Poverty Reduction through Diseases Eradication: A Look at Botanical Medicine in Nigeria (An Application of Apriori Algorithm)

[1]Yemi-Peters, Victoria I., [2]Okon, Emmanuel O., [3]Joshua B. Agbogun

[1]Department of Mathematical Sciences, Kogi State University, Anyigba, Kogi State, Nigeria
[2]Department of Economics, Kogi State University, Anyigba, Kogi State, Nigeria
[3]Department of Mathematical Sciences, Kogi State University, Anyigba, Kogi State

Abstract: **The utilization of plants and their resources for combating various ailments/diseases predates written history and they are still in use all. Recent scientific evidence has revealed that many plants considered to be medicinal are potentially toxic, mutagenic and carcinogenic. This study aimed at determining and implements the extraction of pairs of ailments/diseases that can be cured by a set of medicinal plants. The study was able to extract sets of ailments/diseases that frequently occur together, from a repository database. Using apriori Algorithm, it was possible to implement the extraction and as well link the diseases with the set of medicinal plants that can cure the diseases. Since the major mission of World Health Organization is to help save lives and improve health (health is linked to economic development and poverty reduction); hence it is in support of the promotion of traditional/complementary medicine which differs globally by location and country. Therefore the Nigerian government through the Ministry of Health should encourage and assist the traditional herbal healthcare professionals. This will also guide the standardization and control of the quality and quantity of indigenous drug production. On the other hand, massive awareness campaign should be carried to sensitize the people on the dangers of the indiscriminate use of botanical medicine.**

Keywords: **Poverty, Diseases, Medicinal Plants, Apriori Algorithm, Nigeria.**

1. INTRODUCTION

The World Bank forecasts that Global Monitoring Report (World Bank) 702.1 million people, was below the poverty line from 1.75 billion in 1990 (WorldBank, 2015). Although the estimate for 2012 remains the most reliable recent estimate, World Bank projections suggest that global poverty may have reached 700 million, or 9.6 percent of global population, in 2015 (WorldBank, 2015)".Of these, about 347.1 million people lived in Sub-Saharan Africa (35.2% of the population) and 231.3 million lived in South Asia (13.5% of the population). According to the World Bank, between 1990 and 2015, the percentage of the world's population living in extreme poverty fell from 37.1% to 9.6%, falling below 10% for the first time (WorldBank, 2015). Nevertheless, given the current economic model, built on GDP, it would take 100 years to bring the world's poorest up to the previous poverty line of $1.25 a day (Hickel, 2015). Extreme poverty is a global challenge; it is observed in all parts of the world, including developed economies (WorldBank, 2012a and 2012b).

UNICEF estimates half the world's children (or 1.1 billion) live in poverty (Madu, n.d). It has been argued by some academics that the neoliberal policies promoted by global financial institutions such as the IMF and the World Bank are actually exacerbating both inequality and poverty (Haymes et al, 2015). Another estimate places the true scale of poverty much higher than the World Bank, with an estimated 4.3 billion people (59 percent of the world's population) living with less than $5 a day and unable to meet basic needs adequately (Wikipedia, n.d.b). In 2012 it was estimated that, given a poverty line of $1.25 a day 1.2 billion people lived in poverty (Ravallion, 2013).

The part of the world that is mostly clearly affected by poverty is Africa. In fact, as the rest of the developing world has seen a steady decline in rates of poverty, the situation in sub-Saharan African is only getting worse. As the Global Policy Forum notes, The World Bank recently reported that Sub-Saharan African countries have the largest share of people living below one dollar a day. The tragedy is that while other countries in Asia and Latin America are slowly but surely pulling themselves out of the poverty club, African countries, are regressing into lower levels of deprivation, with the result that the number of poor people in this region is expected to rise from 315 million in 1999 to about 404 million in 2015 (Stephen, 2006).

Nigeria has one of the world's highest economic growth rates, averaging 7.4% according to the Nigeria economic report released in July 2014 by the World Bank (Wikipedia, n.d.a). Poverty still remains significant at 33.1% in Africa's biggest economy (Wikipedia, n.d.a). For a country with massive wealth and a huge population to support commerce, a well-developed economy, and plenty of natural resources such as oil, the level of poverty remains unacceptable.

When looking at the factors that can lead to poverty in a region, there are many things that could be highlighted. One can look at the government, at conflict, at the lack of natural resources, or at the shortage of quality education in a region. However, poverty in a region is not only caused by conflict or inadequate education, but also by diseases. Disease is the impairment of health, a condition of irregular functioning and conditions that affect the body of an organism(Olapade,2000). Increasing health in a region can significantly reduce global poverty (i.e., linking health to economic development and poverty reduction), in effective and unexpected ways (Whinery, 2013). People in developing countries face challenges due to diseases that those in developed nations do not. For instance, in a developing country, someone who gets sick may have to sell their possessions to pay for medicine. Parents, not expecting their children to survive, have more children and spend less on education.

With an Infant Mortality Rate at 86/1000, Nigeria is ranked lower than war-ravaged countries like Iraq and Congo D. R. (Hotcoco, 2012). The Infant Mortality rate can be used as an economic indicator, just as much as it tells how good the healthcare system is. Healthcare services in Nigeria have been and are still very poor. One of the limitations to the full achievement of a universal healthcare delivery system is the limited coverage of Nigerians under Social Health Insurance. The coverage is still below 5% (BusinessDay, 2017).

Traditional systems of medicines, including herbal medicines, have been used for many centuries for health care by people in countries of the South-East Asia Region as well as in other parts of the world. Since the concept of "Health for All" through primary health care (PHC) was launched at the International Conference on Primary Health Care at Alma-Ata in 1978, there has been a global movement to realize universal health-care coverage (WHO, 2010). However, in spite of advances made in the health sector, equitable health care coverage; availability, accessibility and affordability to conventional health care and services are quite often beyond the reach of people who are indigent, marginalized and underserved.

