel for teenage pregnancy, substance abuse and adolescent health concern. Such a population is also vulnerable to poor and inappropriate health-seeking behavior from poor capacity to finance health care as a result of their characteristic lack of livelihood and inadequate perception of health risk.<sup>6</sup> The widowed, divorced and separated fall into the pool of at-risk from neglect, poverty, poor lifestyle, sub-optimal nutrition, poor hygiene and personal health, except those with some forms of social support (from family and society). The married which make up the second largest group (about one-third) are at an advantage of less risky lifestyles from mutual spousal support.

The dominance of one religious system within the community is a potential advantage for effective community mobilization which if properly harnessed, will provide an easy avenue for securing community participation and social resources, mobilization for health programs, and promoting healthy behaviors, attitudes and beliefs, health and well-being of the people. That about 70% of the population had formal education as obtained in the survey portends good omen for good health through easy adoption of health-promoting behavior and less risky behaviors inimical to their health. Their education attainment affords them the opportunity to easy acquisition of information about health and health risks, health education and access to messages on health-promoting lifestyle and management or prevention of diseases.<sup>7</sup> Education further provides an added advantage with respect to employment and obtaining desirable jobs that offer appropriate remuneration, job satisfaction and health-related benefits such as meeting health costs and obtaining health insurance coverage. In addition, it is

**Table 5: Household's Commonly Experienced Health Problems According to Age Group**

Childhood	Malaria	56.8
	Fever	15.3
	Respiratory Infections	20.6
	Diarrhea	6.1
	Enteric Fever	34.0
	Abdominal Discomfort	5.4
	Headache	3.9
	Skin Rashes	4.2
	Miscellaneous Disorders	10.1
Adulthood	High Blood Pressure	23.4
	DM	6.5
	Malaria	50.8
	Enteric Fever	51.5
	Peptic Ulcer Disease	29.3
	Hepatitis	7.7
	Visual Defects	4.1
	Miscellaneous Disorders	34.6

associated with access and opportunity to social networks that provide financial, psycho-social and emotional support.<sup>7</sup>

Financial profile potentially impacts on one's health profile positively as proven relationship exists between economy and health status of individuals and population. The wealthier and better educated people have better health when compared with the unemployment and those within the lower socioeconomic status whose low economic profile is incontrovertibly associated with increased rate of morbidity and mortality. Thus the high prevalence of unemployment (51.1%) as obtained in this survey potentially negates the health profile of a large population group. Worsened is even the low proportion engaged in farming (15.9%), at variance with what is known of rural settings in Nigeria<sup>5</sup> and the accompanying low proportions in low-income subsistent artisanship and trading (14.1%), employment (13.0%) and 5.7% in retirement status, indicate community low economic status. This comparative widespread poor financial profile of the community members potentially negates ability of many to meet cost of health care and other related determinants of human development and thereby nullifies any perceived gain from acquired education.

Through various sources, many of the houses (85.5%) in the community

were found to have access to adequate, potable and safe water for domestic purposes. This is more than the WHO recommendation and finding from the country's 2013 National Demographic and Health Survey, NDHS,<sup>5,8</sup> and has potential in minimizing diseases from water shortage and contamination notably diarrheal disease, enteric fever and cholera. It also enhances the community's socio-economic development as women and young girls are spared from sourcing for water from distant places and can thus focus on more productive economic ventures.<sup>9</sup> The community's sanitation status is further enhanced by the 97.8% of houses with safe fecal disposal mechanisms which include water closet (53.9%) and latrines, VIP and latrine (43.9%). However, the 2.2% of the houses whose members still defecate in the open pose health risk to the community from environmental pollution and health hazards such feco-oral and vector-transmitted such as diarrhea, hepatitis and enteric fever.<sup>10</sup> Open refuse dumping observed in surveyed setting and close to residential setting was found as the commonest method of refuse disposal (57.9%). This is potentially associated with attendant health risk from food and water contamination, breeding sites for vectors of common infections and sources of injuries. Refuse burning by 31.4% of

houses, though an appropriate method, poses such hazards as fire outbreak and air pollution from noxious gases and wind-borne ashes with potential respiratory implications.<sup>11</sup> The more satisfactory burying and composting find place among comparatively fewer houses.

Interestingly most houses, unlike what obtains in most rural settings in Nigeria, were found built with materials that are durable and with low risk to health thereby reducing characteristic health problems often found associated with poor housing. Overcrowding was found minimal as many of the households were characterized by adherence to between 1–2 persons per living room in line with international recommendation. This further reduces incidence of communicable diseases such as respiratory infections, scabies, meningitis, tuberculosis, typhus and louse infestation, and non-communicable disorders such as mental and social disorders commonly encountered in crowded homes, thereby reducing general morbidity and mortality often related to overcrowding and ensuring healthier living profile. Such housing enhances child health and reduces overcrowding-related problems such as poor school performance and school drop outs, delinquency, drug abuse, crimes and other antisocial behavior.<sup>12</sup>

Social amenities such as electricity, means of communication (telephones), information media, refrigeration system, and personal means of transportation, educational institutions and sources health care were found accessible and available to most households. The satisfactory presence of these amenities, often at minimal availability in most rural communities in Nigeria, guarantees improved quality of communal life thereby enhancing health and socio-development profiles. Their presence in houses ensures members' easy and timely access to health services and health information, and promotes better living, economic attainment and quality of life.

