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Adeyemi H. Oluwole

Osifeko M. Ositola
University of Pretoria

Olanike Olufisayo

Ade Ikuesan

Olatunbosun O. Blessing

See next page for additional authors

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Authors

Adeyemi H. Oluwole, Osifeko M. Ositola, Olanike Olufisayo, Ade Ikuesan, Olatunbosun O. Blessing, Adesina A. Peter, and Egbuobi U. C.

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By Adeyemi Hezekiah Oluwole,[1] Osifeko Martins Ositola,[2] Olanike Olufisayo[3], Ade-Ikuesan, Olatunbosun Oluwakemi Blessing, Adesina Ayobami Peter, and Egbuobi Udochukwu C.[4]

Abstract

Behavioral pattern is the characteristic ways a person acts and has been recognized as a cause of many home accidents (h-accd). This study reviewed the types and prevalence of injuries among women in domestic works and proposes a model using Artificial Neural Network (ANN) function to forecast the safety level of women in domestic duty. The study was conducted in some parts of Western Nigeria among 340 subjects (171 married and 169 unmarried) using questionnaire. SPSS was used for data analysis. The ANN function was developed in MATLAB 2015a using the subjects' behavioral patterns and the model was used to predict safety in domestic duties (d-duties) among some women. 'Cuts/laceration' (40%) and 'skin contact with hot substance' (35.6%) were commonly reported. Carelessness (26.5%) and distraction (22.1%) were the main leading factors across the groups. Marital status and h-accd (Chi-square =4.323 and p= .038); 'hours spent on domestic works' and 'the h-accd' were both significant among other tested groups variables. With the developed ANN function, the results of the MSE was 0.33626 indicating that the function predicted the exact value. The result of the predicted h-accd (safety= -0.5445, hazards= 1.0228) in d-duties of the tested variables with the ANN function, showed a very low level of safety. The article concludes that the developed model is reliable and a recommended ergonomic tool useful in all homes, most especially where women perform most domestic works.

Keywords: Women, domestic work, work, safety, behavior, hazards forecasting, western Nigeria, women's work.

Introduction

Domestic work (DomWrk) includes the physically, mentally and spiritually inclined work that one is daily engaged in as home activities [1] and is almost universally unremunerated. DomWrk may be referred to as chores or household duties as well as childcare. DomWrk may include house tidying, washing, kitchen cleaning, food and drink preparation among others [2]. Childcare can also be included in domestic duties [3]. Eichler and Albanese [1] described domestic works as capable of upholding one's daily activities.

[1] Adeyemi H.O. is a Senior Lecturer in Mechanical Engineering with research interest in Artificial Intelligence and Safety engineering.
[2] Osifeko M.O. is a Lecturer in Computer Engineering. He is currently undergoing PhD work in the University of Pretoria.
[3] Olanike O.A. is a Lecturer in Electrical and Electronic Engineering. She is currently undergoing her Ph.D. work.
[4] Olatunbosun O.B., Adesina A.P. and Egbuobi U.C. are students in Mechanical Engineering department, with research interest in Artificial Intelligence and Safety Engineering.

The division of domestic work by gender is common in many societies. Women are assigned to conduct the majority of DomWrk [4]. In some parts of the world, especially in Africa, housewives usually spend more time at home, cleaning the rooms, cooking in the kitchen. Some of these home activities are connected with one injury or another. Women are thus mostly affected by domestic injuries more than any other members of the family [5].

According to Caruso and Waters [6] and Kleppa et al. [7], when women work longer hours, depression and anxiety disorders can result. Women may be forced to engage in risky behaviors, such as the harmful use of alcohol and drugs [8]. A disease like high blood pressure can be likely. In terms of ergonomics, women have slightly shorter hands and lower grip strength, and many may have less upper body strength than men. Women are exposed to musculoskeletal problems; using common tools may lead to discomforts, lifting of heavy objects can lead to back problems, exposures to smokes, fumes, and chemicals can pose safety hazards to respiratory system, prolonged standing most especially for the pregnant women can be associated with preterm birth while lifting and climbing can be hazardous during the later stages of pregnancy [9].

Domestic injuries are described as worldwide public health problems [8]. The consequences of domestic injury may prove disastrous as it may result in disability and loss of productivity [10]. Domestic injuries include, but are not limited to falling from stairs, beds, chairs; slipping in the bathroom; doors hitting hands; cuts. Burns were reported as one of the most prevalent household hazards among housewives that lead to disabilities and death. Cases of fuel combustion are common in developing countries due to the use of wood, charcoal, and kerosene as fuel during cooking. Other injuries include cuts and lacerations from knives, mixer grinders, and broken cooking equipment; falls due to the wet floor. Women can suffer from neck pain, shoulder pain, back pain due to some unergonomic conditions they are subjected to during cooking. Awkward positions during lifting and/or lowering materials from one place to another cause musculoskeletal disorders [11].

