

The Nigerian Twin and Sibling Registry

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Twin studies of Africans have been scarce although Africans have shown the highest twin birth rate in the world. As a parallel study of the South Korean Twin Registry, the Nigerian Twin and Sibling Registry (NTSR) was developed to understand causal influences on the development of cognitive abilities, personality, and mental health among Nigerians. Currently, 1,134 twins and 404 full- and half-siblings have been registered with NTSR. This article describes research background, goals, major recruitment strategies, measures, and future directions of the NTSR.

■ **Keywords:** Nigeria, African twins, siblings, cognitive abilities, mental health, personality

General Research Background and Objectives

Africans have been under-represented in twin studies although Africans are known to have the highest dizygotic (DZ) twin birth rate in human populations (Bulmer, 1970; MacGillivray, 1986). The naturally conceived DZ twin birth rate has been reported to be as high as 49 pairs per thousand births in Africa, while it has been reported to be 8.8 pairs in Europeans, and 2.3 pairs among East Asians (Bulmer, 1970; MacGillivray, 1986). Twin studies of Africans are important because as the ancestral group of all human populations, Africans have higher levels of genetic diversity than do any other human populations (Campbell & Tishkoff, 2008), which can provide us a rich resource to unravel causal genetic and environmental influences on rare as well as common human diseases and related traits. Also, the results of African twin studies may offer novel insights into the development of prevention, intervention, and treatment strategies for health and behavioral problems for those who live in extremely disadvantaged environments in industrialized nations as well as for Africans.

The Nigerian Twin and Sibling Registry (NTSR) was initiated by the first author (Yoon-Mi Hur) in 2010 as a registry parallel to the South Korean Twin Registry in terms of age of the subjects. Nigeria comprises 36 states and its Federal Capital Territory (FCT), Abuja. Located in western Africa, Nigeria is the most populous country (the estimated population size as of 2012 = approximately 170 million) in Africa, and has shown to have the highest DZ twin birth

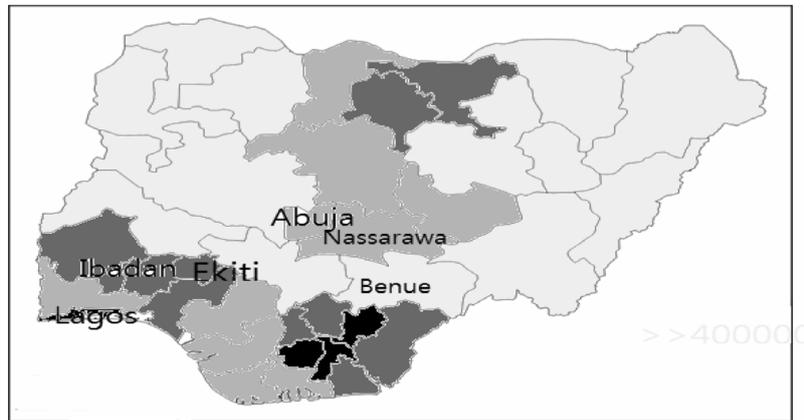
rate in the world (MacGillivray, 1986). The vast majority of people in Nigeria are those of African origin (>99%), and accounts for over half of West Africa's population and about 18% of the total population in Africa. Although English is the official language of Nigeria and widely used for education, indigenous languages still remain and are spoken, especially among those living in rural areas.

General living conditions in Nigeria are poor. Only approximately half the population has access to potable water, electricity, and appropriate sanitation (Country Profile-Nigeria, 2008). Co-twin death is common due to a high rate of infant mortality resulting from poor obstetric practice and pediatric care. However, because people and government officials in Nigeria are generally very cooperative once researchers have a rapport with people, the feasibility of establishment and maintenance of a large scale, population-based registry in Nigeria is very high.

The primary goal of the NTSR is to investigate causal influences on the development of cognitive abilities, personality, and mental health among Nigerian children and adolescents. Accomplishing this goal can lead us to determine optimal strategies for how to improve cognitive

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**FIGURE 1**

Major data collection sites of Nigerian Twin and Sibling Registry in the population density map of Nigeria. Note: Darker areas represent more populous regions.

abilities and mental health of Nigerians. Currently, we attempt to attain this goal by comparing genetic and environmental factors and gene-environment interaction processes between South Korean and Nigerian twins using molecular and quantitative genetic analysis methods. In the NTSR, we recruit full- and paternal half-siblings as well as twins. Because many Muslim in Nigeria still practice polygamy, paternal half-siblings are relatively easily available in Nigeria. In conjunction with twins, the full- and half-siblings are used to investigate paternal and maternal effects and to examine whether twins are comparable to singletons in traits under study. These siblings can also serve as additional resources for linkage and association studies to identify genes for health and behavioral problems.

