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Occupational skin diseases among bricklayers and brick masons in a resource poor setting, Southwest Nigeria: prevalence and correlates – a case–control study

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ABSTRACT

Objectives Cement and most other materials used by bricklayers and brick masons for construction purposes could heighten the risk for occupational skin diseases (OSDs) which mostly include occupational contact dermatitis (OCD) and others. The activities of the bricklayers or brick masons are essentially manual as they work as artisans involving mixing sands and gravels with cement and water for building and block moulding, respectively. This can lead to a significant decline in the quality of life and psychosocial function. We determined the prevalence of OSDs and their correlates among bricklayers and brick masons.

Design This was a comparative case–control study which involved 200 bricklayers/brick masons and 200 healthy non-bricklayers/non-brick masons.

Settings This study was carried out in two local governments (LGAs) in Ogbomoso community.

Methods Respondents were selected using a multistage random sampling technique. Interviewer–administer semi-structured questionnaire was used to collect data. Data were analysed using descriptive statistics, the prevalence of OCD and other OSD were determined, χ^2 test and logistic regression were obtained. A p<0.05 was considered as statistically significant.

Results The mean age of the bricklayers/brick masons was 39.74±17.03 years, while that of the control group was 40.04±17.24 years. The prevalence of OCD was significantly higher in the bricklayers/brick masons (43.0%) than controls (5.5%), p<0.001. Other dermatological conditions were more common among the cases (8.5%) than the controls (5.0%), p=0.04. Bricklayers/brick masons not using personal protective equipment (PPE, hand gloves) were three times more likely to develop OCD compared with those who used them (OR=3.38, 95% CI 0.12 to 0.72, p=0.007). A family history of allergy is also a predictor of OCD (OR=2.69, 95% CI 1.30 to 5.60, p=0.008).

Conclusion OSD are common in bricklayers/brick masons, especially among those without the use of PPE. Regular educational programmes emphasizing the need to reduce direct contact with cement including the proper and regular use of PPE among this population group are advised.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Control inclusion makes this study a robust one compared with similar study in the past.
⇒ Patch testing usage makes the study more scientific and evidence based.
⇒ Multistage sampling method adopted makes this study minimal bias prone.
⇒ Population size limitation beyond the sample size minimised this study.
⇒ Financial constraints due to self-sponsorship limited number of patch tested subjects.

INTRODUCTION

Occupational contact dermatitis (OCD), defined as a pathological skin condition resulting from occupational exposure to some substances or chemicals has been documented to be the most common occupational skin disease in many countries.[1] The OCDs are seen in up to 6.7–10.0% of work-related diseases and can lead to a significant decline in quality of life (QoL) and psychosocial stability.[2] The worldwide incidence of OCD ranged from 0.6 to 6.7 per 10 000 person-years, and 90% of all occupational skin disorders are reported to be OCD.[3 4] About 28.7% of the OCDs reported in Brazil were found in construction workers.[5] In Nigeria, cement-associated dermatoses were common in bricklayers, and prevalence was positively related to the duration of exposure.[6] Dermatitis was

reported to be the most common (31%) cause of skin disorders in Pakistan.[7] An epidemiological survey found that up to 500 000 working hours and over 20 million pounds are lost annually, to illness, absence from work and cost of retraining in the UK as a result of OCD.[8]

Bricklayers/brick masons' contact with cement involves mixing, pouring, spreading, plastering cement concrete, asphalt, gravel and other materials, and this can increase the risk of developing irritant and/or allergic contact dermatitis.[1–3] Despite the current increases in mechanisation involving precast concrete sections, a greater proportion of these artisans are still frequently exposed to cement, particularly in low-income settings (LIS) like Nigeria.[9] The fact that these artisans are involved in hard physical labour, mostly under stressful conditions (hot, cold, wet and sunny weather), further heightens the risk of occupational skin diseases (OSDs) and hazards in them.[9 10]

A significant proportion of occupational diseases have dermatological diseases, mostly, contact dermatitis.[1 4] Others include contact urticaria, infections, pigmentary and hair follicle disorders, neoplasms, and connective tissue-associated diseases like scleroderma, telangiectasia and Raynaud's phenomenon.[11]

The clinical features of occupational contact dermatitis could be acute or chronic. Acute features include erythema, papular and bullous eruption while the chronic includes scale formation. However other symptoms include pruritus and scratch marks which could be present in acute or chronic contact dermatitis.