In Nigeria, primary health care services now exist only in name. The common man has reverted to the herbalist and traditional healers for care because of access and affordability issues. The elites have perfected medical tourism to India, Singapore, South Africa and even Ghana. This is in the face of a rapidly changing disease patterns in which infectious diseases have been replaced by behavioral, environmental and poverty-related diseases (Scott-Emuakpor, 2010). Against this background, this paper is aimed at determining and implementing the extraction of pairs of ailments/diseases that can be cured by a set of medicinal plants or herbs. Herbal medicines (HM) form an essential and major component of traditional medicines (TM). Herbal medicine, also known as herbalism or botanical medicine is a medical system based on the use of plants or plant extracts that may be eaten or applied to the skin (Weil, n.d.). Although Nigeria has a good green vegetation where a lot of medicinal plants grow, but the limited knowledge of the ethno botanical characteristics of plants has made people seek cure outside the country whereas solutions lies within.

2. POVERTY, DISEASES AND HEALTH SITUATION NIGERIA: STYLIZED FACTS

Nigeria is the most populous country in Africa with a population of over 162 million, according to the World Bank 2011 data (Uma et al., 2013). The country is blessed with abundance of both human and natural resources. Prior to the present civilian regime, the military that was in control for fifteen years (1984-1999) did not put meaningful developmental structures on ground and this gradually deteriorated the living standard. However, different policies, programmes and strategies were employed to reposition the economy from being one of the poorest countries of the world to one of the leading economies by the year 2020. Yet, on practical basis, the country lacks the requirements for decent living standard.

The Guardian newspaper of 2005 points that Nigeria is rated one of the world poorest countries (Uma et al., 2013). Available data show that the economy ranks between 130-154th position of the Global 172 economies in the world marginal index, and is among the 20 poorest countries in the world in spite of being the giant of Africa in terms of huge human and mineral resources and available (Uma et al., 2013). The country occupies the 7th position as the world's largest producer of crude oil (Uma et al., 2013).

Ogwumike (2002) points that the number of those in poverty rose from 27% in 1980 to 46% in 1985; it decreased slightly to 42% in 1992, and increased sharply to 67% in 1996. By 1999 the estimated poverty was more than 70%, which compelled the federal government to intensify action on poverty reduction. Consequently, efforts have been made in all angles to reduce the level of poverty in Nigeria but greed has retarded positive efforts. Budgetary allocations have been on the increase, nevertheless, with no remarkable improvement. The National Bureau of Statistics said 60.9% of Nigerians in 2010 were living in "absolute poverty" - this figure had risen from 54.7% in 2004 (BBC News, 2012). (See Figure 1 for absolute poverty measure 2010 showing states above and below national average).Vanguard (2016) reported that no fewer than 112million Nigerians now live below poverty level as global poor hits one billion mark. According to the latest poverty report by the National Bureau of Statistics, NBS, about 112 million Nigerians (representing 67.1 per cent) of the country's total population of 167million (Vanguard, 2016).

Figure 1: Map of Nigeria: Absolute Poverty Measure 2010 showing states above and below national average.

Source: NBS (2012)

According to the National Strategic Health Development plan 2009-2015, "...the health indicators in Nigeria have remained below country targets and internationally set benchmarks including the MDGs, which have recorded very slow progress over the years.

The health status indicators for Nigeria are among the worst in the world. Life expectancy at birth is 49 years while the disability adjusted life expectancy at birth is 38.3 years; vaccine-preventable diseases and infectious and parasitic diseases continue to exact their toll on the health and survival of Nigerians, remaining the leading causes of morbidity and mortality (Omoluabi, 2014), see Table 1 for disease outbreak and chemical disaster in Nigeria between 2009 and 2010.

Table 1: Disease outbreak and chemical disaster in Nigeria between 2009 and 2010

Diseases/Chemicals threats	Affected cases reported	Reported deaths	Region affected	Approximate period of event
Cholera	29115	1191	15 state (144 LGAs)	4th January to 3rd October, 2010
Polio outbreak due to the wild polio type-3	258	No data	Northern states	2009
Meningococcal disease	17462	960	Northern states	January to March, 2010
Mass lead poisoning	Several children	Mass children deaths(exact number not reported)	Mostly in Zamfara state	From at least March, 2010.

Source: WHO (n.d.).

Nigeria has an estimated population of 175 million inhabitants, which constitutes 2% of the world population; however, the country accounts for only 14% of global maternal deaths (WHO, 2012).The maternal mortality ratio of 840 maternal deaths per 100,000 live births in 2010 is unacceptably high (see Table 2 for some health indicators in 2015).

Table 2: Some Health Indicators for Nigeria in 2015

Total population (2015)	182,202,000
Gross national income per capita (PPP international $, 2013)	5
Life expectancy at birth m/f (years, 2015)	53/56
Probability of dying under five (per 1 000 live births, 0)	not available
Probability of dying between 15 and 60 years m/f (per 1 000 population, 2015)	368/318
Total expenditure on health per capita (Intl $, 2014)	217
Total expenditure on health as % of GDP (2014)	3.7

Source: WHO (2017)

Nigeria has the highest number of HIV infected persons in the African continent and the fourth highest TB burden in the world. Non-communicable diseases are increasingly becoming public health problems, especially among the affluent urban population. Currently, under five mortality rate is estimated at 128 for every 1,000 live births (Omoluabi, 2014), an improvement from 2008 according to the same report. According to the 2013 DHS report, only about 61% of women who recently had a live birth sought antenatal care from a skilled provider while 36% had their recent baby at a health facility.

Uptake of immunization for children in Nigeria is also low as only 25% of children are fully immunized at age one. This has not improved from the 23% reported in the 2008 NDHS and is still very low compared to neighbouring countries like Ghana where in 2008, 79% of children aged 12-23 months were fully immunized (Omoluabi, 2014).

Wide regional variations exist in health indicators across the zones. Infant and child mortality in the North West and North East zones of the country are in general twice the rate in the southern zones while the maternal mortality in the North West and North East is over 6 times the rate recorded in the South West Zone. There are also wide variations in these rates across regions, socio-economic strata and rural-urban residence. These indicators do not converge towards achieving the MDGs in Nigeria.

The magnitude of deaths and diseases from preventable causes have wrecked the social, economic, cultural, and religious life of the people in Africa countries (including Nigeria), which, in turn, affect their overall health and wellness (Obrist et al., 2007). Tuberculosis and leprosy are still public health issues in Nigeria with 460,000 and 5,000 cases, respectively,

reported yearly (Federal Ministry of Health, 2010). This further raises the question of what the current systems of healthcare do to address new issues that defy old current approaches (Chimezie, 2015).

