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Research Article

Anatomic inquiry into burial disposal

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Abstract:

Background: A human comprises body, soul and spirit; following death, the body left behind must be disposed. Terrestrial interment is favourite amongst kinsfolks and Anatomy as a discipline has a role by way of archaeology, forensics and training. This study inquired about practices in Nigeria and specifically into body decomposition, cemeteries' potential for groundwater contamination, and gestural sign of artefacts in archaeologic auditing.

Methods: A proforma with socio-demographics and burial characteristics designed and performed in Southwestern, Nigeria. Burial depths were measured with tape after gaining consent from relations. Collation and analysis of data by statistical package for social sciences.

Results: Burial grounds of 307 were randomly explored within a year with male-to-female ratio of 3 to 2; Christianity 246(80.1%), Islam 43(14.0%), African Traditional Religions 15(4.9%) and others 3(1.0%); Diseases and old age were major causes of death and 67.1% had embalmment and delayed burial. Graves were mainly of sandy soil with mean depth 5.40 feet. Over 70% of burial vaults were uncemented and incorporation of artefacts in only 26.4%. Time of burial proved *sine qua non* to choice and mode of embalmment.

Conclusion: Largely sandy soil favoured decomposition to maceration. The significant deeper depth favoured sanitization while coffination and internment in uncemented burial vaults favoured maceration. Potential to contaminate underground water was reduced with respect to most graves sited on plain ground. Incorporation of artefacts was commoner amongst people practicing African Traditional Religions. A need to create and involve Inspectors of Anatomy in matters related to human remains is suggested.

Keywords: Human remains; Bone maceration; Ecology; Anatomy

Introduction

A living *Homo sapiens loquens* comprises body, soul and spirit. In the real sense of science, following death, what is physically left is the body which has to be disposed. The disposal can be performed by way of land (ground), water (river/sea), air (valley), cremation (and subsequent interment), cannibalism and anatomic research (dissection, prosection, cryopreservation, museum/exhibition). Land (terrestrial) disposal or inhumation is made by placing the corpse of a dead person in a vault or sepulchre constructed for that purpose or in a grave dug into the earth. Graves right from inception in most cultures of the crude ancient to modern present world are usually marked by a sign such as the pyramids of Egypt or the tholos tombs of Greece or megalithic stone dolmens, passage graves, mausoleum (from Greek *Mausōleion*, from *Mausōlos*, the name of a king of Caria_- circa 353BC - to whose tomb in Halicarnassus the name was originally applied), and cairns such as those found in Scotland and Ireland (Mark, 2009). However, aside *Homo sapiens loquens*, the culture of burial disposal had equally been observed in chimpanzees, elephants, and dogs (Mark, 2009). Hitherto, exploration of burial grounds had long been a source of archaeological specimen in documenting history and legend (Alekshin *et al.,* 1983). Besides, incorporation of artefacts or the so-called burial or grave goods as enshrined in some culture and traditions are another important source of archaeologic and forensic information. Germane to environmental sanitization towards public interest of burial disposal are some factors: body decomposition, soil characteristics, surface- and groundwater contamination, vegetation and ecology in selecting a site practically for implementing contingency or mitigation measures with recourse to various socio-cultural heritages and posthumous respect of the dead (Williams *et al.,* 2009). To this list, anatomic research in terms of bone maceration, forensic affairs, thanatology and taphonomic knowledge in conversion of matter from one energy to another are added.

Body decomposition, popularly appraised in the determination of postmortem interval (PMI) is determined by some factors (intrinsic and extrinsic) affecting the sequence of

decomposition in terrestrial, aquatic or aeriform ecology. Intrinsic factors include physical body mass, microbiotome, state of health prior to death, those taking drugs while alive and so express. Extrinsic factors (abiotic and biotic) are temperature, water (its presence/absence, hardness or softness), humidity, trauma, embalmment, wrappings and coffins, number of deposited bodies, part or region of body in contact with ground, aeration, soil acidity/alkalinity, soil type, burial depth, vault design, microbes, arthropods and mammals. Besides, postmortem interval (PMI), cause of death, nutrients within digestive tract, sex, age and weather may have some consequences on body decomposition (Stuart *et al.*, 2002). In all stages of decomposition, environmental temperature seems to be the ultimate key.