One of the major measures to enhance protection against domestic injuries is to maintain safe behavior and ergonomic working habits [12]. Safe behavior could involve replacing one wrong attitude in exercising domestic duty with a safe one. It was reported that a strong safety culture depends on each person making safety a habit [13]. Changing of habits, however, first require careful studying of the behavioral pattern of an individual, which may lead to hazards at one time or another. One effective method widely applied to learn human behavioral patterns is by use of Artificial Intelligence (AI).

Artificial Intelligence is a field saddled with the task of creating human-like ability to reason and solve problems in machines [14]. Application of AI entails learning attributes from domain human perception and implementing same to develop expert system in a computer-friendlymanner. Artificial Neural Network (ANN) is a branch of AI considered a modern computational technique engaged to determine unexpected dynamic complications most especially, to develop human behavioral systems. ANN learns to identify data arrangements in which other similar techniques may have failed to solve [15]. As parts of the many key benefits that make it most suitable in developing behavioral systems, ANN canmaster and model non-linear and complicated correlations. It can infer unseen relationships on unseen data making the system generalizes and predict on unseen data, can learn and does not need to be reprogrammed, has less sensitive to noise than others. ANN however, needs training to perform and for a wide neural network, high processing hours are required [16].

Measures to reduce the rate of accidents in domestic tasks, most importantly among women, is necessary and the focus of this study. Women play an important part in raising household income. According to UN Fund-for-Women, 2003, women struggle to keep families together. They make up one-half of the global human resource. Women have economic resilience, productivity, and competitive potential. They encourage economic development in any country [17]. Efforts at minimizing the prevalence of domestic hazards will enhance the safety of lives and properties and will enable women to contribute meaningfully to the development of their families and national economies. Hence, the development of a simple and readily available AI safety system that will ensure this motive is attempted in this project. The study aims at the development of an AI system with ANN that will learn from the behavior pattern of some women in Southwest part of Nigeria and use same to forecast safety level in domestic tasks among the women folks. The objectives are to review the prevalence and the causal factors of injuries among women in domestic works and forecast their safety level in the work.

Materials and Methods

Study Design, Area and Subjects

In this study, a cross-sectional design was adopted. Data were collected from a subset of the total women populations. The information gathered however represented the situation at only one point in time. The study was carried out in Lagos, Ibadan, and Ifo all within South West Nigeria. Lagos is the most populated urban settlement in Nigeria. Located in the South Western region of Nigeria.Ibadan is the third largest city in Nigeria by population and based on longitude 3°55'00'' East side of the Greenwich Meridian and latitude 7°23'47''North of the Equator. Ifo is located at 6°49′00″N 3°12′00″E. ifo has an area of 521 km² and a population of 524,837 [18,19]. The calibers of subjects involved in this study were those living in urban cities (Lagos) and others in less developed areas (Ifo). The rural area women engage in more physically demanding domestic chores like fetching water, handling firewood, pounding yams etc.. The urban dwellers mostly make use of electrical devices like watching machines, electric blenders, gas, and electric cookers, etc. Ages 20 to 50 years were considered for the study. This is because in this age bracket, the subjects have the strength for many domestic duties.

Questionnaires

Three hundred and fifty (350) questionnaires were administered. Written in the English language, the structured questionnaire consisted of various sections; the first section addressed the general information such as marital status, a number of dependents, position in the house, educational qualification, hours spent in domestic works per day, among others. The second part was designed to measure the safety level as experienced by the subjects while exercising their domestic works. Frequency-based response scale of 5 levels: SD = strongly disagree, DA = disagree, NDA = neither disagree nor agree, AG = agree, SA = strongly agree was used to achieve these targets. The third part of the survey measured the types, prevalence, and causes of domestic injuries. Over a period of last twelve months.

To reduce the level of biases in data collection, indirect questions were included. Open-ended questions were added to allow for participants' expression of views on information not provided in the structured questionnaire., Participants were encouraged to go through their provided answers to be sure that their answers were the true picture of their mind before final

submission. To reduce the risk to all participants, the ethical approval was received before the start of the research. the reason for the study was fully communicated with the participants so that they can decide their participation. Consents were taken in written form from the management of the enterprises involved and in oral form from all other participants after they were informed that their participation in the study was voluntary.

