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*Short communication*

## Sources of Cadaver for Anatomic Sciences in an Evolving Medical Institution

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### ABSTRACT

The concept of dissecting human body revolutionized Anatomy as a sacred discipline. Evaluating sources of cadaver adds values to care of human remains with due respect to body donors for their magnanimous and selfless act in furtherance of medical education and research. This study aimed at bridging communication gap in getting the rightful cadavers for anatomic education with specific objectives addressing the challenges involved. The department's Cadaver Registry contained: date and source of cadaver, gender, race, likely age, cause of death, autopsy report, type of embalment, mode of release, financial expenditure and mode of disposal. Data were subjected to simple statistical analysis while Kendall's Coefficient of Concordance was adopted for test of significance. Forty-one adult cadavers procured from five mortuaries were analysed with male to female ratio of 13 to 1 while student to cadaver ratio was 5 to 1. Unclaimed body dominated cause of death with 68.3% while the rest was armed-robbery. Autopsy was earlier performed on 9.8% of cadaver before acquisition. Undisclosed payment transpired on 80.5% before release from provincial mortuaries. Tests of significance amongst the characteristics were statistically-significant proven the itemized factors to be independent. Elucidative programmes were identified in checking the strong socio-cultural heritage against whole body bequeaths to acquire rightful cadavers. Main sources were from unclaimed body and legally executed criminals. Gender and student to cadaver ratios were promising for anatomic utilization. The proposed amendment on old anatomic act in Nigeria should be sagely incorporated with whole body bequeath affairs.

**Keywords:** *Dissection, Cadaver sources, Challenges, Research*

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### INTRODUCTION

Evaluating sources of cadaver adds values to care of human remains with due respect to body donors for their magnanimous and selfless act in furtherance of medical education, dissection, prosection, diagnostic, therapeutic, exhibition and research. Knowledge of anatomy, the oldest subject in medical institution was undisputedly originally ascribed to the ancient Egypt (circa 1600 BC) as exemplified in a treatise by [Edwin Smith Surgical Papyrus](#). The Greeks forged ahead (circa 500 BC) with Alcmaeon, Acron, Pausanias and Empedocles dissecting animals and thereafter equating findings to humans as collated in *Hippocratic Corpus* (Jones and Whitaker, 2016). Equally, at about 480 BC, Aristotle and some others popularized comparative anatomy by dissection. Legally convicted and executed criminals were utilized for dissection in Alexandria school established about 300 BC (Jones and Whitaker, 2016). The chronicle of cadaver acquisition for anatomy dissection had continued unpalatably right from the use of sacrificial victims to the modern-day use

of computer and other sophisticated tools (Persaud *et al.*, 2014). Illegal exhumations of human bodies were practiced in the past in order to make available specimen for dissection and research. This act was termed 'grave-robbing or body snatching' (circa 1600-1700 CE). Besides, the past criminality in provision of cadavers was very high in the sense that people were killing and selling fellow humans for anatomic education. Deterrent examples were the notable stories surrounding Burke and Hare in Edinburg, and that of London Burkers: Burke, Hare, Bishop, May and Williams (London, 2017). Burke and Hare managed a boarding house system where lodgers were later being murdered and betrayed to anatomists for currency until they were apprehended and at last Burke was openly executed, dissected and exhibited. Bishop, May and Williams were body snatchers who were also apprehended following the killing of three male teenagers in London; and finally May and Williams were equally executed the way of Burke, hence, *London Burkers*.