Following death, sequence of decomposition sets in: autolysis, putrefaction and decay in which proteins, fats and carbohydrates of soft tissue are initially broken down with ecologic implication in terms of environmental sanitization. Skeletons and hairs take donkey's years and are good sources of specimen for archaeologic, forensic and anatomic exploration. The approximate period involved for both wet and dry conditions was earlier demonstrated with the degree of degradation in a corpse lying on the surface for 1 week corresponding to that of one immersed in water for 2 weeks or 8 weeks for those buried in the soil (Dix and Graham, 2000). Nevertheless, the sequence of decomposition can be influenced by intrinsic and extrinsic factors as earlier alluded and exemplified by depth of burial vault in which the nearer the surface the corpse is, the more carrion animals to assault the body. Be that as it may, dry sandy (coarse-textured) soil in warm conditions will lead to mummification and clayey (fine-textured) soil is better at preventing leaching of embalming chemicals and microbiotome dispersing far from the body (Hanna and Morcey, 2008). Body decomposes faster with increasing moisture and preserved better in anaerobic than aerobic confinement; body is preserved at extreme of temperature; and decomposition occurs much faster in the presence of oxygen and insects (Fiedler and Graw, 2003). Preservation (embalmment and or mummification) markedly decelerates the degree of body decomposition compared to the bodies that are not embalmed and left to undergo natural decay; and similarly, studies at anthropology research facility (ARF) have shown that obese bodies quickly lose body mass due to liquefaction of body lipids (Mann *et al.*, 1990).

Cemeteries, being more formal, are dedicated parcels of land generally owned by municipalities, intimate or spiritual organizations and adhere to strict city, state, region or national regulations. The geoscientific evaluation of numerous cemeteries across the continents of the globe was contained in a thesis from Sydney where the effects of leachate from human decomposition in relation to surface- and groundwater contamination was highly forecasted (Dent, 2002). In view of the facts that burial grounds can serve as a source of information for historic, anatomic, ecologic. theologic, archeologic, urban planning and philosophic concerns, this study was aimed at making inquiry into the various practices of burial disposal amongst Yoruba, a fraction of the three major tribes in Nigeria. Specifically, the study investigated factors influencing body decomposition for maceration; ecological affairs on cemeteries; cemeteries' potential for groundwater contamination; and heralding of artefacts or grave goods as a gestural sign for archaeological auditing.

Body Texts

The inquiry into burial disposal was done by designing a proforma for collection of data across the 16 local government areas of Ekiti State, Southwestern Nigeria mainly occupied by the tribe called Yoruba with diverse socio-cultural heritage and religious beliefs as obtained in other regions of the country. On the proforma were two sections as shown below.

Proforma on the study

Anatomic Inquiry into Burial Disposal
Code/Serial number……
Section A: Deceased Demographic Profile
1. Age (years)……
2. Gender: □Male □Female
3. Occupation: □None/Unemployed
□Farming
□Student
□Artisan
□Business
□Civil Servant (active or retired)
□Priest/Clergy/Pastor/Imam
□Others
(specify)……
4. Religion: □African Traditions □Christianity □Islam
□Others (specify)……...
5. Cause of Death: □Old age
□Disease
□Accident/trauma
□Others
(specify)……
6. Embalmment: □Yes □No 7. Timing of burial
□Immediate □Delayed
Section B: Burial Characteristics
1. Cemetery: □Community/Town/Government burial ground
□Religion burial ground (*Church, Mosque, Traditional Shrine*)
□House burial ground (*family, personal*)
2. Cemetery potential for groundwater contamination: □Uphill □Downhill □Plain
3. Soil: □Sandy □Loamy □Clayey □Rocky (*stones, gravel, 'eguru'*)
Note: The types of soil were not pure but rather mixed with others in smaller quantities.
4. Depth of burial ground (feet)……
5. Casket/Coffin: □None
□Woody
□Metallic/glazed
6. Burial chamber: Wall cemented/tiled □Yes □No
Floor cemented/tiled □Yes □No
7. Grave goods/artefacts (within or without casket): □Yes □No □Not sure
8. Mode of chamber coverage: □Cemented/concrete □Uncemented/ordinary soil