Data Analysis

Chi-Square statistical test was used to analyze data in this study. Chi-square test resolves whether two or more groups of cases are independent or not. Chi-Square tests were conducted in this study to analyze the recorded data using the SPSS package, the significance of relationships between two variables; the status of the subjects and the occurrences of injuries while carrying out domestic duties. The Chi-Square results, at $p<0.05$, determined whether the relationship was significant or not.

Development of Artificial Neural Network Function

Data Collection

This study attempted to build artificial intelligence systems that have intelligent behavior. The natural behavioral patterns of women in domestic duties were captured using a section of the questionnaire. This was to measure participants' safe behavior in domestic duties. A set of Likert-type items was used to measure adoption of all structured attributes capable of leading to a safe condition in domestic work, among the subjects, in a scale from 1-5 ('1' allocated to poor habit and '5' assigned to safe behavior). All the attributes form the inputs to the ANN function. The coding of the collected data, in preparation for use as input to the network, was carried out on SPSS using the scale and linguistic interpretations as shown in Table 1,

Table 1: Interval and linguistic interpretations of input variables

Interval	Linguistic interpretation
1.0	Poor safe behavior'
1.1-2.49	Weak safe behavior'
2.5 and 2.9	Average safe behavior'
3-3.9	Good safe behavior
≥ 4	Very good safe behavior

The output to the ANN function was a variable 'general domestic safety level'. The subjects were asked to allocate scores to 'safety level' in domestic duty' in a scale from 1-5 ('1' allocated to very low or not safe and '5' assigned to very safe)

Setup on MATLAB

The ANN function was set up on MATLAB 2015a; 70% of the data collected (women safe behavior pattern) was used for training while 15% and 15% was used for validation and testing respectively. The system was retrained concurrently until the acceptable very low error value was achieved. Every ANN model typically comprises of three layers which include input, hidden and the output layer. For this developed function, a total of ten neurons were used in the hidden layer. For data training, the use of Levenberg–Markquard algorithm was adopted. As narrated by Lourakis [20], the training algorithm uses an iterative process to locate the smallest

of a multivariate function indicated as the squares sum of non-linear real-valued functions. The algorithm is suitable for training small and medium-sized problems in the artificial neural-networks field making it appropriate for this work. The revise guideline of Levenberg–Marquardt algorithm is as described in (1)

$$W_{k+1} = W_k - (J_k^T J_k + \mu I)^{-1} J_k e_k \quad (1)$$

μ stands for the aggregate coefficient with a +ve value, I represents identity matrix, e is the training error and W is the weight vector

Results and Discussion

The Subject's Demographic Information

Three hundred and forty (97.1%) participants out of three hundred and fifty (350) completed the questionnaire. One hundred and seventy-one (50.3%) were married while one hundred and sixty-nine (49.7%) were single. Table 1 shoes the demographics of the respondents who contributed to the study

Table 1: Information of respondents (N=300)

GENERAL INFORMATION	DESCRIPTIONS	%
Marital Status	Married	50.3
	Unmarried	49.7
Position in the house	Housewives	45
	Others	55
Educational qualification	SSCE	34.0
	Below SSCE	17.0
	Degree	41.5
	PG	7.5
Hours of domestic work	1hour	11.8
	2-3 hours	38.2
	3-5 hours	23.5
	>5 hours	26.5

Types and Prevalence of Hazards in Domestic Works

From Figure 1, more than 40% of the respondents reported havingsuffered one than one time in the last 12 months from 'cut and lacerations' in the course of carrying out their domestic works. 35.6% had experienced 'skin contact with hot substance', 35.3% reported 'electric shock' while 'burns'. 'smoke inhalation' and 'back pains' were reported by 30.8%, 30.6% and 35% of the subjects respectively. Other injuries reported are 'neck pain' (25.2%), 'shoulder pain' (20%), 'fuel combustion' (10.5%), 'blender injuries' (12%), 'falling' (12%) and 'slipping and slamming doors on hands' (7.6%)

Findings from here show that 'cuts and laceration' were the main injuries common among the subjects. Other injuries prevalent are 'skin contact with hot substances', 'electric shock, 'smoke inhalation' and 'pains in some body parts' like back, neck and shoulders. This result agrees with the findings from another author [21] who have reported some of these as leading injuries among women. 'Skin contact with hot substance' is however added injuries to the ones earlier reported.