As part of the quests to fortifying professionalism in anatomy, Shaikh alluded to some ethical issues surrounding

the usage of human body for dissection, training and research; and distinctly affirmed the principle of autonomy as a right of every individual on which bequeathment should be consented or resisted after death (Shaikh, 2015). In 1830-1833CE, efforts were made to curb the criminal act of grave robbing; Massachusetts set a pace for the first time in the legally usance of unclaimed bodies in anatomy dissection and research, thereby curbing illegal murdering for provision of adequate and rightful cadavers (Garment, 2007). Cadaver dissection is a paradigm in medical training, hence, the ‘first teacher and the first patient’ in medical institution. In view of the fact that there is really no perfect alternative to human cadaver, the limitation in acquiring human cadavers coupled with the difficulty in getting enough makes some institutions result to the use of synthetic cadavers. Besides, only a very few medical schools have artificial cadavers for simulation and dissection purposes. Albeit, with advancement in science and technology, the US medical institutions conducted a survey in 2013 that obviously revealed the continual use of real human cadavers as against total dependency on synthetic and digital models (HuffPost, 2015). There were lots of limitations creating communication gaps in acquiring human remains for anatomic education between developed and developing countries. In Nigeria, body donation is virtually not practised due to strong age-long socio-cultural heritage and veritable religious beliefs. This innovative inquisitional study aimed at bridging communication gaps in getting the rightful cadavers for anatomic education. Specifically, the study was set to analyze the sources of human remains; determine gender pattern of acquired cadavers and evaluate challenges which were often overlooked in obtaining rightful cadavers.

**MATERIALS AND METHODS**

**Study location:** The Department of Anatomy’s Cadaver Registry, Ekiti State University, Ado-Ekiti, Nigeria was the source of information for this study between 2014 and 2017. Ekiti is a homogeneous state located in the south-western part of Nigeria [Density is 380/km<sup>2</sup> (980/sqm) and Area occupied is 6,353km<sup>2</sup> (2,453sqm) of 7°40'N 5°15'E] with 16 local government areas having population of 2,398,957 out of Nigeria population of 140, 431,790 as at 2006 census (National, 2015). Male to female ratio is about equal with age group 0-14 as 887,335; 15-64 as 1,425,279 and 65+ as 86,343. Main occupation is farming.

**Data collection:** The registry contained the following: date of procurement, source of cadaver, gender, race, likely age, cause of death, autopsy report, type of embalming, mode of release, payment for the release and mode of disposal. Data collated and entered into Statistical Package for Social Sciences (IBM SPSS version 25) for analysis using simple means and frequency, and Kendall’s Coefficient of Concordance (KCC).

**Ethical consideration:** Approval was obtained from the concerned Ethics and Research Committee, College of Medicine, Ekiti State University.

**RESULTS**

The Cadaver Registry of the department contained the list of cadavers from years 2014 to 2017. There were 41 cadavers procured from the mortuary of five hospitals. All were adults of black race and had the usual method of embalmmnt with formalin as the fundamental ingredient.. They were all legally released for medical education by the various institutions bearing the mortuaries. Other useful information was contained in Table 1.

**Table 1:**  
**Abstraction from Cadaver Registry (n=41)**

<b>Parameter</b>	
<b>Year of procurement</b>	<b>Frequency (%)</b>
2014	15 (36.6)
2015	14 (34.1)
2016	2 (4.9)
2017	10 (24.4)
<b>Source of cadaver</b>	<b>Frequency (%)</b>
OAUTHC	12 (29.3)
EKSUTH	8 (19.5)
SHAI	8 (19.5)
UITH	7 (17.1)
GHO	6 (14.6)
<b>Gender</b>	<b>Frequency (%)</b>
Male	38 (92.7)
Female	3 (7.3)
<b>Cause of death</b>	<b>Frequency (%)</b>
Unclaimed	28 (68.3)
Robbery	13 (31.7)
<b>Autopsy</b>	<b>Frequency (%)</b>
No	37 (90.2)
Yes	4 (9.8)
<b>Cost of procurement</b>	<b>Frequency (%)</b>
Fee	33 (80.5)
Free	8 (19.5)
<b>Non-parametric quantification</b>	<b>Mean Rank</b> (Kendall’s W = 0.001)
Source	3.19
Gender	1.77
Cause of death	3.17
Autopsy	1.87
<b>Issue on procurement</b>	<b>Mean Rank</b> (Kendall’s W = 0.001)
Date of procurement	1.76
Cost of procurement	1.24