A team akin to 'Inspectors of Anatomy' was constituted for

collection of information: including embalmers across the locality, technical staffs of health institutions, anatomists and interested fellows. Inquiry was randomly conducted across the state with consents verbally gained principally from next-of-kin and close relations. Measurement of burial depth carried out with the use of flexible metallic tape. There were difficulties in some cases in documenting artefacts/grave goods due to respective socio-cultural clandestinities. Exclusion criteria included burying of young ones (age 18years and below) as people were unwilling to give information; highly placed traditional chiefs/rulers in which visitation was abomination; and unpalatable causes of death (drowning, suicide and sacrificial execution). In a like manner, epitaph that gives the deceased's identity, the location of his/her tomb, and the date of death was not inclusive in this study for social reasons. Timing of burial was taken as: 'Immediate' (burial within 24 hours of death) and 'delayed' (burial after 24 hours). Grave goods or artefacts as either within or without the caskets where applicable were seen at the grave side or inquired from the associates and relations. Mode of coverage had to be taken at what happened as at the immediate period of burial: inquiry about what was done at the grave sides after sometimes could not be ascertained as visitation to grave yards by non-members of family connoted acts of trespassing based on the socio-cultural heritage in this locality. Data collection was on for a period of twelve months. Collation done and analyzed with IBM statistical package for social sciences (SPSS version-25). Reliability and descriptive statistics, receiver operative characteristic (ROC) curve with area under the curve (AUC), t-tests and Kendell's coefficient of concordance (KCC) were applied. All the hypotheses were tested at 0.05 level of significance within confidence interval of 95%.

Results and Discussion

Results

A total of 307 burial grounds were explored randomly across the state within a year with male 185(60.3%) to female 122(39.7%) ratio of 3 to 2. Religious belief: Christianity 246(80.1%), Islam 43(14.0%), African Traditional Religions 15(4.9%) and others 3(1.0%). Cause of death: disease 153(49.8%), old age 123(40.1%), road traffic crash 23(7.5%) and others 8(2.6%). Those who died from diseases were mainly from complications of diabetes mellitus, hypertensive heart disease, renal disease, breast tumours and other malignancies. Head injury was responsible for most death in road traffic crash with motorcycle injury topping the list. 'Others' category was from spiritual/ritual killings, undisclosed infectious lesions, sudden death, gunshots, suicide and undiagnosed lesions due to ignorance and puberty. Embalmment: 'yes' 206(67.1%) and 'no' 101(32.9%). Timing of burial: delayed 206(67.1%) and immediate 101(32.9%). The act of funeral embalmment and utility of coffin/casket were never welcome by Islamic injunction and their dead ones were being buried immediately. Age range and occupation as contained in the proforma. Age 70 and above died more of old age and complications of chronic illnesses than those younger ones who died of traumas and others.

Table 1: Demographics of age range and occupation

Variable	Value label	Number (%)
Age range (years)	18-29	16 (5.2)
	30-39	27 (8.8)
	40-49	35 (11.4)
	50-59	27 (8.8)
	60-69	38 (12.4)
	70-79	98 (31.9)
	80-89	46 (15.0)
	90-99	13 (4.2)
	≥ 100	7 (2.3)
Occupation (category)	Business	118 (38.4)
	Civil servant	66 (21.5)
	Farmer	48 (15.6)
	Artisan	32 (10.4)
	Students	17 (5.5)
	Others	13 (4.2)
	Clergy	11 (3.6)
	Unemployed	2 (0.7)