3.   TRADITIONAL MEDICINE IN CONTEMPORARY NIGERIA

Traditional medicine is as old as the hills in Nigeria (Adesina, 2006). The development of traditional medicine in Nigeria has led to various categories of healers, the various healing methods, strategies and medicines or remedies now known. The British colonial masters brought in orthodox medicine and, today, both systems of medicine exist in the country; both have the primary objective to cure, manage or prevent disease and maintain good health. It is important to stress the relevance of traditional medicine to the majority of Nigerians. Most Nigerians, especially those living in rural communities do not have access to orthodox medicine and it is estimated that about 75 per cent of the populace still prefer to solve their health problems consulting traditional healers (Belonwu, 2011). Where such access exists, the rising cost of imported medications and other commodities used for medicines have posed a big problem. Besides, many rural communities have great faith in traditional medicine, particularly the inexplicable aspects as they believe that it is the wisdom of their fore-fathers which also recognizes their socio-cultural and religious background which orthodox medicine seems to neglect. Recent reports show that more people in the world embrace traditional medicine. In 1996, the WHO published (WHO Policy an Activities in the Field of Traditional Medicine) that in China, the ratio of medical doctors to the population stood at 1:20,000 compared with traditional practitioners ratio of 1:2000, and in Swaziland, these figures are respectively 1:10,000 and 1:100 (Belonwu, 2011).

Table 3 in Appendix shows some commonly used Nigerian medicinal plants/herbs. The botanical names as well as the local names and parts of each plants commonly used by traditional healers are indicated. According to Adesina (2006), there is abundant justification for the use of herbs by the various traditional healers. Disease conditions identified in traditional include; (1) Cardiovascular disease- hypertension, stroke, etc., for which the antihypertensive herbs, the African Rauwolifa and the Negro coffee have been used; (2) Disease of the nervous system- convulsions, insomnia etc., for which the parrot's beak and the African Rauwolfia also offer a good remedy;(3) Disease of the alimentary system- diarrohea, dysentery etc for which basil is useful;(4) Disease of the endocrine system-diabetes etc., for which the leaves of the common Roused periwinkle or Mormodica are valuable; (5) Disease of the respiratory system – asthma, cough etc., for which the lemon grass is of value; (6) Disease of the genitor urinary-gonorrhea, haematuria, etc., for which the bush banana is useful; (7) Disease of the skin-wounds, dermatonycosis etc. for which the craw-craw plant is very useful; (8) Disease associated with the ear, nose and throat ache, sinusitis, etc., for which the resurrection plant is usually recommended and; (9) Disease caused by microbes, viruses, insects etc. infection, malaria etc., for which garlic, clove, the African mahogany etc. have been found useful.

Numerous other diseases or complaints of a special nature such as hernia, snake bite, arthritis, gout etc. have been treated using herbs alone or in admixture with animal parts and minerals. Today plant medicines include vincristine and vinblastine isolated from the Rose periwinkle and used to treat childhood leukemia and Hodgkin's disease, reser pine extracted from the African or Indian Rauwolfia and used in tranquillizers, diogenin extracted from the yam and used in the treatment of rheumatism and to produce oral contraceptives and the shea butter which showed nasal decongestant activity etc. Non-plant medicines include the bee venom which is used in the treatment of arthritis and the civet cat exudates which have shown anticonvulsant effects. Plant extracts and chemicals which muscle relaxant have been used by the TBAs to assist in child deliveries. All these facts point to the values of medicinal plants and their importance in traditional medicine in present day Nigeria (Gbile and Adesina, 1986).

However, there are some challenges confronting the practice of traditional medicine. According to Aluko (2005), there has been no standardized measurement in the application of drugs as the same cup is used in administering drugs to all and sundry. Where this is the case, we cannot rule out the likely danger that such might bring to the human kidney. Also the preservative means has not been developed. The all in all syndrome drug application has not equally been helpful as the potency of a drug for all diseases is questionable. In addition, as Aluko (2005) reported, climatic changes have been negatively affecting the practice of traditional medicine in Nigeria. Abrupt and unpredictable changes in weather have rendered the availability of essential herbs indeterminate.

4. MATERIALS AND METHODS

To determine and implement the extraction of pairs of ailments/diseases that can be cured by a set of medicinal plants, a repository database was assessed to know the frequency occurrence of some sets of ailment/diseases (the repository database was the hidden pattern (data) consisting of a total of 182 medicinal plant species belonging to 70 families. The Apriori algorithm (an association rule mining algorithm) was adopted and implemented to extract more valuable information from the dataset. The programming and query languages used were ASP.Net C# and MS SQL. Nonetheless, the Apriori algorithm is an association rule mining technique used in mining data in the repository database. In using this technique, the minimum support and the level of confidence of how the data item are associated have to be known. The models used to get the results are stated below: (Note the minimum support greater or equal to 2) (Agrawal, et al., 1993); Hongbo 2010; Mohammed and Wagner, 2014)

An association rule is an expression $X \xrightarrow{S,C} Y$, where X and Y are itemsets and they are disjoint, that is:

$X, Y \subseteq DB$ and $X \cap Y = \emptyset$. Let the itemset $X \cup Y$ be denoted as XY. The support of the rule is the number of transactions in which both X and Y occur together as subset:

$$S = Sup(X \rightarrow Y) = |t(XY)| = Sup\ (XY)$$

The relative support of the rule is defined as the fraction of transactions where X and Y occur together and provide an estimate of the joint probability of X and Y:

$$rSup(X \rightarrow Y) = \frac{Sup\ (XY)}{|DB|} = P(X \wedge Y)$$

The confidence of a rule is the conditional probability that a transaction contains Y given that it contains X:

$$C = conf(X \rightarrow Y) = P(Y/X) = \frac{P(X \wedge Y)}{P(X)} = \frac{Sup\ (XY)}{Sup(X)}$$

A rule is frequent if the itemset XY is frequent, that is, $Sup(XY) \geq$ minsup and a rule is strong if conf $\geq mincof$, where mincof is a user-specified minimum confidence threshold.

Apriori algorithm Implementation Steps:

The simplified steps for the implementation of Apriori Algorithm are enumerated below:

Step 1: Count the number of occurrence of each item in all transactions (frequency of occurrence).

Step 2: Select all items whose frequency of occurrence is greater or equal to the support S (Obtain single item that occur frequently).

Step 3: Make pairs for all elements selected in Step 2 and ensure only unique pairing.