Differential diagnoses of occupational contact dermatitis include atopic dermatitis, irritant contact dermatitis, drug-induced photosensitivity, nummular eczema, seborrhoeic dermatitis, tinea corporis and scabies.

The high alkalinity of wet cement and its tiny content of water-soluble chromate have been documented as the offending trigger for OSDs, and this is due to the corrosive and sensitising effects of lime and chromium, respectively.[9–11] The construction industry in Nigeria is at present, the second largest, a clinical and epidemiological audit of bricklayers found cement dermatitis (CD), wear and tear dermatosis and hypersensitivity to chrome as common OSDs.[12]

Research work is still ongoing globally, regarding OSDs but literature on cement-related OSDs is still scanty hence effective preventive strategies are unavailable.[13] This comparative case–control study therefore assessed the prevalence of OSDs and their correlates among bricklayers and brick masons in Nigeria.

Objectives

1. To determine the prevalence of occupational and other skin disorders among bricklayers and brick masons in Ogbomoso, Oyo state, Nigeria.
2. To determine the predictors of occupational skin disorders and its correlates among bricklayers and brick masons in Ogbomoso, Oyo state, Nigeria.

Hypotheses

Null hypothesis

There is no difference in the occurrence of dermatitis and other skin disorders, among bricklayers and brick masons in Ogbomoso and its environs of Oyo state, Nigeria.

Alternate hypothesis

There is a difference in the occurrence of dermatitis and other skin disorders, among bricklayers and brick masons in Ogbomoso and its environs of Oyo state, Nigeria.

MATERIAL AND METHODS

Study design

This community-based comparative case–control study was conducted at Ogbomoso, Southwest Nigeria.

Settings

This study was conducted in an urban setting. 10 zones were selected from 15 zones in the Ogbomoso North and South Local government area by random sampling. 20 consenting bricklayers were chosen by balloting from 40 bricklayers that make up each zone until a total of 200 bricklayers were chosen. The samples were collected within 3 weeks. Patch testing, laboratory study which includes skin scraping and nail clips for fungal study were performed using 10% and 20% Potassium hydroxide (KOH), respectively. Data entry and analysis with discussion took place within 9 weeks.

Participants

400 (200 practicing and apprentice bricklayers and masons and 200 age and sex-matched healthy non-bricklayers/brick masons) adult participants from within the same locality took part in the study. The participants (bricklayers/brick masons/apprentices) were enrolled at the work sites where interviewing and physical examination took place in a room prepared for this purpose while the control (non bricklayers/brick masons) were mobilised within the same communities where local security meetings of the environment usually takes place weekly.

Patient and public involvement

Patients or the public were not involved in the design, or conduct, or reporting, or dissemination plans of our research.

Sample size determination

The minimum sample size was calculated using Leslie Fischer's formula and a prevalence from a similar study conducted in Nigeria.

- Qualitative outcome variable $n=Z_{\alpha}^{2}\, pq\, /d^{2}$

where n is the minimum sample size

Z_{α} is the standard normal deviate corresponding to a level of significance of 5%

p is the proportion of outcome of interest from the previous study 16.1% of the respondents had contact dermatitis[14]

q=1 p

d is the desired level of precision (usually at 5% for single proportions); d varies for single means

σ=SD deviation of the quantitative outcome of interest obtained from a previous study

$n=1.96^2\times0.161^{64}\times0.839/0.5^2$

=208

When the population is less than 10 000, the formulae that shall be used are:

$$nf=\frac{n}{1+n-1/N}$$

where nf is the desired sample size when population is less than 10 000

n is the The desired sample size when population is greater than 10 000 which equals 208

N is the the estimate of population size which is=1000 (Anecdotal evidence from the bricklayer association)

So, $nf=\frac{208}{1+208-1/1000}$

= 172.32

Non-response of the above population will be 10% of 172.32=17.23

172.32+17.23=189.55

This was approximated to 200 for a good representation of the population size.

This gave a sample size of 200 after correcting for non-response.

