Demographic Analysis of a Laboratory Cadaver Population

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RÉSUMÉ

Il s'agit ici d'une analyse démographique d'un ensemble de cadavres provenant du Java Central et de la région de Jogjagarta. Cette étude a été faite au département d'anatomie du collège médical de Mada, Université Jogjakarta, en Indonésie. La population cadavérique en question comprenait 390 sujets dont 253 mâles et 137 femelles. L'article nous donne la longévité de ce groupe, les causes de la mort et le statut économique, de leur vivant.

PURPOSE

Since the beginning of 1950 until the end of 1962 the Laboratory of Anatomy, Gadjah Mada University College of Medicine, Jogjakarta, Indonesia, had received 390 cadavers from various institutions in Central Java. This study is an attempt to investigate trends exhibited by the cadaver population in the length of life and diseases suffered at the time of death, and to compare them with other populations.*

* We are grateful to the staff of the Department of Anatomy, Gadjah Mada University College of Medicine, especially Dr. H. Prastowo Mardjikoen and Dr. Soemiati Achmad, who kindly provided us with information and records of the material studied. And we are most thankful to Prof. R. Radiopoetro, Head of the Department, for the facilities we enjoyed during the investigation.

Finally, our appreciation to Prof. Dr. M. Sardjito, M. P. H., for reading the manuscript, although we alone are responsible for the content of this paper. We acknowledge geographer Soerastopo Hadisoemarno for providing the map of Central Java.

MATERIAL AND METHOD

The total number of the cadavers is 390, and the material was received during a period of twelve years from cities and towns tabulated in Table 1.

TABLE 1

Table 1. — Places of origin of the cadavers according to sex

Place	Female	Male	Total
Jogjakarta	61	113	174
Semarang	20	60	80
Magelang	25	27	52
Kebumen	8	8	16
Klaten	5	10	15
Pusworedjo	4	10	14
Surakarta (Solo)	5	7	12
Purwokerto	1	4	5
Wonosobo	1	3	4
Purwodadi	2	2	4
Muntilan	3	0	3
Banjumas	0	2	2
Gombong	1	1	2
Kudus	0	1	1
Salatiga	0	1	1
Wonosari	0	1	1
Unknown	1	3	4
Total	137	253	390

The population consists of 137 females and 253 males. Breakdown in age groups is shown in Table 2.

TABLE 2

Table 2. — Age groups of the cadavers according to sex

Age in Years	Female	Male	Total
Less than 1	11	18	29
1-10	0	0	0
11-20	21	31	52
21-30	28	54	82
31-40	19	51	70
41-50	25	39	64
51-60	9	19	28
61-70	5	13	18
71-80	8	2	10
81-90	0	1	1
Unknown	11	25	36
Total	137	253	390

Data concerning the cadavers were drawn from the anatomical records obtained from the hospitals, penitentiaries, social institutions and police stations whence the material originated. It

is obvious that such information is never complete or absolutely accurate. Thus, in several cases the age and cause of death were not documented.

Age information was no doubt derived antemortem from the persons concerned, or postmortem from the police, doctors or clerks of the source institutions or from the parents in case of several babies. The younger the person, the more accurate is the information on his age, as for instance the newborns and children. Age information on the adults was based on their memory which was rarely accurate; even if it were correct it was usually calculated in Javanese lunar years. Estimates made by policemen, doctors and clerks leaned generally on facial appearance, skin condition, gait etc., and vary in accuracy with the experience of the particular observer. Ages in the adults, given or estimated, are usually multiples of five (Cobb, 1952:799; Krogman, 1962: 28), so that age data cluster around those figures. It is obvious, that the age recorded may be over or under the real age. Thus, if in this study we use an interval of one year for age groups, errors will certainly accumulate. Consequently, we group the material with intervals of 10 years, so that errors will be reduced considerably, since memorized or estimated age rarely exceeds the real one by 10 years. And besides, the trends we are searching for extend over long periods, such as whether the mortality peaks take place during the infant, juvenile, adolescent, mature or senile period. We think, therefore, this demographic study is valid, despite the foregoing weakness in age records.

Data pertaining to the cause of death are obviously not exact. Occasionally, an individual was found dead on the street or died on arrival at the hospital, so that even clinical examination was lacking or incomplete. Classification of the causes of death accurately by means of international codes is totally impossible, because more often than not laboratory tests or autopsies were not performed. But that is beside the purpose of this paper. We only try to know the disease suffered by a particular subject prior to his death which either caused his demise or served as a base for the direct cause of death; and furthermore, the diseases are classified in a general way according to systems involved, or even according to the embryonic origin of the systems. Therefore, from this point of view this study is also justified. It should be

noted that if the terminal diseases were not known, they were not documented in the anatomical records.