Step 4: Count the number of occurrence of each pair in the transactions

Step 5: Repeat Step 2 for each pair (select pairs whose frequency is greater than support value i.e. the pairs of ailments having the same curative medicinal plants)

Step 6: To make 3 sets of ailments, find two pairs with the same medicinal plant then combine without repeating any ailment (Yemi-Peters and Oluwade, 2016)

5. RESULT OF APRIORI ALGORITHM IMPLEMENTATION

The figures below show the output of the implementation of the Apriori algorithm on the medicinal plants repository database. The sets of the extracted diseases that associates together using the condition of minimum Support which is equal to two, are captured in figure 2 and the results of the level of association, confidence and the ratio of occurrence of the diseases together are shown in figure 3. Figure 4 displays the set of associated ailments/disease linked with the various medicinal plants that can cure them; Figure 5 presents the interface to view Medicinal Plants and their descriptions in the different Nigerian indigenous languages (Yoruba, Igbo and Hausa).

Figure 2: Report of Diseases that frequently occur together in the repository database
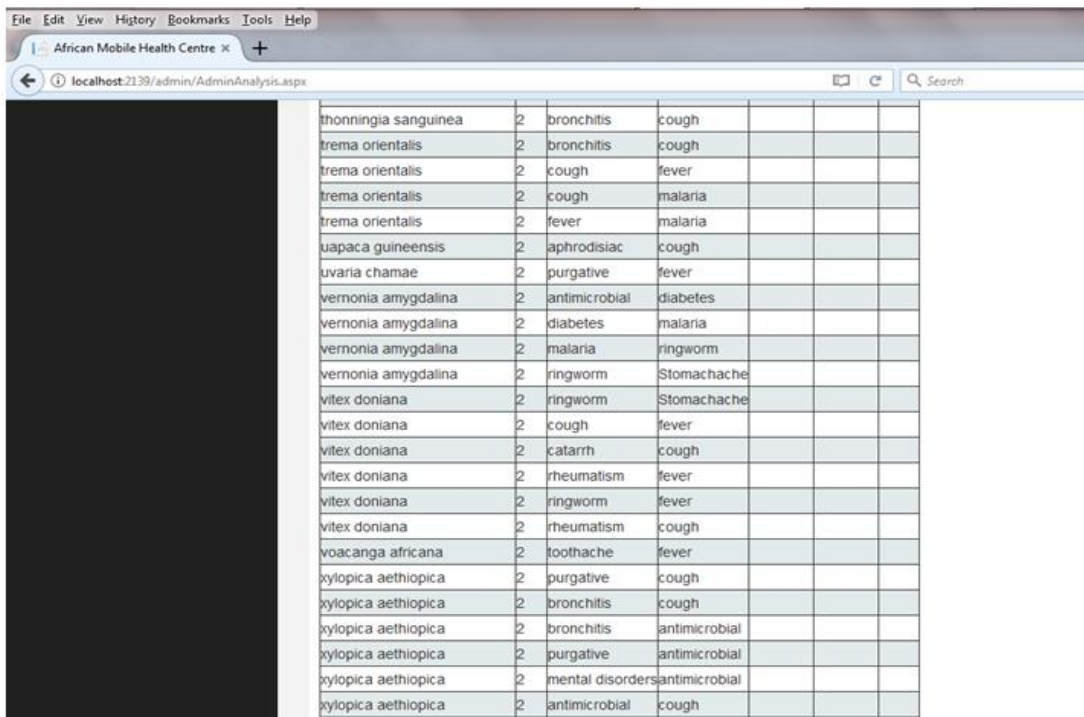
Figure 2 shows how the Apriori algorithm was used to implement the extraction of ailments and diseases that frequently occur together in the repository database and to further give the level of how the ailments associate together. This implies showing the set of symptoms of different ailments/ diseases that can be treated together.

Figure 3: Output showing the levels of association, confidence and ratio of occurrence of diseases
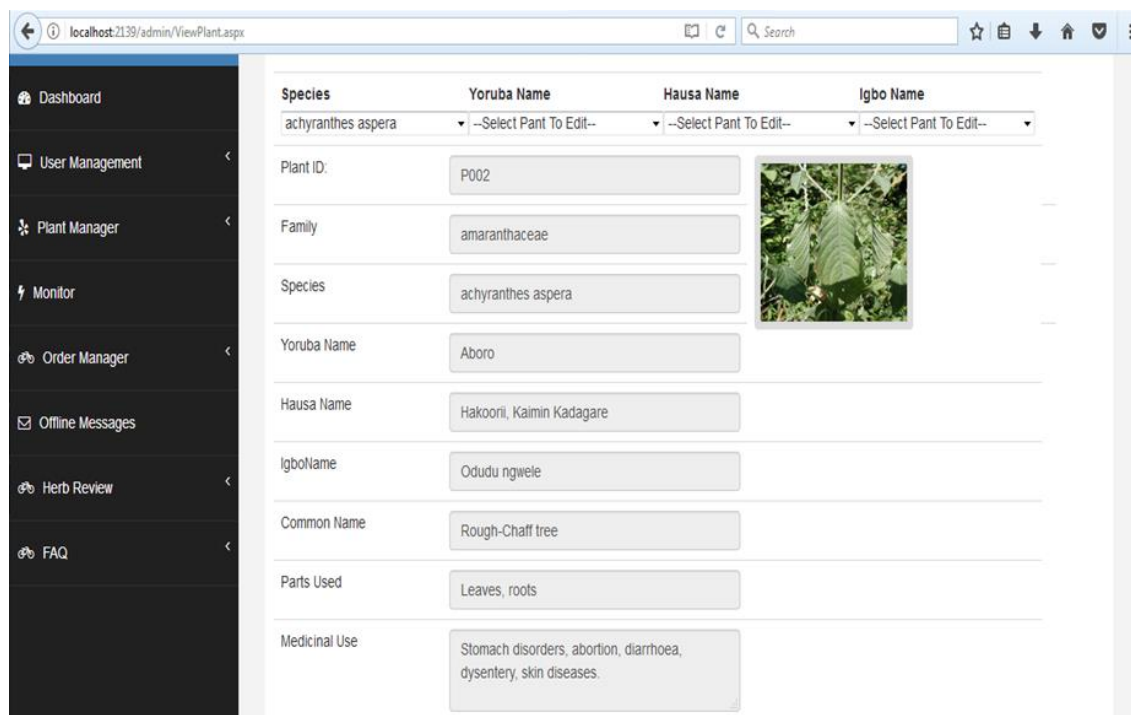
Figure 3 shows the result of the association and confidence level of ailments/diseases that frequently occur together and Extraction set of ailments/diseases that are highly associated linked with the medicinal plant that can be used to cure them.

