CELADE

CENTRO LATINOAMERICANO DE DEMOGRAFIA

Jorge L. Somoza, Carmen Arretx
and Rolando Mellafe

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ESTIMATES OF MORTALITY AMONG MEMBERS OF RELIGIOUS ORDERS IN CHILE IN XVIII AND XIX CENTURIES

CONTENTS

INTRODUCTION

One of the main purposes of the works on Historical Demography that CELADE has initiated is to illustrate the application of techniques of demographic analysis to data available in Latin America from Colonial times.

The first study in this series of works deals with the estimate of mortality of monks and nuns starting from information obtained in the convents of Chile, complemented with information gathered from the registers of cementeries. The study consists of two parts: one of them in charge of a historian, describes the sources of the information, the way the data were collected and some circumstances connected with the monacal life in the convents under study. The second part, prepared by demographers, deals with the demographic analysis of the information.

It is appropiate to point out to the reader from the very beginning that the results of this study, namely the estimation of mortality of monks, is probably not a good representation of the mortality of the whole population, since it refers to a rather restricted selected group. It would be of course of greater interest to estimate the mortality of the population as a whole rather than the mortality of a selected group. This purpose however is much more difficult to attain. In Historical Demography one has usually to take advantage the best one can of the available data rather than select the kind of estimation that one would like to make.

The information on entrance into convents and on deaths of monks, when age is recorded, seems to be very appropiate for the purposes of elaborating a life table. This statistical instrument can be figured as the history of a cohort of persons followed along the life of each of them recording the age at death of each component of the cohort.

The idea of studying mortality on the basis of information such as the one we are considering here is certainly not new. (1) The only feature that might be original in this paper is that the information in which the estimates are based on comes from Latin American sources and refers to old periods.

I. HISTORICAL BACKGROUND

1. First Convents in Santiago.

The first priests arrived to Chile together with the conquerors. The "mercedarios" landed in 1548, and soon after came the Dominicans and the first Franciscans in 1553. (2) Parishes and convents were promptly founded along the country.

We have the testimony of the chronicher Antonio Vásquez de Espinoza who, when describing the city of Santiago in 1614, explains:

"There is in Santiago City a Cathedral church with bishop and nine prebendaries that assist and serve it, and 35 clergymen including curates that say Mass in "chacras" (small farms) and "haciendas" (land estates). Besides the main one there are two parish churches: San Lázaro and San Saturnino; five convents: Santo Domingo had 70 religiousmen with some rent, a chacra, a vineyard and an "estancia" with 6 negroes to serve it. San Francisco had 40 religiousmen, San Agustín 30 and had a chacra and vineyard with 6 negroes for its service and benefits. ...There are two nun monasteries of Santa Mónica subjected to the bishop and had 90 nuns with some income, a chacra and a vineyard for sustenance and gifts of the nuns. Another monastery of Santa Clara dependant of San Francisco monks, founded with 13 nuns who came from the monastery of Osorno city that became depopulated because of the rebelion and general uprising of the indians in the year 1598 when the governor Martín García de Loyola was killed. His Majesty made them mercy of 6 000 pesos with which they bought a site in which they started building the said year of 1614. It had by then 30 nuns with some income and an "estancia". At present days it is a very good monastery and has much increased". (3)

It is evident that since the beginning of the XVII Century, there was in Chile, and specially in Santiago, an appreciable amount of religious orders. These orders kept convents with a fair number of monks or nuns.

We chose the Convents that would provide us with the best documental source. It was necessary to consider the year of foundation, the organization and availability of its archives to obtain the largest volume possible of data concerning the length of life of its members. Therefore, the convents chosen were three, cited by the above mentioned chronicher: the nun's Convent of Santa Clara founded in 1598; St. Francis founded in 1572 and St. Agustin in 1595.

In this research, the number of members each convent had in different periods is not an important fact. We were truly interested though in working with accurate records of dates of birth, death and entrance of this monastic population. To give an idea about the volume taken into account in our investigation, we will refer to it summarily. The whole of Santa Clara was formed by 30 nuns in 1614. It increased to 50 towards the half of the century and remained stationary until the end of 1820 when it started decreasing. At the end of the last Century the nuns were 30 again. (4)

The various Orders raised their population during the same periods. The largest populations belong to the XVII Century when a general growth in the country took place and the influence of the church in cultural, economic and social aspects reached its heights. Let us not forget there was a great demand of priests specially Franciscans to serve as missionaries among the insurgent indians. In 1614, they were 40, in the half of the next Century, 70.

Slowly since 1810, religious fervor that characterizes colonial centuries starts to diminish. This critical tendency involves a lessen of the clergy's economic and social power and of its cultural and administrative interference. This process culminates towards the half of the XIX Century when monastic population was clearly reduced. Franciscans came to be less than 40 (5) and Agustins suffered a similar decrease. (6)

We want to make clear that when we refer to the Convent population we are strictly bearing in mind nuns and monks that dwelled inside. Besides them a considerable number of other people such as different kinds of Sisters and Brothers, servants and slaves plus orphans and young apprentice girls and boys not including novices were also living in the Convents. None of them were taken into account in our research, they usually stayed transitorily and there was almost no personal information about them.