Prevailing environmental attributes were observed to influence prevailing health problems in surveyed setting typical of rural settings.<sup>11</sup> Examples of common health issues related to

observed environmental profile include malaria from unsatisfactory drainage system and poor management of encroaching vegetation to homesteads, and gastrointestinal infections from poor refuse management from some insanitary fecal disposal. Characteristic of communities with inadequate environmental management, malaria peaked as the commonly encountered diseases.<sup>13,14</sup> Unsanitary waste disposal systems often associated with vector breeding was observed in most homesteads, and this is associated with prevalence of infections indicated as household common health problems. Socio-demographic characteristics which include ageing, high alcohol intake, stress-related lifestyles from economic activities, and cigarette smoking observed therein are potential factors for non-communicable disorders such as high blood pressure, peptic ulcer diseases, musculoskeletal disorders, visual defects, and diabetes and liver disorders found from the survey.

The survey revealed a mix of outcomes, some of which entail sustenance and others remediation for sustainable health and socio-economic development of Kaura LGA. Recommendations include targeted empowerment programs, education (especially female education), sexual and reproductive health service strengthening (especially as related to child spacing), support for economic productivity (with emphasis on enhanced agricultural practices and storage), social service schemes e.g. community health insurance scheme to enhance universal health coverage and access to health care, support system for vulnerable population (example those unmarried) and factoring health education in school curricula. Sanitation services e.g. fecal disposal and promotion of preventive environmental health measures, consideration for skills acquisition and income generation programs, health system strengthening and inter-sectoral

collaboration (identifying potential health services providers and establishing linkage system for wider and holistic health service provision) and review of physical planning and ensuring adherence to environmental management that promotes environmental health, notable drainage system and green management will add to improving the health of community members. Other areas worth giving attention to enhance population health include promotion of personal health screening of individuals from age 40 years for hypertension and diabetes and promoting waste management among community members. Use of the religious system that is common to members of the community as platform for health promotion, and giving consideration to youth development programs that focus on adolescent and reproductive health, education and empowerment program are other areas for attention.

Implementation of afore-mentioned recommendations will require concerted efforts and collaborations of various sectors to achieve the sustainability of well-being of the people of Kaura Local Government Area.

#### REFERENCES

1. Salama R. Community Diagnosis. Available from: [www.pitt.edu/~super7/32011-33001/32491.ppt](http://www.pitt.edu/~super7/32011-33001/32491.ppt)
2. Centre for Health Protection. Basic principles of health cities: community diagnosis. Updated in April 2009. Available from: [https://www.chp.gov.hk/files/pdf/hcp\\_community\\_diagnosis\\_en.pdf](https://www.chp.gov.hk/files/pdf/hcp_community_diagnosis_en.pdf)
3. Kaduna State Government. Draft of Kaura Local Government Development Plan (LGDP), 2018-2020. 2018. Available from: <https://www.pbc.kadgov.ng/pdf>
4. Mazziotta M. Non-probability Sampling: a Variant of Random Walk Method. Sampling-Master HDFS. [http://www.masterhdfs.org/masterHDFS/wp-content/uploads/2014/05/Mazziotta\\_Random\\_walk\\_method\\_2016.pdf](http://www.masterhdfs.org/masterHDFS/wp-content/uploads/2014/05/Mazziotta_Random_walk_method_2016.pdf)

5. National Population Commission - NPC/Nigeria and ICF International. 2014. Nigeria Demographic and Health Survey 2013. Abuja, Nigeria: NPC/Nigeria and ICF International.
6. Robards J, Evandrou M, Falkingham J, Vlachantoni A. Marital status, health and mortality. *Maturitas*. 2012; **73**: 295–9.
7. Zimmerman E and Woolf SH. Understanding the relationship between education and health. 2014. Discussion Paper, Institute of Medicine, Washington, DC. Available from: <http://nam.edu/wp-content/uploads/2015/06/understandingtherelationship>
8. WHO/UNICEF. Progress on sanitation and drinking-water: Joint Monitoring Programme 2010 update. 2010. [https://www.who.int/water\\_sanitation\\_health/publications/9789241563956/en/](https://www.who.int/water_sanitation_health/publications/9789241563956/en/)
9. Lori L. Rural and urban water issues in Africa. 2018. Available from: <https://thewaterproject.org/pdf/rural-and-urban-water-issues-africa.pdf>
10. Ismaila RA. Access to sanitation facilities among Nigerian households: determinants and sustainability implications. *Sustainability*. 2017. **9**(4): doi:10.3390/su9040547. Available from: <https://www.mdpi.com/2071-1050/9/4/547/htm>
11. Lucas AO, Gilles HM. Short Textbook of Public Health Medicine for the Tropics (3<sup>rd</sup>). London. Hodder Arnold 1990: 289-301
12. Parks K. Park's Textbook of Preventive and Social Medicine, (18<sup>th</sup>). 1167, Prem Nagar, Jabalpur, 482 001 (India). M/s Banarsidas Bhanot. 2005: 558–561
13. Kimbi HK, Nana Y, Sumbele IN, Anchang-Kimbi JK, Lum E, Tonga C, *et al*. Environmental factors and preventive methods against malaria parasite prevalence in rural Bomaka and urban Molyko, Southwest Cameroon. 2013. *J Bacteriol Parasitol* **4**:162. doi:10.4172/2155-9597.100016.(16) (pdf) Available from: <https://www.researchgate.net/publication/236049916>
14. Hamel MJ, Odhacha A, Roberts JM, Deming MS. Malaria control in Bungoma District, Kenya: a survey of home treatment of children with fever, bednet use and attendance at antenatal clinics. 2001. *Bulletin of the World Health Organisation*. **79**: 1014–23.