Page | 40

Figure 4: Set of associated ailments/disease linked with the various medicinal plants that can cure them.

Figure 4 shows the continuation of set of associated ailments/diseases linked with their various medicinal plants that can cure them. All these have been extracted from the repository database being the hidden patterns gotten from the conventional database initially provided.

Figure 5: Interface showing medicinal plant identification and descriptions in the various local Nigerian language names.

The user interface in Figure 5, consisting of the set of dials, knobs, operating system commands, graphical display formats allow the user to communicate and use the computer or program. It shows medicinal plant identification and descriptions in the various local Nigerian language names.

6.   SUMMARY, CONCLUSION AND SUGGESTION

The utilization of plants and their resources for combating various ailments predates written history and they are still in use all over the world (Abe and Ohtani, 2013). Recent scientific evidence has revealed that many plants considered to be medicinal are potentially toxic, mutagenic and carcinogenic (Fennell et al., 2004). This study aimed at determining and implements the extraction of pairs of ailments/diseases that can be cured by a set of medicinal plants. The study assessed a repository database to know the frequency of occurrence of some sets of ailment/diseases (the repository database was the hidden pattern (data) consisting of a total 182 medicinal plant species belonging to 70 families). The Apriori algorithm (an association rule mining algorithm) was adopted and implemented to extract more valuable information from the dataset. The programming and query languages used were ASP.Net C# and MS SQL.

The study was able to extract sets of ailments/diseases that frequently occur together, from the repository database. Using apriori Algorithm, it was possible to implement the extraction and as well link the diseases with the set of medicinal plants that can cure the diseases. The results from the Apriori algorithm implementation gives a high level of confidence in decision making for the production of herbal medicinal mixtures and drugs by the pharmaceutical practitioners, researches and healthcare personnels

Based on inherited knowledge and long-term usage for the treatment of various ailments over the centuries, medicinal plants are considered natural and therefore safer than conventional synthetic pharmaceuticals. There is, however, scarce scientific evidence supporting this belief (Raskin et al., 2002). Since the major mission of World Health Organization is to help save lives and improve health (health is linked to economic development and poverty reduction); hence it is in support of the promotion of traditional/complementary medicine which differs globally by location and country. Therefore the Nigerian government through the Ministry of Health should encourage and assist the traditional herbal healthcare professionals. This will also guide the standardization and control of the quality and quantity of indigenous drug production. There is also a need for the Government to massively sensitize the people on the dangers of the indiscriminate use of herbal remedies since recent scientific evidence has revealed that many plants considered to be medicinal are potentially toxic, mutagenic and carcinogenic (Fennell et al., 2004).

ACKNOWLEDGEMENT

REFERENCES

[1]   Agrawal,R., Imielinski,T, and Swami,A.(1993) "Mining Association Rulesbetween Sets of Items in Large Databases". In Proceedings of ACM SIGMOD International Conference on Management of Data. ACM. Pp 207-216.

[2]   BBC News (2012). Nigerians living in poverty rise to nearly 61%.http://www.bbc.com/news/world-africa-17015873

[3]   Belonwu, M. C. (2011).Attitudes to and Use of Traditional Medicine in the Treatment and Management of Malaria in Nigeria: Case Study of Anambra State. A Project Submitted to the Institute for Developmental Studies (IDS) University of Nigeria, Enugu Campus, in Partial fulfillment of the requirements for the Award of the Degree of Master of Science (M.Sc) in Development studies. *www.unn.edu.ng/publications/files/images/UNEC%20 PROJECT%201.pdf*

[4]   BusinessDay (2017).A Reflection on Healthcare Services in Nigeria and the Challenges of Medical Tourism. https://www.businessdayonline.com/reflection-healthcare-services-nigeria-challenges-medical-tourism/

[5]   Chimezie,R.O. (2015).Failure of Primary Healthcare Delivery in Africa. *International Journal of Interdisciplinary and Multidisciplinary Studies* (IJIMS), 2(4), 208-215.

[6]   Federal Ministry of Health. (2010). National Tuberculosis and Leprosy Control Program: Workers Manual 5th Ed. Retrieved from http://ntblcp.gov.ng/index.php/publications/reports

[7]   Gbile, Z.O, and Adesina, S.K. (1986). Nigerian Flora and its Pharmaceutical Potentials. *J. Ethnopharmacol.* 19(1),1-16.

[8]   Haymes, S., Vidal de Haymes, M., and Miller, R. (eds) (2015). The Routledge Handbook of Poverty in the United States, (London: Routledge), ISBN 0415673445, pp. 1–2.

[9]   Hickel, J. (30 March, 2015). It will take 100 years for the World's Poorest People to Earn $1.25 a Day. The Guardian. Retrieved 31 March 2015.

[10]   Hongbo D. (2010). "Data Mining Techniques and Applications: An Introduction." Cengage Learning EMEA, United Kingdom. ISBN: 978-1-84480-891-5 PG 1-7, 195-197.

[11]   Hotcoco (2012). The Problem with Healthcare in Nigeria. http://www.nairaland.com/838022/problem-healthcare-nigeria

[12]   Olapade, O. 9200).The use of herbs in alternative health care delivery in Nigeria. Paper delivered at the symposium organized by the National Association of botany Students, obafemi Awolowo University, Ile-Ife .

[13]   Madu, E.C. (n.d.)."Investment and Development Will Secure the Rights of the Child"

[14]   Mohammed, J.K., and Wagner, M.J.(2014). " Data Mining and Analysis Fundamental Concepts and Algorithms'. Cambridge University Press http:www.cs.rpi.edu/Zaki/dataminingbook Retrieved on 16-09-2017.

[15]   NBS (2012). Nigeria Poverty Profile 2010. www.nigerianstat.gov.ng/pdfuploads/Nigeria%20Poverty%20Profile%202010.pdf.

[16]   News (2012).Nigerians Living in Poverty Rise to Nearly 61%. http://www.bbc.com/news/world-africa-17015873.