Table 2: Burial characteristics

Variable	Value Label	Number (%)
Cemetery	Religion	149 (48.6)
	House	141 (45.9)
	Community/Municipal	17 (5.5)
Potential for groundwater contamination	Uphill	35 (11.4)
	Downhill	61 (19.9)
	Plain	211 (68.7)
Soil type	Sandy (coarse-textured)	186 (60.6)
	Clayey (fine-textured)	46 (15.0)
	Rocky	41 (13.4)
	Loamy	34 (11.0)
Depth (feet)	Six	163 (53.1)
	Five	79 (25.7)
	Four	58 (18.9)
	Eight	4 (1.3)
	Seven	3 (1.0)
Casket (coffin)	Woody	258 (84.0)
	None	43 (14.0)
	Metallic/glazed	6 (2.0)
Burial vault (chamber wall)	Uncemented	219 (71.3)
	Cemented	68 (28.7)
Burial vault (chamber floor)	Uncemented	222 (72.3)
	Cemented	85 (27.7)
Grave goods (artefacts)	No	222 (72.3)
	Yes	81 (26.4)
	Not sure	4 (1.3)
Burial vault (chamber coverage)	Uncemented/ordinary soil	250 (81.4)
	Cemented/concreted	57 (18.6)

Table 3: Cross tabulation of cemetery versus cemetery potential for groundwater contamination

		Cemetery potential for groundwater contamination			
		Uphill	Downhill	Plain	Total
Cemetery	Community	1	7	9	17
	Religion	4	17	128	149
	House	30	37	74	141
Total		35	61	211	307
Chi-Square Test (interval by interval, ordinal by ordinal), p = 0.001					

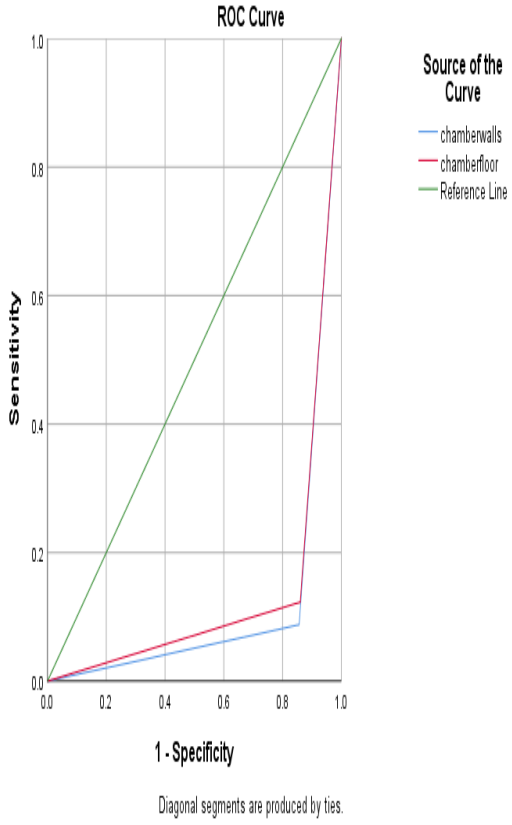

Figure 1: Burial vault using chamber coverage as a state variable

Table 4: Area under the curve for burial vault

Test result variable	Area	Standard error	Asymptomatic significance
Chamber walls	0.116	0.025	0.001
Chamber floor	0.131	0.028	0.001

Note: From Figure 1 and Table 4, even though chamber floor has a higher area under the curve (AUC) than chamber walls, the two test variables are both independent of chamber coverage with the p values of 0.001(H_0, null hypothesis rejected).

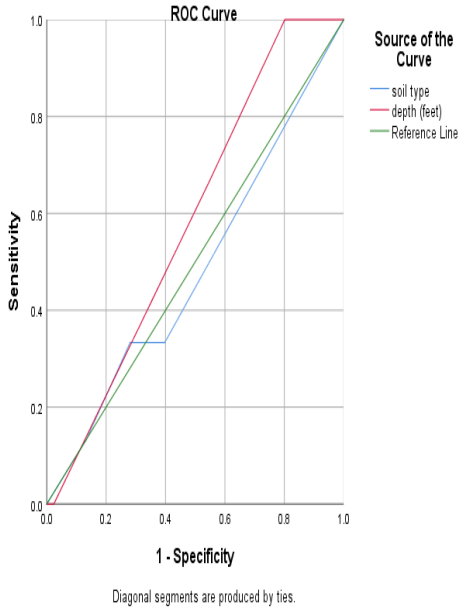

Figure 2: Soil type and chamber depth using chamber coverage as a state variable

Table 5: Area under the curve for soil type and chamber depth

Test result variable	Area	Standard error	Asymptomatic significance
Soil type	0.484	0.079	0.833
Chamber depth (feet)	0.584	0.061	0.270

Note: From Figure 2 and Table 5, it is observed that the insignificant p values show that both soil type and chamber depth are interrelated, though the depth predicted better than the mode of coverage because of higher AUC and its tilting to the left side of the diagonal line.