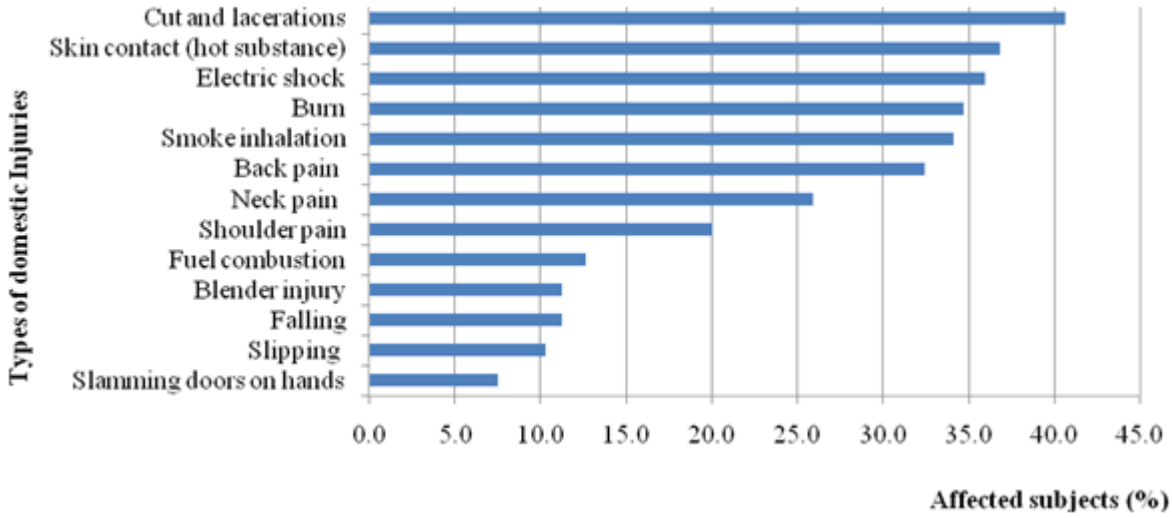

Figure 1. Reported hazards types and prevalent among women in domestic works

Causal Factors to the Reported Domestic Hazards

As shown in Figure 2, 26.5% of the subjects reported 'carelessness' as the common reasons for most of the accidents suffered at domestic work. 22.1% experienced accident due to distraction while 17.6% of the respondents mentioned 'work pressure'. Others are 'equipment failure' (14.7%), 'lack of relevant skill' (10.3%) and 8.8% could not know the actual cause of the accidents.

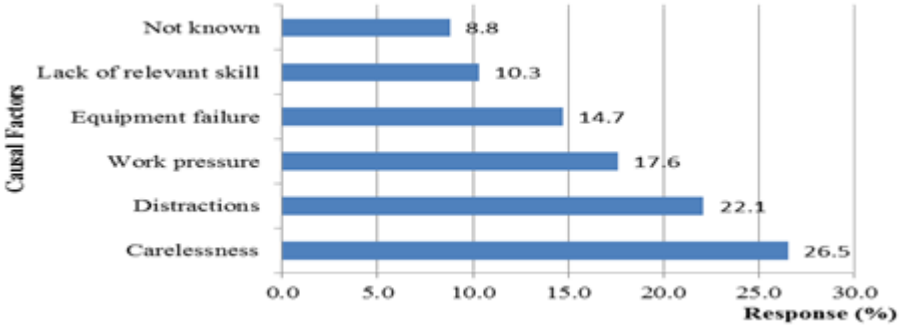

Figure 2. Reported risk factors for domestic accidents

These findings show that 'carelessness' was the major cause leading to injuries in domestic work. This is also in an agreement with the view of Mackessack-Leitch [22] who earlier mentioned human error as one of the major leading factors for home injuries. Other notable factors include 'distraction' and 'work pressure' the distractions may arise from children needing care, bell rings, phone ring and other issues that may demand some attention, most especially while cooking in the kitchen. Hazards may also arise when women have more than one work to attend to at the same time. This may lead to work pressure which may reduce the ability to work safely.

Behavioral pattern of women in domestic works

From Table 2, forty-six (46) safe behaviors attributes were measured and the calculated average rating as reported by the subjects are shown. 0-1 mark was considered 'poor safety behavior', 1.1 -2.49 grade is 'weak safety behavior', 2.5 – 2.9 marks is considered 'average safety behavior,' 3-3.9 marks is 'good safety behavior'while 4.0 marks and above is adjudged 'a very good behavior'.