Inclusion criteria for cases

This included consented bricklayers, brick masons and apprentices of at least 18 years of age, who practice primarily in Ogbomoso, Oyo state, Nigeria.

Exclusion criteria for cases

Bricklayers, brick masons and bricklayer apprentices with known chronic illnesses and individuals with chronic allergies were also excluded.

Inclusion criteria for control

This included consented non-bricklayers/brick masons of at least 18 years of age, who resides primarily in Ogbomoso, Oyo state, Nigeria.

Exclusion criteria for control

Non-bricklayers/brick masons and bricklayer with known chronic illness and individual with chronic allergy were also excluded.

Sampling technique

A multistage sampling technique was used to select the respondents. Two Local Government Areas (LGAs) were selected from the five LGAs in Ogbomoso town using simple random sampling by balloting. 10 out of the 15 zones of the bricklayers and brick masons in the two selected LGAs were randomly selected through balloting, and 20 consenting bricklayers and masons were selected from each zone.

Data collection method

Data were collected using an interviewer-administered questionnaire (online supplemental table 1online supplemental file 2, 1).

Participants' weight and height were measured using a weighing scale and stadiometer, respectively, and the body mass index (BMI) was calculated using the equation, BMI=weight (kg)/height (m^2).

The examination was performed by the principal investigator (dermatologist) along with a senior registrar in dermatology who were able to distinguish between OCD and papulosquamous disorders like psoriasis, lichen planus and superficial fungal infections like tinea corporis. The patch test was conducted for participants with clinical evidence of OCD by the principal investigator supported by the research assistants according to standard protocol. The patch test was performed in a dedicated procedure room attached to the medical ward of the institution of the principal investigator.

Statistical analysis

Data generated from the study were entered into the Statistical Product and Service Solution (SPSS) V.25.0. Continuous variables were presented as means with SD and compared using the paired Student's t-test. Categorical variables were presented as proportions and percentages and compared using χ^2. Univariate analysis was used to determine the association between the variables and OCD while the multivariate model was used to determine the independent associates of occupational contact dermatitis after adjusting for confounders. Statistical significance was considered at $p<0.05$.

Ethical consideration

Permission to conduct the study was obtained from the association of bricklayer and brick masons. Written informed consent was obtained from the eligible respondents after they had been well educated on the purpose of the study. Confidentiality was also assured.

Definition of terms

In Nigeria, most of the bricklayers and brick masons are informally trained, with no formal established guidelines for training and certification. For this study, the following were defined as shown below.

Supervisors

Qualified bricklayers and brick masons who are the heads of each team and recruited other qualified bricklayers and brick masons and apprentices.

Qualified bricklayers and brick masons

Those deemed fit by their trainers to practice with little or no supervision after a variable training period and hired by the supervisors.

Apprentices

Those undergoing the informal training process.

Table 1 Socio-demographic characteristics of respondents (N=400)

Variables	Study group n=200	Controls n=200	Total N (%)	X²	df	P value
Age group (years)						
18–20	9 (4.5)	9 (4.5)	18 (4.5)	0.09	4	0.999
21–29	65 (32.5)	65 (32.5)	130 (32.5)			
30–39	37 (18.5)	35 (17.5)	72 (18.0)			
40–49	28 (14.0)	28 (14.0)	56 (14.0)			
≥50	61 (30.5)	63 (31.5)	124 (31.0)			
Mean age (in years)	39.74±17.03	40.04±17.24	39.89±17.12			
Marital status						
Married	138 (69.0)	141 (70.5)	279 (69.8)	2.69	3	0.441
Single	58 (29.0)	52 (26.0)	110 (27.5)			
Divorced	2 (1.0)	6 (3.0)	8 (2.0)			
Widower	2 (1.0)	1 (0.5)	3 (0.8)			
Religion						
Christian	135 (67.5)	165 (82.5)	300 (75.0)	12.18	2	0.002*
Islam	64 (32.0)	34 (17.0)	98 (24.5)			
Traditional	1 (0.5)	1 (0.5)	2 (0.5)			
Tribe						
Yoruba	193 (96.5)	189 (94.5)	382 (95.5)	0.93	1	0.335
Others	7 (3.5)	11 (5.5)	18 (4.5)			
Educational status						
No formal	13 (6.5)	11 (5.5)	24 (6.0)	0.42	3	0.937
Primary	71 (35.5)	71 (1.5)	142 (35.5)			
Secondary	109 (54.5)	109 (54.5)	218 (54.5)			
Tertiary	7 (3.5)	9 (4.5)	16 (4.0)			

*Statistically significant.