RESULTS

Year of death

During the twelve year period the number of cadavers received each year is tabulated in Table 3 according to sex.

TABLE 3

Table 3. — Years of death of the cadavers according to sex

Year	Female	Male	Total
1950	1	3	4
1951	7	10	17
1952	8	18	26
1953	12	18	30
1954	15	25	40
1955	20	26	46
1956	8	29	37
1957	9	24	33
1958	11	27	38
1959	10	17	27
1960	9	9	18
1961	11	18	29
1962	16	29	45
Total	137	253	390

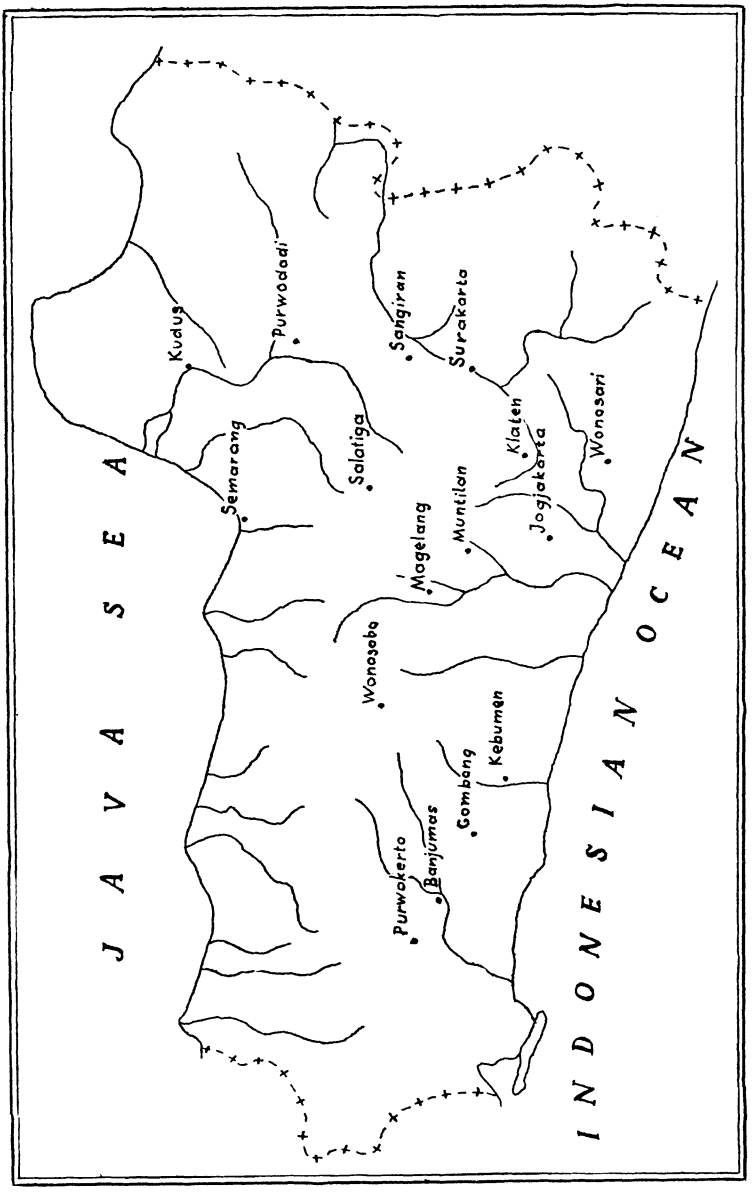

Fig. 1. Map of Central Java, showing the places of origin of the laboratory cadavers studied. The *Pithecanthropus* site of Sangiran, better known to anthropologists, is included for orientation.

It is obvious that the peak occurred around 1955, while in 1950 very few cadavers were obtained. Female cadavers reached their peak in 1955 too, and the male in 1956. The least number of cadavers received for both sexes was in 1950.

Place of origin

As expected (Table 1) most of the cadavers came from Jogjakarta, the seat of the Laboratory, which did not present any transportation problem. Runners-up are the following towns: Semarang and Magelang (Fig. 1). Next come Kebumen, Klaten, Purworedjo and Surakarta with almost equal figures. From other towns the figures are negligible.

FIGURE 1

Female cadavers originated mostly from Jogjakarta, but the second source was Magelang. The great number of male individuals from Semarang made this third largest city in Indonesia the second source of our laboratory cadavers.

Age

Age groupings are shown in Table 2. It is interesting to note that age group 1-10 years is lacking. The mode is in the 21-30 years age group. There are only 11 subjects over 70 years of age. Age data concerning 36 individuals, consisting of 11 females and 25 males, were not recorded. Twenty-nine cadavers are below one year of age.