[17]   NSP (n.d.).Nigerian Medicinal Plants. http://www.nsp.com.ng/nigerian-medicinal-plants.

[18]   Obrist et al. (2007). Access to Health Care in Contexts of Livelihood Insecurity: A Framework for Analysis and Action. Plos Medicine. Volume 4.Issue 10.

[19]   Ogwumike, F. O. (2002). "An Appraisal of Poverty Reduction Strategies in Nigeria, Central Bank of Nigeria, Economic and financial review, 39(4),20.

[20]   Omoluabi, E. (2014).Needs Assessment of the Nigerian Health Sector. https://nigeria.iom.int/sites/default/files/newsletter/ANNEX%20XXIV%20Needs%20Assessment%20of%20the%20Nigeria%20health%20Sector.pdf.

[21]   Raskin, I., Ribnicky, D.M., Komarnytsky, S., Ilic, N., Poulev, A., Borisjuk, N., and Fridlender, B. (2002). Plants and human health in the twenty-first century. *Trends in Biotechnology*, 20 (12), 522-531

[22]   Ravallion, M. (2013). "How long will it Take to Lift One Billion People Out of Poverty?" The World Bank Research Observer 28 (2), 139.

[23]   Scott-Emuakpor, A. (2010).The Evolution of Healthcare Systems in Nigeria: Which way Forward in the Twenty-First Century, *Nigerian Medical Journal*, 51(2), 53-65.

[24]   Stephen, R. (2006). The Complexity of African Poverty. https://www.globalpolicy.org/component/content/article/211/44627.html

[25]   Uma, K. E., Eboh, F. E., Obidike, P. C., and Ogwuru, H. O. R. (2013). Poverty, Underdevelopment and Emerging Economies: Nigeria in Focus, *Global Journal of Management and Business Research Finance,* 13(6),24-32.

[26]   Vanguard (2016). Poverty: 112m Nigerians live below Poverty Line. https://www.vanguardngr.com/2016/10/poverty-112m-nigerians-live-poverty-line/

[27]   Weil, A. (n.d.).Herbal Medicine and Medicinal Herbs. https://www.drweil.com/health-wellness/balanced-living/wellness-therapies/herbal-medicine/

[28]   Whinery, T. (2013). How Diseases Lead to Poverty. https://borgenproject.org/how-diseases-lead-to-poverty/

[29] WHO (n.d.).Global Alert and Response (GAR): Nigeria. [Last accessed on 2011 Jan 3]. Available from: http://www.who.int/csr/don/archive/country/nga/en/

[30] WHO (2010).Traditional Herbal Remedies for Primary Health Care. http://apps.who.int/medicinedocs/en/d/ Js22298en/

[31] WHO(2012). World Health Statistics 2012, available at: http://www.who.int/gho/publications/world_health_ statistics/2012/en/index.html

[32] WHO (2017). Countries: Nigeria. http://www.who.int/countries/nga/en/

[33] Wikipedia (n.d.a).Poverty in Nigeria. https://en.wikipedia.org/wiki/Poverty_in_Nigeria.

[34] Wikipedia (n.d.b).Poverty. https://en.wikipedia.org/wiki/Poverty

[35] WorldBank (2012a). "World Bank Sees Progress Against Extreme Poverty, But Flags Vulnerabilities". The World Bank. 29 February, 2012.

[36] WorldBank (2012b)."Poverty and Equity – India, 2010 World Bank Country Profile". Povertydata.worldbank.org. 30 March 2012. Retrieved 26 July 2013.

[37] WorldBank (2015)."Global Monitoring Report; Development Goals in an Era of Demographic Change" (PDF). www.worldbank.org/gmr. Retrieved 4 Nov 2015.

[38] WorldBank (2015)."World Bank Forecasts Global Poverty to Fall Below 10% for First Time; Major Hurdles Remain in Goal to End Poverty by 2030". Worldbank.org. 2015-10-04. Retrieved 2016-01-06.

[39] Yemi-Peters,V.I., and Oluwade, B.A. (2016). "An Apriori Algorithm Based Extraction of Pairs of Ailments Treatable by a Set of Medicinal Plants" IEEE Nigeria Computer Chapter 1ST International Conference.IEEEnigComputConf'16,November,2016

APPENDIX

Table 3: some commonly used Nigerian Medicinal Plants

S/N	BOTANICAL NAMES	LOCAL NAMES				PARTS COMMONLY USED
		Yoruba	**Igbo**	**Hausa**	**Others**	
1	*Pergularia daemia*(Forssk.) Chiov. (Asclepiadaceae)	ijoyun, kole ori ogba	utaezi			Leaf and bark
2	*Bryophyllum pinnatum* (Lam.) Oken (Crassulaceae)	abamoda, eru-odundun			danweshin (edo)	Leaf and root
3	*Mangifera indica*Linn. (Anacardiaceae)	mangoro	mangolo	mangwaro		Leaf and bark
4	*Alstonia boonei* De Wild (Apocynacea)	ahun, ako-ibepo	egbu ora		ukhu (edo);	Root, bark and leaf
5	*Cleistopholis patens*(Benth) Engl. & Diels (Annonacaceae)	apako, oke	ojo		otu (edo)	Leaf and bark
6	*Musanga cecropioides*R. Br. (Cecropiaceae)	aga agbawo	ulu, egbu, onru, ujuju		egbesu (itsekiri)	Bark and root
7	*Ceiba pentandra*Linn. Gaertn (Bombacaceae)	araba	akpu	rimi		Leaf, bark and root
8	*Pseudospondias microcarpa* A. Rich. Engl. (Anacardiaceae)	okikan aja		rimin kuroni		Bark
9	*Anchomanes difformis* Engl. (Araceae)	igo, langbodo, ogirisako	oje	cakara	olikhoror (edo)	Root, stem, leaf
10	*Rauvolfia vomitoria*Afzel.	asofeyeje	akanta	wada		Bark and root