RESULTS

All 400 (200 cases and 200 controls) participants were males. The mean age of the bricklayers/brick masons and the controls were 39.7±17.0 years and 40.0±17.1 years, respectively, (p=0.999). About 69.0% of the cases and 70.5% of the control were married (p=0.44). 109 (54.5%) cases and 109 (54.5%) controls had secondary education (table 1).

161 (80.5%) of the cases were bricklayers and brick masons, 17 (8.5%) were apprentice and 22 (11.0%) were supervisors. A greater proportion (80%) of the cases were qualified bricklayers and masons (online supplemental figure 1).

Nature of work by greater proportions of the respondents (61.5%) were a combination of various duties of construction work. Above half of cases (51.5%) mould 51–100 blocks daily and most of the respondents had been involved in this job for 20 years and above (37.5%) (table 2).

A greater proportion of the cases compared with the controls had contact dermatitis (cases 43%; controls 5.5%, (p<0.001) and traumatic skin injury (cases 72%; controls 26.5% (p<0.001) (table 3). Occupational contact dermatitis was commoner in the upper limbs (39.0%), (p<0.001) compared with the lower limb (4.0%), (p<0.004). Fungal infections were more common in the cases (13.0%) than the controls (8.0%) (table 3).

Table 4 shows that the occurrence of OCD among respondents was associated with the frequent use of hand gloves and boots usage (p<0.001)

Table 5 shows the predictors of occupational contact dermatitis among the study group. The risk of developing contact dermatitis among study group not using gloves were 3 times more than those using hand gloves (p=0.007). Family history of allergy increased risk of developing occupational contact dermatitis by 3 times among the study group than those with no family history of allergy, (p=0.008). Personal history of allergy to belt buckle and necklace increased risk to occupational contact dermatitis by 3 and 1 times, respectively, than those with no personal history of allergy. Though these differences were not statistically significant (p=0.228 and 0.817, respectively) at 95% CI.

Table 2 Occupational profile of study group (N=200)

Variables	Study group	Freq. (%)
Job descriptions		
Bricklayers/brick masons	161	80.5
Bricklayers/brick masons apprentice	17	8.5
Bricklayers/brick masons supervisor	22	11.0
Total	200	100
Nature of work		
Brick moulding	17	8.5
Sand/cement mixing	11	5.5
Bricklaying	19	9.5
Plastering	18	9.0
Washing of instrument	12	6
All of the above	123	61.5
Total	200	100
Numbers of blocks moulded or build with per day (blocks)		
0–50	9	4.5
51–100	103	51.5
101–150	55	27.5
151–200	27	13.5
201–600	6	3.0
Total	200	100
Duration of works (years)		
1–5	43	21.5
5.1–10	42	21.0
10.1–15	28	14.0
15.1–20	12	6.0
>20	75	37.5
Total	200	100

DISCUSSION

This study determined the prevalence of OSDs among bricklayers and brick masons in Ogbomoso, Oyo state, Southwest Nigeria. The study also determined the prevalence of the common occupational dermatoses and assessed the relationship between the disease pattern and the participants' work specification.

The findings from this study show that all bricklayers and masons were males and a greater proportion of them were young and married, and majority of them had completed secondary school education. There was a predominance of bricklayers and masons relative to the supervisors and apprentices. There was a predominance of OCD among the OSDs seen among the study group. The use of personal protective equipment (PPE) had a protective effect as it reduced the incidence of the OSDs. A greater proportion of the bricklayers and masons were block moulders and had practiced the vocation for more than 20 years, and majority of them moulded between 51 and 100 blocks daily.

The all-male population pattern and the greater proportion of them being young in the vocation mirrors findings by Sarma[13] who found a mean age of 24.8 years for the bricklayers and brick masons who were all males. This study findings however are in disagreement with findings by Hansen *et al*[14] in Denmark that showed that less than 30% of construction workers were less than 50 years. Another study in the USA found a mean age of 43 years for construction workers.[15] The higher life expectancy in Denmark, USA and other developed nations compared with developing nations like India and Nigeria, could also be contributing to the younger participants in this study coupled with the relatively lower economic and educational status could have led more younger persons in low-income societies to choose the construction industry as a last resort.