Table 2. An overview of the safe behavioral pattern of the subjects in domestic works (N340)

Ref.	**Behaviour Template (Bt)**	**Average ratings (STD)**
Bt-1`	I follow all recommended safety procedures	3.4(0.9)
Bt- 2	I pay attention to proper cutting procedures	3.1 (1.1)
Bt- 3	I do not use wet towels to handle hot pots	4.1 (1.1)
Bt- 4	I clean up wet floors, spilled food or grease immediately	3.2 (1.0)
Bt- 5	I don't attempt, loads that are too heavy	2.4 (1.4)
Bt- 6	I switch off before plugging appliances into an electric outlet	3.9 (1.0)
Bt- 7	I never start an equipment until all parts are in proper places	3.0 (11.3)
Bt- 8	I follow manual when using electrical power equipment	2.2 (0.8)
Bt- 9	I use the right knife for every cutting	4.1 (0.9)
Bt-10	I don't talk while holding a knife in hand	2.0 (1.0)
Bt-11	I cut away from the body while using any knife	2.6 (1.1)
Bt-12	I use a cutting board at all times	2.6 (1.2)
Bt-13	I place knives in designated knife drawers	4.2(0.8)
Bt-14	I pick up knives by the handle only	4.2 (0.9)
Bt-15	I switched off cooking activities before attending to other matters	3.0 (1.0)
Bt-16	I remove the lids of pots slowly to avoid burns to hands or face	4.2 (0.8)
Bt-17	I place a lighted match to gas jets before turning on the gas	3.6 (1.0)
Bt-18	I know the location of fire extinguishers, know how and when to operate them	1.2 (1.3)
Bt-	I never leave utensils on the floor	3.5 (1.2)

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Bt-20	I keep all traffic areas clear of boxes, equipment, broomse.t.c	2.2 (1.3)
Bt-21	I discard all glass that is cracked	3.3 (1.4)
Bt-22	I do not place the broken glass in wastebaskets	1.5 (1.2)
Bt-23	I use ladders, not boxes or chairs, to get things from high shelves	2.8 (1.1)
Bt-24	I wear gloves while disposing of refuse	2.2 (0.9)
Bt-25	I wash and sanitize hands properly after disposing of refuse	4.0 (0.6)
Bt-26	I keep back straight when lifting object	1.5 (0.8)
Bt-27	I keep the object to lift close to the body	2.2 (1.3)
Bt-28	I bend knees before lifting any item	2.3 (1.2)
Bt-29	I lift with legs and not with the back	2.7 (1.4)
Bt-30	I call for help to lift or move heavy containers	2.6 (1.4)
Bt-31	I avoid awkward postures while lifting	2.4 (1.3)
Bt-32	I wear specific personal safety equipment when required	3.8 (1.1)
Bt-33	I don’t walk around in the house barefooted	4.0 (1.0)
Bt-34	I wear eye protection like safety goggles or masks when frying	3.9 (0.9)
Bt-35	I use respirators to protect self from inhaling harmful fumes	2.8 (1.1)
Bt-36	I am fully trained by an experienced operator before an attempt to operate any equipment	2.5 (1.2)
Bt-37	I report any equipment that is broken or does not function properly	3.0 (1.1)
Bt-38	I know where water shutoff is located	2.1 (1.0)
Bt-39	I know the location of gas shutoff	4.1 (0.6)
Bt-40	I wear gloves while doing laundry work	1.5 (2.0)
Bt-41	I don’t lift cloth above head to spread clothes over the string	1.6 (1.2)
Bt-	I use waterproof aprons and boots for the activities at laundry work	2.0 (0.8)

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Bt-43	I use pounding machine instead of manual pounding of yam	2.4 (1.4)
Bt-44	I make sure iron is facing up at all times unless it is in use	3.0 (1.1)
Bt-45	I don't use a mobile phone during food or drink or while ironing	2.6 (1.2)
Bt-46	I leave the iron to cool where children and animals cannot reach	2.2 (1.4)

0-1 = poor safe behavior, 1.1 -2.49 = weak safe behavior, 2.5 – 2.9 = average safe behavior,

3-3.9 = good safe behavior, ≥ 4 = very good safe behavior.

The pattern of behavior as revealed in Table 2 show that 21 out of the 46 attributes, representing 45.7% were rated as 'good' and/or 'very good'. Seven (7) (15.2%) were scored 'average' and the rest, 18, representing 39.1% were rated below 'average'. 'Picking up knives by the handle' and placement of same in designated drawers/places, however, score the highest mark of 4.2 (0.9) and 4.2 (0.8) respectively and were the most recognized very good safe behavior. Among all other attributes 'knowledge of the location of fire extinguishers, how and when to operate them' had the least mark of 1.2 (1.3) and was rated the highest hazard behavior among the women.