In the females the peak of mortality occurred in the 21-30 years age group, with a minor peak in the 41-50 years age group. Eleven subjects are below one year and 11 are over 70 years.

The males showed a mortality peak in the 21-30 years age group too, followed by the 31-40 years age group. Eighteen cadavers are under one year and only three over 70 years.

Terminal diseases

Data pertaining to the diseases contracted at the time of death were recorded in 59 males (23.32%) and in 27 females (19.71%), giving a total of 86 individuals or 22.05% of the material. In 9.23% of the cadavers, consisting of 13 females and 23 males the only information documented was "homeless."

The terminal diseases found in the material are summarized in Table 4.

TABLE 4

Table 4. — Terminal diseases suffered by the cadavers according to sex

Disease	Female	Male	Total
Gastrointestinal[1]	11	17	28
TB and respiratory	2	21	23
Perinatal	7	9	16
Accidents[2]	3	4	7
Mental and nervous	0	3	3
Cardiovascular	3	0	3
Malaria	0	2	2
Renal	0	1	1
Tetanus	0	1	1
Diabetes mellitus	0	1	1
Neoplasm	1	0	1
Total	27	59	86

[1] Including undernutrition, hepatic cirrhosis and infection.
[2] Including physical trauma, homicide, suicide and burn.

We can conclude that, as expected, the most frequently encountered ailments are gastrointestinal, followed by respiratory disorders and perinatal death. Among the gastrointestinal disorders undernutrition is prevalent, either below or beyond 50 years of age. Similarly, TB is predominant among respiratory diseases regardless of age. All of the few cases of cardiovascular disorders occurred at age 50 or over.

If the diseases are classified according to the systems involved, we obtain the following table.

TABLE 5

Table 5. — Terminal diseases of the cadavers according to systems involved

System	Female	Male	Total
Gastrointestinal	11	18	29
Respiratory	2	21	23
Urogenital	3	1	4
Nervous	0	4	4
Blood and cardiovascular	3	2	5
General[1]	8	13	21
Total	27	59	86

[1] Including accidents and perinatal death.

Thus, the system most frequently attacked is the gastrointestinal tract, and the second is the respiratory tract; together they contribute to more than 50% of the cases. In other words, systems of entodermal origin are involved in 52 cases, mesodermal systems in 9 cases, whereas ectodermal systems in only 4 cases (Table 6).

TABLE 6

Table 6. — Terminal diseases of different populations according to the embryonic origin of the systems involved

Embryonic Origin	Entoderm	Mesoderm	Ectoderm
Present study			
Female	13	6	0
Male	39	3	4
Total No.	52	9	4
%	80.0	13.8	6.2
Jogjakarta[1] %	53.7	36.2	10.2
Pearl[2] %	57	30-35	8-13

[1] Calculated from Biro Statistik etc. (1961).

[2] Cited from Hooton (1956).

DISCUSSION

Laboratory cadavers in Indonesia originate solely from the lower socioeconomic stratum which is very vulnerable to ups and downs in economic condition and highly exposed to the hazards of life. These factors, however, are not the only ones affecting the number of cadavers received by the laboratory in different years. Other influencing factors to be considered are the activity of the laboratory staff in obtaining cadavers from different towns and the transportation facilities on which this largely depends. And not all hospitals from the places mentioned previously contributed their unclaimed dead since 1950 to the University.

The important sources of the cadavers population are Jogpakarta, Semarang and Magelang. Big cities seem to be more attractive to the economically marginal stratum, since they offer more niches to the homeless, beggars etc. than do the smaller towns, and thus effecting migration to urban areas. In addition, it has to be taken into account that large hospitals and peniten-

tiaries are found in big towns. The only exception in this case is the city of Surakarta from where not many cadavers were derived. The more distant a place is from Jogjakarta the less likely it is that its cadavers will be taken to the laboratory.

It is not surprising that male cadavers exceed the female in number, but compared with other laboratory cadaver populations the female subjects in our population are relatively more numerous (39.7%). Among the cadavers obtained from Jogjakarta we notice that the females constitute more than 50%, while among those from Magelang the male:female ratio is almost 1:1. The average ratio in the whole material is about 3:2, which remains practically constant for every age group, except for age group 31-40, where it is 5:2 and for advanced age groups of which the samples are very small. Cobb (1935) reported 18% females among the Western Reserve University laboratory cadavers of 1911-31 (total population: 2139), giving a male:female ratio of 9:2. Krogman (1962) gives the usual ratio of 15:1 for laboratory cadavers in the U.S. This fact indicates that in the U.S. female dead are less often left unclaimed. It is also most likely that in Indonesia the female has more obstacles in obtaining a job to sustain her life.