**Key:**  
 OAUTHC-Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife, Nigeria  
 EKSUTH- Ekiti State University Teaching Hospital, Ado-Ekiti, Nigeria  
 SHAI- State Hospital, Adeoyo, Ibadan, Nigeria  
 UITH- University of Ilorin Teaching Hospital, Ilorin, Nigeria  
 GHO- General Hospital, Osogbo, Nigeria

There was no female armed-robber. Cadaver male to female ratio was approximately 13 to 1. The unclaimed 28 bodies included: 4 from road traffic injury, 2 from burns and 3 from undisclosed diseases. Ratio of robber to unclaimed bodies was approximately 1 to 2.

The autopsied cadavers had partial post-mortem examination but fully intact musculoskeletal system along with the head and neck save for the little disruption of thoracic and abdominal organs, though none were eviscerated. Actual cost of procurement (designated for preservation) was not stated but the ones from the affiliated teaching hospital (EKSUTH) were said to be freely released. The total number of medical students admitted per academic year was 45 to 50 in the past four years bringing the number of cadaver made available from the whole 41 cadavers to approximately 10 per year meaning that at least there would have been average of 5 students to a cadaver in the anatomic dissection hall. The collection of detritus and muddled bodies after finishing with the dissection was being disposed in the departmental burial ground for biological type of bone maceration on the whole meant for the museum.

Table 2 depicted the association among source of cadaver, cadaver gender, cause of death and autopsy report to be independent by rejecting the null hypothesis based on the p-value (0.001) of a non-parametric Kendall's Coefficient of Internal Consistency at 95% Confident Interval. Equally, same association existed between date of procurement and possible financial transaction with p-value of 0.001 (Table 3).

## DISCUSSION

It is generally believed that without the Cadaver, medical education would come to a standstill as an unscripted fact. Ekiti State University medical school was able to acquire cadavers from neighbouring states along with few within the state. Hitherto, the teaching hospital (upgraded from the previous state specialist hospital) was never used to the culture of cadaver donation or procurement. In 2016, only 2 cadavers were acquired from the EKSUTH's mortuary. People, in this locality might have sensed the use of unclaimed human remains in the department of anatomy and had to prompt up action to getting their dead ones out of the hospital at all cost. The two cadavers obtained in the year 2016 included one robber and an unclaimed body from another suspected criminal act.

Results from this study indicate that EKSU medical school is being assisted by the provincial states with cadavers for medical education. The good gesture seems to be based on mutual understanding apart from the fact that those other states bearing mortuaries are more populated and more developed than the relatively young Ekiti State. Of all the sources listed, Obafemi Awolowo University Teaching Hospitals Complex (OAUTHC) is the closest to EKSUTH. Apart from closeness in distance, OAUTHC is strategically located very close to a major highway connecting the southern and northern parts of Nigeria. The high volume of vehicular movements and concomitant high rate of road traffic crashes may be responsible for higher numbers of unclaimed bodies which eventually are being released to centres seeking bodies for dissections.

This study quite agreed with a multi-centered work across different countries which concluded that provision, sourcing and procedure of acquiring cadavers were different from one country to another, likewise among medical institutions within a country (Biasutto et al., 2014). In this present study, the

student to cadaver ratio of 5 to 1 was good for a group dissection, affording students to develop a host of skills that were increasingly important in the professional world with active participation (Mammix and Neale, 2015). This was unlike a study in India with 12-14 students to a cadaver in which only 2-3 students were actually actively carrying out the dissection exercise while others were busying playing (Kumaran, 2016). One could then make an inference that the more the students to a cadaver, the more the level of frivolousness. Consequently, 2-3 out of 5 students in our own dissecting table may choose surgery as their future career in continuity of dissection going by the popular saying of William Hunter: anatomy is the basis of surgery.