Statistical Tests results

From the table, the result shows the relationship between the marital status of the women and domestic accidents (Chi-Sq=4.323, p= 0.038) is significant ($p<0.05$). In a similar case, between the hours of doing domestic works and hazards (Chi-Sq=5.5.24, p= 0.025) is significant, meaning that the occurrences of hazards sustained in domestic tasks may have been influenced by their marital status. This result is in line with the view of Mondal [21] who has reported that housewives are more prone to domestic hazards. Work pressure is a key among the reasons why domestic hazards are higher among married women. Most married women are engaged either in full time salary or daily work to support their families. There is likelihood of exhaustion from the workplace before arriving home to pick up some waiting domestic tasks (cooking, cleaning, caring for children among others). While the unmarried may decided to delay house chores till more convenient times if she is tired, this may not be sometimes possible for the married.

Fatigue can lead to physical, mental and/or emotional symptoms. When someone is drowsy at work, coordination may be poor, it may be difficult to fully focus on the task and may not also have the required energy to pay the right attention to safety regulations connected with the task. This may lead to any degree of accidents and death may occur as a result.

Table 3. Result of statistical analysis conducted to determine the significanceof domestic accidents causal factors and women's status.

Description	Chi-Square test		Decision
	Value	Asy. Sig. (2-sided)	
Marital status and h-accd	4.323	.038	Sig.
Educational background and h-accd	3.509	.320	Not sig.
Position in the house and h-accd	2.617	.355	Not Sig.
Hours of domestic work and h-accd	5.524	.025	Sig.
Location and h-accd	1,211	.424	Not Sig.

Artificial Neural Network function for domestic works safety forecasting

Mean Square Error

The mean-square error (MSE) is a measure of the variations between values predicted by a model or a function and the actual observed values. MSE is a good measure of precision and gives insight into the short-term performance of a model. A low value of MSE is desirable with zero been an ideal case.

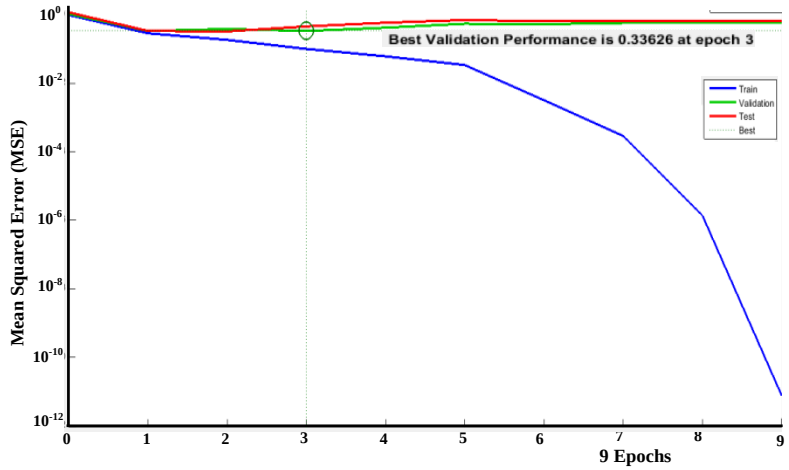

Figure 3. Training, evaluation and testing error of Feed-Forward Neural Network to Predict safety.

Mean Square Error (MSE) as shown in Figure 3, is a network performance function; it measures the network's performance according to the mean of squared errors. The result showed that the best validation performance occurred at an MSE of 0.34 indicating the system performed well given the set of data input. However, it is still a subject of future research how a lower value of MSE can be derived from the function. The results showed the lowest MSE at 0.33626, which indicates that the ANN system was able to predict the exact value according to the input factors.

Model applications

The result was generated when the input variables (1; 2; 2; 3; 4; 3; 3; 2; 2; 4; 4; 1; 4; 2; 3; 1; 4; 3; 2; 2; 1; 1; 3; 1; 3; 1; 1; 2; 2; 4; 2; 3; 3; 4; 2; 3; 1; 1; 2; 2; 3; 3; 1; 2; 1 and 2) were run in the neural network function to compute a value representing an output which is interpreted to predict the safety level. Each of the 46 variable values is a corresponding rating for the 46 stated women behaviour attributes in Table 2. Twelve (12) of the values (behaviour attributes with references Bt-1, Bt-12, Bt-16, Bt-21, Bt-22, Bt-24, Bt-26, Bt-27, Bt-37, Bt-38, Bt-43 and Bt-45) were rated '1.0'(poor safety behavior), 14 of the samples (behaviour attributes with references Bt- 2, Bt- 3, Bt- 8, Bt- 9, Bt- 14, Bt- 19, Bt- 20, Bt- 28, Bt- 29, Bt- 31, Bt- 35, Bt- 39, Bt- 40, Bt- 44 and Bt- 46) were scored '2.0' (weak safety behavior), 12 attributes (behaviour attributes with references Bt-4, Bt-6, Bt-7, Bt-15, Bt-18, Bt-23, Bt-25, Bt-32, Bt-33, Bt-36, Bt-41 and Bt-42) were allocated '3.0' marks (good safety behavior) and the rest seven behaviours (attributes with references Bt- 5, Bt- 10, Bt- 11, Bt- 13, Bt- 17, Bt- 30 and Bt- 34) were scored '4.0' (very good safety behavior). The model gives a prediction in the range between 0 and 1 to classify the level of safety in carrying out domestic tasks, '0' when the safety is considered 'Low' and '1' when safety is 'High'.