S/N	BOTANICAL NAMES	LOCAL NAMES				PARTS COMMONLY USED
		Yoruba	**Igbo**	**Hausa**	**Others**	
	(Apocynaceae)					
11	*Spondias mombin*Linn. (Anacardiaceae)	iyeye	ijikara	tsaadar lamarudu		Leaf and bark
12	*Voacanga africana*Stapf. (Apocynaceae)	ako dodo	pete pete			Bark and root
13	*Spathodea campanulata* P. Beauv. (Bignoniaceae)	oruru	imi ewu		okuekue (edo)	Bark
14	*Canarium schweinfurthii* Engl. (Burseraceae)	ako, anikantuhu, origbo	ube ohia	atile		Bark
15	*Basella alba* Linn. (Basellaceae)	amunututu, efo tutu				Leaf
16	*Holarrhena floribunda*(G. Don) Dur. & Schinz. (Apocynaceae)	ako ire	mba	bakin mutum		Root
17	*Terminalia ivorensis*A. Chev. (Combretaceae)	afara dudu	awunshin		egboen-nebi (edo).	Bark
18	*Ananas comosus*Linn. (Bromeliaceae)	ogede-oyibo, ope-oyibo	akwu olu	abarbaa	edinebo (edo)	Fruit and leaf
19	*Stemonocoleus micranthus* Harms. (Caesalpiniaceae)		nre		erhanebeni (edo)	Whole plant
20	*Piper guineense*Schum. and Thonn. (Piperaceae)	ata-iyere	uziza			Fruit, leaf and seed
21	*Adansonia digitata*Linn. (Bombaceae)	luru, ose		bakko, kumbali	usi (edo)	Leaf
22	*Moringa oleifera* Lam. (Moringaceae)	ewe igbale				Root
23	*Newbouldia laevis*Seem. (Bignoniaceae)	akoko	ogirisi	aduruku	ikhimi (edo)	Bark, root and leaf
24	*Aneilema beninense*(P. Beauv.) Kunth. (Commelinaceae)	godobo-funfun, odo	obo-ogu uku		ohiovbo (edo);	Leaf
25	*Terminalia catappa*Linn. (Combretaceae)				mbansan mbakara (efik)	Bark and young leaf
26	*Bixa orellana* Linn. (Bixaceae)	osun buke	uhie aro, mkpulu ofia, ula			Seed and leaf
27	*Telfairea occidentalis*Hook. F. (Cucurbitaceae)	apiroko, egusi, iroko	ohi (fruit), ugu		ubon (efik)	Leaf
28	*Kalanchoe crenata*Haw. (Crassulaceae)	eleti	unwa	harfifi		Leaf
29	*Calotropis procera*Ait. F. (Asclepiadaceae)	bomubomu		bambambele		Leaf, root and bark
30	*Myrianthus arboreus*P. Beauv. (Cecropiaceae)	ewe ade, ibisere	ujuju		ihi eghe (edo)	Bark
31	*Canna indica* Linn. (Cannacea)	ido, idoro	abereka mwo	bakalekale		Leaf, root, shoot and stem
32	*Xanthosoma mafaffa*Schott. (Araceae)		ede eko, akasi oyibo, ede ohia	gwaazaa-mai-gooraa	iyokho akara (edo)	Root and leaf
33	*Kigelia Africana*(Lam.) Benth. (Bignoniaceae)	orora, pandoro,uyan	alamborogoda, uturukpa	hantsar giiwaa, rahainaa	ugbon-gbon (edo)	Leaf, bark and fruit
34	*Cnestis ferruginea* DC	akara oje, oyan aje		fura	ukpo-ibieka	Bark, leaf, root

S/N	BOTANICAL NAMES	LOCAL NAMES				PARTS COMMONLY USED
		Yoruba	**Igbo**	**Hausa**	**Others**	
	(Connaraceae)			amarya	(edo)	and fruit
35	*Mariscus alternifolius*Vahl. (Cyperaceae)	samikoko, alubosa eranko	ataku mainya, nne ikute	ayaa	efo'aba (nupe)	Whole plant
36	*Heliotropium indicum*Linn. (Boraginaceae)	agogo igun, ogbe ori akuko	azu uzo, ilolo isi mwa-eku, utaba ani	kalkashin kooramaa		Leaf
37	*Lagenaria siceraria*(Molina) Standl. (Cucurbitaceae)	ado, igba, akengbe, itakun igba	mbubu, igba, ebele	bumbu, dan kwakwangi	ekpere (edo)	Leaf, seed and root
38	*Opuntia dillenii* Haw (Cactaceae)	oro agogo agogo				Stem, leaf and fruit
39	*Cyperus esculentus*Linn. (Cyperaceae)	imumu ofio omu, erunsha		arigiza, ayaa rigiza, bakar	efa (nupe)	Leaf
40	*Thevetia neriifolia*Juss. (Apocynaceae)	olomiojo				Leaf and bark
41	*Aspilla Africana*(Pers.) C.D. Adams (Compositae)	ako yunyun, yinrin-yinrin, ako	azuzo, oramejina	jamajina, kalankuwa	edeme edon(efik)	Whole plant and leaf
42	*Vernonia amygdalina*Del. (Compositae)	ewuro, orin, pako, ewuro jije	olubi, olugbu, onubu	chusar doki, fatefate, mayemaye	oriwo (edo)	Leaf, root, bark and fruit
43	*Dioscorea dumetorum* (Kunth) Pax.(Dioscoreaceae)	esuru, ewu eleso, gudugudu	adu, akpana, ona igbo	gursami, kisra	ufua (edo)	Tuber and root
44	*Dacryodes edulis* (G. Don) H.J. Lam. (Burseraceae)	elemi, ibagbo	ubwe oyo, ube, ube-oyibo		orunmwun (edo)	Leaf and bark
45	*Sclerocarya birrea* (A. Rich.) Hochst. (Anacardiaceae)			danya, huli		Bark, leaf and root
46	*Terminalia glaucescens* Planch (Combretaceae)	idi, idi-apata, idi-odan	edo, barbar	baushe		Root, leaf and bark
47	*Sterculia tragacantha*Lindl (Sterculiaceae)	alawefon				Bark and leaf
48	*Ricinodendron heudelotii* (Baill.) Pierre (Euphorbiaceae)	erin mado	okwe	waawan kurmii	erinmadu epo (edo)	Bark sap
49	*Colocasia esculenta*(Linn.) Schott (Araceae)	isu koko	ede nkiti	gwaazaa	iyokho (edo)	Root
50	*Pterocarpus mildbraedii* Harms (Leguminosae)		oha ojii	madoobiyaa	urube (edo)	Leaf and bark
51	*Harrungana madagascariensis*Lam. Ex Poir. (Guttiferae)	asunje	uturu	alillibar raafii		Stem bark, root bark and leaf
52	*Citrullus lanatus*(Thunb.) Mansf (Cucurbitaceae)	bara, egusi agbe, sofin	egusi, ogili, nkbuluko	agushii, bambus, guna	ikpogi (edo)	Fruit, seed and leaf
53	*Bridelia micrantha*(Hochst) Bail (Euphorbiaceae)	asa, araasa	oga ofia			Leaf, wood and bark
54	*Crinum zeylanicum*Linn. (Amaryllidaceae)	isumeri		albasar kwaadii		Bulb and fruit