Male cadavers were more and all the armed robbers were males supporting the fact that males are more into criminality than females. However, the reduced number of female cadaver might have had adverse impact on medical students in understanding the anatomy of the females through the compulsory exercise of dissection. The situation in our university seemed to be better than that of the Nigerian Premier University of Ibadan (UI) with cadaveric male to female ratio of 13 to 1 unlike 8 to 1 in our present study in Ekiti State University (EKSU) (Osuaquwu et al., 2004). Provision of computer gadgets and other substitutes to appreciate female anatomic structures as suggested for UI Medical School would, of course, be more of addendum in Ekiti. Body donation programme, if encouraged and appreciated in Nigeria should be able to take care of this limitations in getting female cadavers. Albeit the literature and web seemed to be silent on the gender ratio of cadavers, the ratio may not be important in most developed world where body donation is practised by both sexes towards enriching anatomic science laboratories and museums with rightful cadavers.

The source of cadavers was more from unclaimed bodies that were said to have died from road traffic injuries, burns, mentally-ill and undisclosed illnesses. Amongst these categories were the female cadavers. The hazard of receiving unclaimed bodies in these days of deadly contagious conditions of Human immunodeficiency virus (HIV), Ebola, Monkey virus, Lassa fevers amongst others without recourse to medical history calls for concern. The unchecked bodies might have died of any of these illnesses; concealed by relations and peradventure found their ways to the anatomy arena (Biasutto et al., 2014). Cadavers from banditry/robbery to unclaimed body were more (4: 1) in a study conducted in more populated and bigger Oyo State compared to that of the present study (1: 2) carried out in less populated and smaller Ekiti State of which the criminal acts were less (Osuaquwu et al., 2004). This is to prove that in a society where there are reduced cases of executed criminals and unclaimed bodies, nevertheless bequeathment may be the order of legitimate cadaver source for anatomic science education (Saritha et al., 2014).

The pressing need for cadaver which was not adequate was the main reason of accepting few (9.8%) partially autopsied bodies for anatomic education. Elaborate programme that will suppress the socio-cultural and beliefs of our people in refusing whole body donation may have to be well-established to enhance body donation for medical education. It is of note

procurement of cadavers of younger age or underage may be very difficult because of denial of parental or guardian consent. Parents that were not even agreeing to bequeathment on socio-cultural heritage and beliefs would definitely refuse the 'anatomic gifts' of the dead children who might have died usually from unpalatable circumstances. All the cadavers were of black race and there was really no need in procuring from foreign white race in which the cost of importation might be too expensive for a limited health-resource country like ours. The best answer to shortage of cadaver is espousal of bequeathment over our strong socio-cultural and veritable religious beliefs. Cadaver final place of rest might be another issue directly or indirectly linked to socio-cultural and religious beliefs. The way forwards: after finishing with dissection the (muddled dissected remains and detritus) could be tightly packaged and ceremonially handed over to the relations for burial/cremation disposal which might appear as if the bodies had passed through some investigative stages. Acceptance of funeral culture in the society in the absence of physical body of the cadaver and total respect of ethics for cadavers in the perceived anatomy ceremonial ground or auditorium is to be considered constituents of the options for whole body bequeathment that can be explored as being canvassed by Shaikh (2015).

Cadavers could be sourced from anywhere in this modern age by acknowledging ethics and sovereign laws of the country. This study identified elucidative programme as a way-out in checking the strong religious and socio-cultural heritage against whole body bequeathment to bridge the communication gaps of getting the rightful cadavers. This innovative study had procurement of cadavers mainly from provincial centres having no vacancy in keeping many unclaimed cadavers for long, thereby calling for upgrading of Nigerian mortuaries to the global best practices. Gender pattern and student to cadaver ratios were promising for anatomic education and researches and this should be kept up and embraced by other evolving centres alike. Current proposal by Anatomical Society of Nigeria (ASN) on amendment of old anatomic act in Nigeria should be fully incorporated with whole body bequeathment affairs

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