The age group 1-10 years is not represented, partly due to the reluctance to receive children for student dissection; infants below one year of age are present in the population, because they were mostly contributed by the University hospital maternity wards.

Only 57 subjects (16.1%) are beyond 50 years, a condition comparable to the state of affairs in Germany of 1910 (de Froe, 1948), where people above 51 years were 18%. The number of old females, although slightly larger (17.5%), does not differ markedly from that of old males (15.4%). It is only in advanced communities that the number of elder females exceeds that of the males significantly (Wrong, 1956:44). There is also no marked sex difference in the number of young people under 30 years of age (female, 47.6%; male, 45.2%).

The death rate reached its peak in the 21-30 years age group, in other words right after the cessation of growth. This means

that only a small portion of the potential length of life could be attained by our population (about 114 years, according to Cobb, 1954). No old age peak is found, indicating that the group did not enjoy public health facilities brought by cultural progress. Vallois (1961:224) commented that "until the beginning of modern times, the average length of life did not exceed thirty to forty years." In the female a minor peak is observed in the 41-50 years age group, but no trends in the pattern of disease contracted in this group could be traced, since 21 of 31 people in the age group did not present the needed data.

Compared with the Western Reserve University cadaver population previously referred to (Cobb, 1935, 1935a), we noticed that the length of life in our material is lower (Table 7).

TABLE 7

Table 7. — Mean age at death in various populations

Population	Age at death
Gadjah Mada U. lab cadaver	21-30
WRU cadaver (Cobb): Negro	37
White	45
Ancient Roman (Mcdonnell, cited by Cobb)	21-30
West African Negro (Todd, cited by Hooton)	30
Tasmanian (same)	< 25
Indian Knoll (Churcher and Kenyon)	30.4
Indian Tabor Hill (same)	30.35
17th century Genève (de Froe)	26
50 B.C. (Dublin, Lotka and Spiegelman, cited by Harrison)	22
Early Iron and Bronze Age (same)	18
Prehistoric: (Harrison)	< 40
(Dahlberg)	25-30
Mesolithic (Vallois)	21-30

We speculate that the Cleveland population enjoyed relatively more advantages brought by public health measures. A peak of mortality between 21-30 years reminds us of certain populations of West Africa, Tasmania (Todd, cited by Hooton, 1956), ancient Romans (McDonnell, cited by Cobb, 1954), a Bronze Age English town (Dublin, Lotka and Spiegelman, cited by Harrison, 1958), American Indians (Churcher and Kenyon, 1956), Genève in the 17th century (de Froe, 1948), and even of prehistoric men (Dahlberg, Vallois, 1961). This again emphasizes the tremendous influence that could be brought about by public health upon human longevity in a relatively short time.

Of the diseases suffered at the time of death most affected the gastrointestinal tract, and then the respiratory tract. Those are diseases of poverty and exposure which reveal the absence of basic medical care. The two systems are responsible for more than 50% of death, which is in conformity with the statistics of Pearl on deaths in the U.S., England and Brazil (Hooton, 1956:273). In Negro and Caucasoid cadavers of Cleveland (Cobb, 1935) the most commonly affected system was the respiratory tract, probably due to the cold climate and the lesser incidence of malnutrition. In Jogjakarta in 1959 the highest mortality in the total population was also due to respiratory diseases (35.9%, calculated from Biro Statistik etc., 1961). In the U.S. of 1900 the leading causes of death were respiratory (TB and pneumonia) and gastrointestinal (diarrhoea and enteritis) diseases (Wrong, 1956:45).

The main terminal diseases in our cadaver population either below or above 50 years of age are gastrointestinal. In this group liver cirrhosis is due to undernutrition and not to alcoholism which is not a problem in a predominantly Moslem country such as Indonesia. TB does not affect any particular age group more often than the others.

The frequent gastrointestinal respiratory disorders make the entoderm the most sensitive system in the cadaver population. This fact is in accordance with Pearl's statistics and with the condition in Jogjakarta in 1959. The second system commonly affected is of mesodermal origin and this is more emphatic in the females owing to the relatively higher rate of urogenital diseases.

However, the mesodermal systems in our material are attacked to a lesser degree compared to Pearl's findings, which are more closely comparable to the condition in the total population of Jogjakarta. The last and the least affected systems derived from the ectoderm, the most differentiated embryonic tissue.

We expect that through socioeconomic improvement in the future the mortality peak of laboratory cadaver populations in Indonesia will shift upward from the 21-30 years age group, and that ailments will more often threaten the mesodermal systems rather than the entodermal. To facilitate the study of these demographic data periodically it is recommended that death records made by the police or hospitals should be more complete and accurate.

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