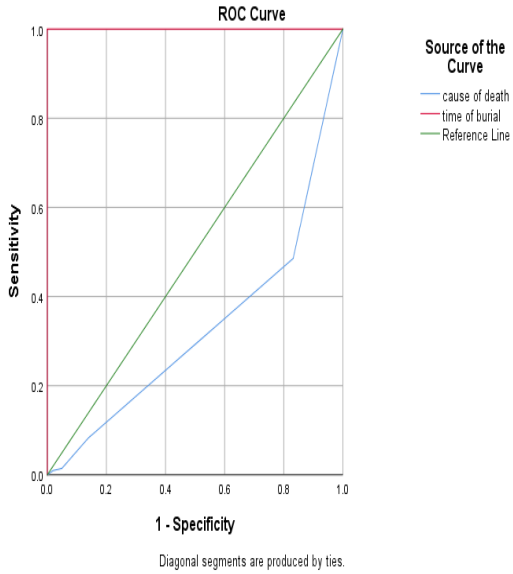

Figure 3: Cause of death and time of burial using embalmment as a state variable

Table 6: Area under the curve for cause of death and time of burial

Test result variable	Area	Standard error	Asymptomatic significance
Cause of death	0.327	0.032	0.001
Time of burial	1.000	0.000	0.001

Note: From Figure 3 and Table 6, time of burial proved sine qua non as a major determinant of embalmment (with AUC of 1. 000) than cause of death.

Table 7: Univariate analysis of the depth

One-Sample Statistics						
Variable	Number	Mean	Standard Deviation	Standard Error of Mean		
Depth (feet)	307	5.40	0.847	0.048		
One-Sample Test						
Variable	Test value = 6					
	t	dt	Significance (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
Depth (feet)	-12.393	306	0.001	-0.599	Lower	Upper
					-0.69	-0.50

Note: The mean depth is 5.40 ± 0.85 feet while the significance is 0.001. Therefore, null hypothesis is rejected and conclude that there is statistical significance between the mean depth of 5.40 feet of this study and the ordinarily posited test value of 6 feet in this locality.

Table 8: Kendall's Coefficient of Concordance (KCC) in burial characteristics

KCC	Soil type	Depth	Chamber walls	Chamber floor	Chamber coverage
Mean Rank	2.25	5.00	2.52	2.53	2.71
P value	0.001				
KCC	Time of burial	Embalmment	Cemetery	Cemetery potential for groundwater contamination	Casket/Coffin	Grave goods /Artefacts
Mean Rank	2.81	2.08	4.53	4.98	3.39	3.11
P value	0.001					

Note: All the parameters are independently useful in this anatomic inquiry since p values are less than 0.05: alternate hypothesis (H_1) is accepted. KCC Kendall's Coefficient of Concordance.

Discussion

It was a conception that there were fewer studies on the health consequences of cemeteries in scientific documentations coupled with the lack of proper siting of the many existing cemeteries with no realization of health hazards (WHO, 1998). This inquiry focused on these assertions by viewing socio-demographics of the dead ones and immediate events surrounding burial disposal from anatomic point of view on human remains. In this randomized study, the male to female ratio of 3 to 2 proved that more of males were dying than females while acknowledging all the various aetiologies of death in this locality. This avouchment could be corroborated to the reality of many more male cadavers than that of female ones in this sovereignty as established in a recent study on the sources of cadavers for medical education (Popoola, *et al.*, 2020).