Target Samples and Regions

The target samples of the NTSR are school-aged twins and siblings. As Nigeria provides free, government-supported education, public schools in Nigeria are good resources to identify twins. The education system in Nigeria consists of 6 years of primary school, 3 years of junior secondary school, 3 years of senior secondary school, and 4 years of university education leading to a bachelor's degree. We are recruiting full- and paternal half-sibling pairs who attend the same schools where twins are enrolled. This recruitment strategy enables us to approximately match full- and half-siblings with twins in terms of age, parental socio-economic status, and school and neighborhood environmental factors.

Major sites for the data collection include, but are not limited to, Abuja, Lagos, and Ibadan (see Figure 1). Abuja (approximate estimate of the population size = 1.6 million) was chosen because government departments that can provide information and permissions to conduct research are easily accessible in Abuja. Also, residents of this city represent relatively well the whole Nigerian population, as the population of the city comprises of many immigrants from

other parts of the country. Lagos and Ibadan were selected because they are the two largest, most populous cities (Lagos = 11.4 million, Ibadan = 3.3 million) in Nigeria and because people in these two cities are predominantly descended from the Yoruba tribe who are well known to have high twin birth rates.

Recruitment Procedures

Twins and siblings in the NTSR are recruited from junior and senior secondary public schools in target cities. The first author visited Universal and Secondary Education Boards in Nigeria and obtained information about schools (districts, contact information, enrollment size for each school, and so on) in cities and permissions to conduct research on twins and siblings enrolled in schools. With the letters of permission, we contact principals of schools (typically, enrollment size >500 students) and make inquiries about twins and siblings. When school principals inform us that they have twins and siblings, we visit the schools and administer tests to twins and siblings in a library or classroom. Typically one or two research assistants are assigned to each testing room to help twins and siblings to complete questionnaires and cognitive ability tests. Teachers are also invited to help with the administration of the tests. Written informed consent is obtained from all participants and/or their guardians.

Current Sample and Zygosity Assignment

Table 1 provides the number of twins and siblings registered with the NTSR as of 2012. In total, 1,538 subjects have been registered. These subjects were collected mainly from 42 public schools in the six administrative areas in Abuja and from schools located in neighboring states, including Ekiti, Nassarawa, and Benue states (see Figure 1). Of these, 1,134 individuals represent twins, and 404 individuals, full- and half-siblings. Opposite-sex twins are automatically assigned to DZ twins. Zygosity diagnosis of the same-sex twins is still

TABLE 1**Sample of Nigerian Twin and Sibling Registry as of 2012**

	MZ	DZ	Co-twin missing	Zygosity unknown	Full-siblings	Half-siblings ^a	Total
N (individual)	242	444	282	166	369	35	1,538
Mean (SD) age in years	15.9 (2.6)	15.1 (2.5)	16.2 (2.5)	15.1 (2.5)	16.8 (1.9)	17.8 (1.8)	15.8 (2.6)
M:F (%)	45:55	47:53	30:70	45:55	47:53	49:51	43:57

Note: ^a paternal half-siblings. MZ = monozygotic twins, DZ = dizygotic twins.

ongoing. Zygosity of the same-sex twins is determined by analysis of DNA (15 micro-satellite markers and amelogenin marker) extracted from twins' saliva or buccal sample. We also give twins three self-report questions about zygosity to compare them with the results of DNA analysis in the future.

Measures

To facilitate comparison between Nigerians and South Koreans, we attempt to employ widely used measures. However, selection of the measures appropriate for African culture is also an important issue. Thus, before we choose the measures, we discuss the items in the instruments with university or graduate level students in Nigeria. Some of the measures we give twins and siblings are listed in Hur et al. (2013), which describes the South Korean Twin Registry. We are currently making efforts to investigate psychometric properties of the measures in Nigerians and refine items of the measures to incorporate Nigerian culture, languages, and environments.

Future Directions

In the future, we plan to extend our study to include primary school twins and siblings and their parents for further investigation of the developmental trajectory of cognitive abilities, personality, and mental health among Nigerians. We will also make special efforts to conduct longitudinal follow-up studies. For this purpose, we maintain contact information about our subjects and their parents.

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