From the generated value on the interface, safety is shown to be -0.5443 while hazard value is 1.0228. This can therefore, be interpreted to mean that a woman doing her domestic duties with adoption of the behavior attributes references Bt-4, Bt-6, Bt-7, Bt-15, Bt-18, Bt-23, Bt-25, Bt-32, Bt-33, Bt-36, Bt-41, Bt-42, Bt- 5, Bt- 10, Bt- 11, Bt- 13, Bt- 17, Bt- 30 and Bt- 34 rated as '3.0', may experience injury connected to the work. This is because the hazards level (1.0223) is higher than safety (-0.5443) with the behavior.

If, therefore, safety must be enhanced, all behavioral patterns that scored below the average must be improved upon. Some of these behaviors include:

> '1) Following all recommended safety procedures, 2) paying attention to proper cutting procedures, 3) stop using wet towels to handle hot pots, 4) following manufacturer's instructions when using electrical power equipment, 5) use of the right knife for every cutting, 6) use of cutting board at all times,7) picking up knives by the handle only, 8) removing the lids of pots slowly to avoid burns to hands or face, 9) never leave utensils on the floor, 10) keeping all traffic areas clear of boxes, 11) portable equipment, mops and brooms, 12. discarding all glass that are cracked, never place broken glass in wastebaskets, 13) wearing gloves while disposing of refuse, 14) keeping back straight when lifting object, 15) keeping the object to lift close to the body 16) bending knees before lifting any item; lifting with legs and not with back, 17) avoiding awkward postures while lifting, 18) using respirators to protect self from inhaling harmful fumes, 19) reporting any equipment that is broken or does not function properly 20) knowing where water shutoff is located in the house, 21). knowing the location of gas shutoff, 22) wearing gloves while doing laundry work, 23) making sure iron is facing up at all times unless it is in use, 24) using pounding machine instead of manual pounding of yam, 25) stop using a mobile phone during food or drink or while ironing, 26). leaving the iron to cool where children and animals cannot reach'

The adjustment of the above behavior during domestic works will boost the values of safety level and reduce the hazards ratings.

Conclusion

This study has discussed the gendered division of labor and women's unfair work burdens. It reviewed the types and prevalence of injuries among women in domestic works and proposed a model using Artificial Neural Network (ANN) function to predict the safety level of women in domestic tasks. The findings affirmed that 'skin contact with hot substance' was the leading domestic hazard recorded among the studied women. Others include 'cuts and laceration', 'electric shock', 'slip, blender', 'defective appliances', 'smoke inhalation' and 'pains in some body region' in descending order. Carelessness was identified as the main risk factors among others such as 'lack of relevant skill', 'work pressure' and 'equipment failure'. Among other variables tested statistically, the relationship between 'marital status' and the occurrence of 'accidents' was significant. This is also similar to the 'hours used in domestic works' and the occurrences of 'hazards' with the significant relationship. Hence, the occurrence of hazards reported by the subjects in the domestic tasks may have been influenced by work pressure and their marital status. This is particularly significant from the results, which indicate that married women are most endangered in domestic duties, and married women performed productive labor as well. This may be the trend in many countries where the disparity between women and men is high. Women are rushed, tired, overworked, and responsible for the unremunerated care of the household and children. As African feminists are advocating for changes as much as western feminists, to push for women to be equitably treated with men, the society at large has to do more to solve this problem together. Boys must be socialized into domestic labor as are girls. Men too must not see domestic work as women's work.

The developed ANN function, from the women's safety behavioral patterns in their domestic works, is useful in all homes, most especially where women perform more of domestic work. When put into use, the function brilliantly predicted safety levels among some women in their domestic duties and reported the results in the range of 0 and 1(low risk and high risk respectively). The developed intelligent ergonomic model will enhance the safety level and reduce the hazards connected with women in domestic duties.