Since very little or no money is paid at the commencement of apprenticeship, and the fact that remunerations, though unattractive, are mostly given on a daily basis, allow these artisans to take care of urgent and immediate family financial commitments, further encouraging the young into the vocation.[16] The mean age of the current study participants was similar to the 34.49 years found by Kashif *et al*[17] in Pakistan, but higher than the 24.8 years reported from Kolkata, India.[17]

The age group of 25–30 and 31–36 was found in a study done by Esmail and Sakwari[18] in OSDs in construction workers in Tanzania which was partially similar to the age group in the index study.

Table 3 Prevalence of occupational skin disorder respondents

Variable	Study group (n=200)	Control (n=200)	Total (n=400)	X^2	df	P value
Contact dermatitis	86 (43.0)	11 (5.5)	97 (24.3)	78.54	1	<0.001*
Traumatic skin injury	144 (72.0)	53 (26.5)	197 (49.3)	82.83	1	<0.001*
Fungal infections	26 (13.0)	16 (8.0)	42 (10.5)	2.66	1	0.141
Other skin disorders	17 (8.5)	10 (5.0)	27 (6.8)	1.96	1	0.231

Others—acne vulgaris, seborrhoeic eczema, idiopathic guttate hypomelanosis, onchodermatitis.
*Statistically significant.

Table 4 Use of personal protective equipment (gloves and boots) among respondents

Variable	Study group (n=200)	Control (n=200)	Total (n=400)	X^2	df	P value
Gloves	22 (11.0)	90 (45.0)	112 (28.0)	57.34	1	<0.001*
Frequency of use						
Always	4 (18.2)	0 (0.0)	4 (3.6)	25.58	2	<0.001*
Sometimes	4 (18.2)	0 (0.0)	4 (3.6)			
Occasionally	14 (63.6)	89 (100.0)	103 (92.8)			
Types of gloves used						
Cellophane	2 (9.1)	0 (0.0)	2 (1.8)	61.48	2	<0.001*
Thick rubber	14 (63.6)	0 (0.0)	14 (12.6)			
Woollen	6 (27.3)	89 (100.0)	95 (85.6)			
Boots	92 (46.0)	39 (19.5)	131 (32.8)	31.89	1	<0.001*
Frequency of use						
Always	39 (42.4)	0 (0.0)	39 (29.8)	53.04	2	<0.001*
Sometimes	25 (27.2)	0 (0.0)	25 (19.1)			
Occasionally	28 (30.4)	39 (100.0)	67 (51.1)			
Types of boots used						
Thick rubber	92 (100.0)	39 (100.0)	131 (100.0)			

*Statistically significant.

The presence of skin diseases in this age group could therefore be associated with significant cosmetic and psychosocial instability.[19]

The all-male pattern observed in this study mirrors findings from another study in China that found an all-male (100%) vocation but is different from another study that found a male-to-female ratio of 1.5:1. The all-male pattern in this study can, however, be attributable to the fact that the study participants were recruited from their weekly meeting where only the males gather, as against what happens at the work-site, where females are involved in carrying of sands, gravel, concrete and drawing water for mixing work. A typical construction sites still remains a man's domain, justifying Procter's description of the construction site as 'the last bastion of sexist discrimination in the workplace'.[20] Similarly, a technical report on women's occupational health and safety in New Zealand also supported the fact that bricklaying or block laying and builders were dominated by males in 98% and 99% of the study conducted on the employment status of respondents.[21]

Majority of the bricklayers had secondary school education which was adequate to ensure effective communication. The bricklayers were involved in all aspects of the job description unlike the brick masons who were not involved in bricklaying, plastering or concrete laying. This makes the bricklayers more likely to develop OSDs compared with the brick masons.[11 15 16] This study found that the majority of the participants worked every day of the week is similar to findings by Sparer *et al*[22] who reported that more than 65% of construction workers work daily for more than a month at a particular site, but in this study, participants mostly work in small non-mechanised settings, often works for days to a few weeks. A number of working days per week and the working years determine the risk for, and frequency of occupational disorder.[6 22] Over half of the artisans had been on the job continuously for more than 5 years, similar to findings that 43.7% of construction workers who worked for 8–10 hours had fewer symptoms while 75% of those that worked for more than 10 hours daily had more symptoms.[23]