S/N	BOTANICAL NAMES	LOCAL NAMES				PARTS COMMONLY USED
		Yoruba	**Igbo**	**Hausa**	**Others**	
55	*Funtumia ebrifu*(Preuss) Stapf. (Apocynaceae)	ako ire	mba-miri		ayon (edo)	Leaf and root
56	*Trichosanthes cucumerina* Linn. (Cucurbitaceae)	tomato elejo				Fruit, shoot and leaf
57	*Bombax buonopozense* P. Beauv. (Bombacaceae)	eso, olu kondo, poponla	akpu ogiri, akpu okporo	gurjiya	olikhatuloko (edo)	Bark, leaf, fruit and flower
58	*Myrianthus arboreus*P. Beauv. (Cecropiaceae)	ewe ade	ujuju		ihi egbe (edo)	Bark
59	*Gliricidia sepium*(Jacq.) Walp (Leguminosae)	agunmaniye				Leaf, bark and root
60	*Mammea ebrifug*Sabine (Guttiferae)	ologbomodu	ukutu			Seed, root bark, stem and fruit
61	*Cleome rutidosperma*DC (Capparaceae)	etare	akidimmoo	garseya		Leaf
62	*Plukenetia conophora*Mull-Arg (Euphorbiaceae)	awusa, asala	ukpa			Kernel
63	*Discoglypremna caloneura* (Pax) Prain (Euphorbiaceae)	akikaagba	obinwaanyi			Seed
64	*Macaranga barteri*Mull-Arg. (Euphorbiaceae)	araasa	owariwa			Bark and leaf
65	*Margaritariadiscoidea* (Bail) Webster (Euphorbiaceae)	awewe	isi mkpi		aseivin (edo)	Root
66	*Pentadesma butyraceae* Sab (Guttiferae)	orogbo erin	oze			Seed, bark and root
67	*Spathodea campanulata* P. Beauv. (Bignoniaceae)	oruru	imi ewu		okuekue (edo)	Bark
68	*Cyathula prostrate*(Linn) Blume (Amaranthaceae)	sawere pepe	agbirigba	danka dafi		Whole plant
69	*Emilia sonchifolia*(Linn) DC. (Compositae)	odundun odo		hurahuran boka		Leaf
70	*Maesopsis eminii*Eng. (Rhamnaceae)	igilogbo				Leaf
71	*Alchornea Cordifolia*(Schum. & Thonn.) Mull-Arg (Euphorbiaceae)	epa	ubebe	bambami	uwonmwe (edo)	Leaf, pith and root
72	*Homalium letestui*Pellegr. (Flacourtiaceae)	abo ako	akpurukwu		akpuro (edo)	Bark
73	*Citrus aurantifolia*(Christm.) Swimgle (Rutaceae)	osan wewe	epe nkirisi	dankabuya		Leaf, stem, root and fruit
74	*Rhynchospora corymbosa* (Linn.) Britt (Cyperaceae)	labelabe		kudunduru		Leaf and seed
75	*Struchium sparganophora* (Linn) O. Ktze (Compositae)	ewuro odo	nti mgbada			Leaf
76	*Carica papaya* Linn. (Caricaceae)	ibepe	mgbimgbi	gonada		Leaf, root, fruit and seed
77	*Margaritariadiscoidea* (Bail) Webster (Euphorbiaceae)	awewe	isi mkpi		aseivin (edo)	Root
78	*Luffa cylindrica* (Linn) M. J. Roem (Cucurbitaceae)	erun, kankan, kanrinkan-ayaba	nza, asisa, agbo, osa mme	baska	ihion (edo)	Seed, leaf and fruit
79	*Crinum jagus*(Thomps.) Dandy (Amaryllidaceae)	edesuku	olodi, ozu			Bulb

S/N	BOTANICAL NAMES	LOCAL NAMES				PARTS COMMONLY USED
		Yoruba	**Igbo**	**Hausa**	**Others**	
80	*Ageratum conyzoides*Linn. (Compositae)	ako yunyun, imi-esu	agadi-isi-awa,			Leaf and root
81	*Gongronema latifolium* Benth (Asclepiadaceae)	arokeke	utazi			Stem, leaf, bark and fruit
82	*Cyrtosperma senegalense* (Schott) Engl. (Araceae)	ope igo	eko, mgbo eko		nnyoro oton (efik)	Rhizome, leave, fruit and root
83	*Xylopia aethiopica*(Dunal) A. Rich (Annonaceae)	eeru, awonka, olorin	uda	kimbaa		Root, leaf, fruit, seed
84	*Ocimum gratissimum*Linn. (Labiatae)	efinrin	nchu anwu			Leaf
85	*Combretum smeathmannii* G. Don (Combretaceae)	agbon igbo, lawo				Leaf
86	*Azadirachta indica* A. Juss (Meliaceae)	dongoyaro	ogwu iba	dongoyaro		Leaf and bark
87	*Commelina erecta*Linn. (Commelinaceae)	ileke opolo, ito ipere	ahihia ebisango	ba-kiskis		Whole plant
88	*Lagenaria breviflora*(benth) Roberty (Cucurbitaceae)	eso gbegbe	anyummuo	gojin jima		Stem, root, fruit
89	*Asystasia gangetica*(Linn.) T. Anders (Acanthaceae)	lobiri	uli oko, ikere		eboghogiro (edo)	Leaf and root
90	*Hygrophila auriculata*(Schumach.) Heine (Acanthaceae)	mafowo, kauruonu		zazargiwa, kayarukumi		Whole plant and root
91	*Cucurbita maxima*Dutch(Cucurbitaceae)	apala, elegede	ukoro, anyu, akwukwo	akwato,ba kanuwaa	eyen (edo)	Seed, fruit, leaf and shoot

Source: NSP (n.d.).