References

[1]. Eichler M. Albanese, P. What is household work? A critique of assumptions underlying empirical studies of housework and an alternative approach. Canadian Journal of Sociology 2007; 2(2):227-258.
[2]. Canadian Centre for Occupational Health & Safety. Food and Kitchen Hygiene. [Internet]. 2017 [cited 2018 November 10]. Available from: https://www.ccohs.ca/oshanswers/prevention/kitchen_hygiene.html
an emphasis on the healthcare sector. Industrial Health 2008; 46:523–534.
[3]. Hakim C. Key issues in women's work: female diversity and the polarization of women's employment (2nd ed.). Portland, OR: Cavendish Publishing; 2004
[4] Carin SN. Domestic workload and multiple roles; epidemiological findings on health and sickness absence in women. [Internet] 2008. [cited 2018 November 5]. Available from: Available from: http://www.diva-portal.org/smash
[5]. Mondal J. Bhattacharjee T. A review on domestic injuries among housewives. International Journal of Nursing Research and Practice 2017; 4(1): 1-11
[6]. Caruso CC, Waters TR. A review of work schedule issues and musculoskeletal disorders with 13. Anderson GM. Lorber RL. Safety 24/7: Building an incident-free culture.[Internet]. 2006 [cited 2018 October 30]. Available from: www.amazon.com
[7]. Kleppa E. Sanne B. Tell GS. Working overtime is associated with anxiety and depression: the Hordaland health study. Journal of Occupational and Environmental Medicine. 2008; 50:658–666
[8]. World Health Organization. Injuries and violence; the facts. [Internet] 2014 [cited 2017 February 16] Available from: http://apps.who.int/iris/
[9]. New York Committee for occupational safety and health. Risks facing women in construction. [Internet]. 2014 [cited 2017 June 21] Available from: http://nycosh.org/wp-content/uploads/2014/09/Women-in-Construction-final-11-8-13-2.pdf
[10]. Dinesh JB. Sushilkumar C. A Study of Occurrence of Domestic Accidents in Semi-Urban CommunityIndian J Community Med. 2008; 33(2): 104–106.
[11]. Adeyemi HO. Adejuyigbe SB. Akanbi OG. Ismaila SO. Adekoya AF. Enhanced ergonomics training; a requisite to safe body postures in manual lifting tasks. Global Journal of Researches in Industrial Engineering 2013; 13(6):37-42.
[12]. Health and Safety Executive (2003) Health and safety regulation. a short guide [Internet]. 2003 [cited 2017 June 21]. Available from: www.hse.gov.uk/pubns/hsc13.pdf
[13]. Shoshana G. Jose IG. Jose AM. Racial discrimination and household chores. institute for the study of labour [Internet] 2010 [cited 2017 October 16]. Available from: http://ftp.iza.org/dp5345.pdf
[14]. McPherson SS. Artificial intelligence: building smarter machines. Minneapolis, MN; 2018
[15]. Seyyed RK. Mohammad M. Sohrab H. Application of Artificial Neural Networks in Estimating Participation in Elections. International Journal of Information Technology, Modeling and Computing 2013; 1(3): 23-31
[16]. Oludele A. Olawale J. Neural Networks and Its Application in Engineering. [Internet] 2009 [cited 2018 April 14]. Available from: http://citeseerx.ist.psu.edu
[17]. Alphaeus TK. A progressive analysis on role of women in the socio-economic development in Sierra Leone. Journal of African Studies and Development 2014; 16 (10):190-201
[18]. Aliu IR. Adebayo A. Evaluating the influence of housing quality on urban residents' wellbeing: the case of Lagos Nigeria. International Journal of Academic Research 2010; 2(6).

[19]. Azeez T. Adeleye O. Olayiwola L. Spatial variation in residents' accessibility to land for housing development in ibadan metropolis, Oyo, State, Nigeria. Ethiopian Journal of Environmental Studies & Management 2016; 9(2):1047 – 1058
[20]. Lourakis MIA. A brief description of the Levenberg-Marquardt algorithm implemented by levmar [internet]. 2005 [cited 2018 May 12]. Available from: http://users.ics.forth.gr/~lourakis/publ/2005_levmar.pdf
[21]. Mondal J. A review on mechanical and physical hazards at domestic kitchen. International Journal of Occupational Safety and Health, 2012; 2(1): 7 – 10
[22]. Mackessack-Leitch K. Domestic accidents: their cause and prevention J R Coll Gen Pract.1978; 28(186): 38-4