Table 5 Predictors of occupational contact dermatitis

Variable	B	OR (C.I 95%)	P value
Not using glove	−1.2	3.38 (0.12 to 0.72)	0.007*
Family history of allergy	1.0	2.69 (1.30 to 5.60)	0.008*
Belt allergy	1.0	2.77 (0.50 to 14.50)	0.228
Necklace allergy	−0.2	1.25 (0.12 to 5.30)	0.817

*Statistically significant.

Injury from exposure to cement is also dependent on the daily number of blocks moulded or laid, and this is particularly significant in irritant contact dermatitis, the occurrence of which is concentration-based. The alkalinity and hygroscopic effect of cement, associated with zinc and selenium deficiency, particularly with large quantity-exposure, induce the processes that leads to cement burns and dermatitis. This has led many researchers to recommend the listing of cement as a hazardous material and environmental pollutant.[24] The higher prevalence of OSDs in bricklayers and brick masons compared with the controls attest to the occupational hazard associated with cement, similar to findings from Finland in which 42.0% of construction workers had work-related contact dermatitis.[25] This prevalence is very close to the 43% found in our study which was higher than the 38.6% reported from the UK, and the 16.9% from Germany.[26 27] In an extensive review work on contact irritant dermatitis, Patel *et al*[28] found to have a higher incidence of contact irritant dermatitis compared with contact allergic dermatitis.

This study found that non-use of hand gloves and family history of allergy are both predictors of the occurrence of OCDs in bricklayers and brick masons, this is slightly different from the observation in a previous study that stated that though cement can cause both allergic contact dermatitis and primary contact irritative dermatitis. The PPE may also favour the development of allergic contact dermatitis. This assertion was similar to a study conducted on Singaporean healthcare workers whose dermatitis were found to be related to use of latex gloves. Out of 13.7% of the Singaporean healthcare workers with adverse reactions after wearing gloves, 22.9% of those were sensitised to latex. Personal and family history of atopy was higher in sensitised workers compared with those who were not.[28]

However, it should also be borne in mind that despite the beneficial effects of PPE in reducing the frequencies of OSDs (as earlier reported and as was found in this study), the higher risk for fungal infections in hand gloves users by bricklayers/brick masons has been documented.[29–34]

Limitations

Encountered in this study included the fact that women did not get the opportunity of taking part, and this could limit a community-based study. The fact that the working schedule of most of these artisans is dependent on the availability of work, the reliability of the daily and yearly time expositions in assessing the 'duration' effect may be compromised. Similarly, not determining the association between OCD and some nutrients/mineral deficiency could have eroded the usefulness of knowing the possible confounding role of these nutrients/minerals.

CONCLUSION

Occupational contact dermatitis remains the most common occupational skin disorder in construction workers and its risk of occurrence is related to the volume and duration of exposure. It is a male-dominated trade that does not require formal training, and this, coupled with the mostly daily remunerations could be contributory to the large proportion of the young in the trade. The significance of contact with cement and its constituents in the pathogenesis of OCD is further exemplified by its higher frequency in the upper limbs than in the lower limbs.

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Contributors MGI conceived the study, participated in its design, acquisition of data, analysis and interpretation of data, also involved in drafting the manuscript. OKI, AOA and OOnin made substantial contributions to conception, design, analysis and interpretation of data, also involved in revising the manuscript critically for important intellectual content. PKU, SSO, OOlay, FOO, MMO, SOA, OOlas and OOnay participated in data interpretation and revising the manuscript critically for important intellectual content. All authors read and approved the final manuscript. The guarantor is MGI.

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Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants and was approved by Ethical Review Committee of Ladoke Akintola University of Technology (LAUTECH) Teaching Hospital, Ogbomoso Nigeria. The ethical approval number/ID was LTH/OGB/EC/2014/061. Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. All data relevant to the study are included in the article or uploaded as supplementary information.

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