Ab initio people said to be burying their dead ones around the places of abode without any reference to the cause of death until the missionaries came to establish schools, healthcare centres and churches along with some portions of land as church cemeteries for religious burial rites. This was a form of organized innovation and division of labour taking folks away from their veritable socio-cultural heritage. With all these, cemeteries were viewed as sacred portions of land for disposal and transformation of the dead ones without perils to community health. In another vein, cemeteries might have been appreciated as a place of visit for those people wanting to remember a dead person and at the same time a symbol of historic memory (Fogli, 2004). The immigrant Islamic system equally prescribed early burial rites of dead ones. These might be some of the reasons the religious cemeteries took the lead from initial house burials as established in this present study. Perhaps, these missionaries might have been doing this not only for religious purposes but to also take care of increasing number of death in unpalatable mass burial or pandemic situation as is being witnessed now globally. The community cemeteries were recently set up by the various governments for a better city ecological planning and development; maintaining health and sanitization; and taking care of judicial killings and unknown bodies which were very few as reflected to be the least (<5%) in this study.

Water naturally flows downhill along with the leachate. In health matter, contamination of surface- and groundwater from necro-leachate and decomposing embalming chemicals is another conception, most especially, amongst the low-class people dwelling in the rural setting who hinged on wells, streams, lagoons and rivers as sources of domestic water. Albeit, the cemeteries located in plain topography were the highest 211(68.7%), the ones that were located uphill 35(11.4%) and downhill 61(19.9%) altogether was still a concern in the leachates contaminating domestic water, most especially, from house cemeteries with a statistically-significant value according to Table 3. On the whole, uphill and downhill constituted 96(33.3%) as one-third of the

cemeteries that could initiate health hazards in this locality where health and sanitization might have been seen as secondary to unquestionable aged-long socio-cultural heritage and veritable religious beliefs in house burials.

Types of soil (sandy, clayey, loamy or rocky) is a substantial factor in natural decomposition of any organic matter in the cemeteries. Largely, in this study, the sandy soil (60.6%) having coarse texture allowed faster evaporation of water leading to speedier desiccation and consequential mummification. Contrarily, the lesser clayey soil (fine-textured) which retained more anaerobes that never support decomposition as such unlike aerobes was just 15.0% as an antagonistic factor to decomposition and maceration (Fiedler and Graw, 2003; Tumer *et al.*, 2013). No wonder, on these reasons, it was a recurrent phenomenon finding some bodies buried in clayey soil decades ago to be intact to a reasonable degree during incidental exhumation of clandestine and overt graves following town planning programs and road construction. There have been more dramatic changes related to decomposition in loamy and rocky soils during these community planning exercises when the bony and other human remains were gainfully studied in anatomy museums. Nevertheless, clayey soil is better at preventing chemicals, microorganisms and viruses dispersing far from the cemetery meaning that in this study 46 (15.0%) of clayey soil seemed advantageous in containment of degrading products from embalming chemicals and necro-leachate, in a way, sanitizing the environment (Hanna and Moyce, 2008).

The depth of burial ground plays an integral part in body decomposition and the deeper the better for environmental sanitization. Majority of the bodies were buried 6 feet deep and more which might suppress decomposition (Table 2) while those buried less than this value might support skeletonization which is useful in bone maceration (Mann and Bass, 1990). The univariate analysis of the depth (Table 7) has rightly proven the statistical significance between the mean depth of 5.40 feet of this study and the ordinarily posited test value of 6 feet in this locality. However, bodies buried in shallower depths might be sources of nutrient to biological agent like insects, maggots and other detritivorous animals: the nearer to the surface the body is, the more carrion animals to attack the body.

Coffinated bodies, by and large, are considered to decompose faster when compared to uncoffinated ones in the soil thereby promoting decomposition processes of the body (Hanna and Moyce, 2008). Christians believe in the use of coffins while this is said to be abomination in Islamic injunction. Majority of the bodies 258 (84.0%) in this study were interred with wooden caskets/coffins which might not remain airtight for long. One would then have inferred that bodies belonging to the Christians (with coffins) did decompose faster than that from Islamic world (without coffins), but other factors: embalmment, anaerobes in deeper depths and cementing of burial vaults might be antagonistic factors to faster decomposition amongst Christian burials. As precautionary addendum to health hazards, the deeper depth accustomed in Christianity seemed to be advantageous towards sanitization than shallow depth of Islam which was tending towards faster skeletonization for bone maceration.

Before now, burial vaults were reinforced to ward off grave robbers, otherwise christened body snatchers, from accessing the bodies and the valuables within the caskets but presently and more importantly in preventing collapse of chamber walls using cement-based concrete or other solid materials. Besides, concrete vaults are observed to prevent vulnerability to external influence of scavengers that speed up process of decomposition; and to aiding identification and allotment of graves apart from making vaults air- and perhaps water-tight. There was paucity of documentations on the effects of burial vault design on body decomposition both in literature and web save from the fact that with increasing moisture within confinement of vault, body might decompose faster after ruling out other major factors (Fiedler and Graw, 2003). Nevertheless, in this study, more than 70% of the graves were either not cemented or covered with concrete slabs aiding decomposition activities of scavengers where plentifully available. In retrospect, the larger uncemented vaults might be creating more rooms for skeletonization of bones for anthropologic studies and forensic evaluations after ruling out other factor so expressed. The practice of incorporating grave goods was not too popular in this locality thereby discouraging grave robbers looking for valuables. However, grave goods (made of metals, woods, stones and plastics) as observed in this study were incorporated more into very few bodies being buried in African Traditional system for future identification and spiritual aggrandizement (Table 2).

Comparison of vaults parameters (Figure 1 and Table 4) showed that neither the walls nor the floor were depending on the coverage: they were all independent with p-values less than 0.05. Mausoleum which was usually part of cover slabs might have nothing significant with either the walls or floor. However, where applicable, coverage and mausoleum might be viewed by Inspector of Anatomy (IOA) as a mere sign of identification with no string attached than historical corroboration. Contrarily, chamber depth and types of soil (Figure 2 and Table 5) were interdependent using coverage as state value with areas under the curve (AUC) of 0.584 and 0.484 respectively and p-values greater than 0.05. In another vein, time of burial (AUC of 1.000) proved *sine qua non* to the choice and mode of embalmment while comparing with cause of death (AUC of 0.327) (Figure 3, Table 6). No wonder, the quick and immediate burial rites in Islamic injunction might need no embalmment than watchful waiting since the bodies would still be within the processes of autolysis and early putrefaction of decomposition.

Statistical analysis of all burial characteristics (Table 8) showed that Kendall's Coefficient of Concordance (KCC) values were significantly less than 0.05. The interpretation was that all the various parameters were independently explaining the qualitative and quantitative analyses of the characteristics in assessing the unparalleled significance of Anatomy and extended affairs for Inspectors of Anatomy,

primarily involved in monitoring and regulating the use of human remains for teaching and research to participate in body disposal: terrestrial burial, aquatic burial, aeriform burial or cremation affairs (Pillay *et al.*, 2017).

Conclusion

In terms of soil type, sandy soil which favoured external influence of scavengers in debriding soft tissues for maceration was most common compared to others. As for the depth, the deeper, the less the decomposition which seemed to be the order in this study. The utility of woody coffins embodying organic matter is much more prone to decomposition than unyielding inorganic metallic/glazed coffins along with the uncoffinated bodies were in favour of faster decomposition to maceration. It was a fact established in this study that very many people practiced the idea of interment in uncemented burial vaults favouring moisture and scavengers towards maceration. Patronage of well-planned modern-day community cemeteries was very low (5.5%) compared to aged-long religion (48.6%) and house (45.9%) cemeteries with consequential health hazards from leachates. One-third of the cemeteries (uphill and downhill) had potential to contaminate the domestic sources of water: wells, streams, rivers and lagoons as potable water not readily feasible from the apocryphal governmental logistics. Incorporation of grave goods was only popular amongst African Traditional Religions which were very few but might be a pointer to their mostly-sited clandestine graves that could be detected incidentally during future community planning and enhancing archeological auditing. Altogether, it is heretofore advocated, there is need for the government in this part of the globe to join the rest of the world in establishing offices of Inspectors of Anatomy to be part of environmental planning in matters related to human remains and health hazards prevention.

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Ethical Approval: Duly approved by ethical and clearance committee of the institution.

Informed Consent: Consent was verbal and not written.

Contributions: The study was solely designed by SOP based on the prevailing circumstances on tissue preservation following the discovery of human remains while constructing new roads and other community development programs in Nigeria. Besides, SOP contributed immensely in all aspects of the study. OOE contributed in data collection across the state and discussion. WOB contributed in data collection and discussion. AJO contributed solely on data collection.

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