2. Sources.

The administrative organization of the Church in Hispanic America has its origins in the eclesiastic restructuration made in the Council of Trent from 1545 to 1563. Modifications there imposed, were transfered untouched to the new continent by the Spanish clergy. The new eclesiastic rules commanded the keeping up of special records related to different aspects of the institution's life. (7)

For our research the most important documents were found in:

1. Libros de Atestatos: Books where information about the novices was gathered before their entrance.

2. Libros de Toma de Hábitos o de Vesticiones: These dealt with proceedings and requirements to be accomplished by the aspirants shortly before ordination.

3. Libro de Profesiones: These books registered the novices that had made the vows of poverty, chastity and obedience.

4. Libros de Defunciones: These recorded the dates and details of monks death.

5. Libro de Espolios: Registered the worldly posessions and testaments of monks. (8)

In order to complete the information regarding length of life, some indirect documentation was explored. Libros de Gastos for example, so useful to Economic History, where daily expenses were registered, provided us with information about dates of funeral ceremonies that completed our data on deaths. (9)

Finally, to locate and confirm dates of birth or defunctions, the first volumes of the General Cementery of Santiago were consulted. These start in 1823 under the names of "Libros de Partidas de Pobres" and "Libros de Partida de Pagos". (10)

3. General Methodological Steps.

All of the convents involved in our research have documental material since they were founded. Nevertheless most of it deals with donations received and general economic administration. Un-interrupted and sistematized sets of data belong to a later period. Therefore we included Santa Clara Nuns since 1706, Saint Agustin Monks since 1696 and Franciscans since 1794.

A filling card was prepared for each person containing name, date of entrance, date of Ordination, date and place of birth, names of parents and godparents. Place of birth and parents' names were recorded in case it would have been necessary to locate Baptism Certificates in the appropiate parish. Once the cards were filled as completely as possible, we went on with the estimate of time lived and age at Ordination by procedures that will be described in the following pages. At this level of the research a methodological test was made with a small sample of the whole of the monks that had no omission in their basic record card. A mortality curve was elaborated with 30 Franciscans and 50 nuns. This test presented some distortions because of the small number of cases considered but could in general be qualified as correct.

Under these circumstances, the methods specially those for estimating age of ordination were considered valid.

Our next step was a meticulous revision and a careful refinement of the data in our hands. Supplementary documentation mentioned above was very useful in this task.

4. Age at ordination and age of death.

We had the date of death for all the cases (about 600) except for 17 nuns and 29 monks who were omitted. Among them a few foreigners.

In many cases death records indicated or simply confirmed dates of birth and ordination as they stated for how long the nun or monk had dwelt in the convent.

Finally, the monks and nuns taken in this research had their births between 1655 and 1892 and their deaths occured between 1728 and 1933.

The age at ordination is fundamental for our study as it made us possible together with the date of death, to obtain indirectly the date of birth as well as time lived in the convent. We had the choice between the date of Ordination and the date of entrance but we prefered the first of them, avoiding in such a way to include the percentage of novices that was never ordained and therefore obviously did not die in the Convent. We esteemed the noviciate period in two years.

We also considered the differences in ages of entrance of men and women. Among men the average age was 25 for the first half of the XIX Century. Among nuns between 16 and 17. With these averages obtained from our filling cards, we distributed 19 cases of monks that had no age of ordination in the five year group of 20-24. The same was done with 40 nuns except they were included in the group of 15-19. The age of ordination could never be below 15 for there was a special eclesiastic legislation that made that clear. Also an accurate health examination was demanded as a requisite for Ordination. It was usual to find in the final proceedings stating that the "novice is free from any public or secret illness...".

II. THE MEASURE OF THE ANNUAL RISK OF DYING ACCORDING TO AGE.

1. The basic idea of the life table.

If it were possible to follow up each individual member of the cohort previously defined, then it would be possible to measure the annual risk of dying along an interval of ages, which we shall designate in general x to x+n, by computing the quotient between the number of deaths occuring to members of the cohort studied between ages x and x+n and the time lived by the members of the cohort measured in years, also between ages x and x+n. This measure is called <u>mean annual death rate</u> between x and x+n, symbolyzed ${}_nm_x$ and defined, as mentioned above, by the relation:

$$ {}_nm_x = \frac{{}_nD_x}{{}_nE_x} $$

where ${}_nD_x$ represents the number of deaths in the cohort, with ages between x and x+n, and ${}_nE_x$ the time lived measured in years by the members of the cohort, along the same interval of ages.

It is obvious that if this measurement of mortality intends to be representative of the mortality of the whole cohort, a necessary condition should be fulfilled: it should not be possible for the individuals to leave the cohort for any reason that might constitute a selection related to the risk of dying. (A case of such a selection would be that persons who became ill were eliminated from the cohort).

2. Some statistics of the set of cases investigated.

The information on the age at entrance and on age at death for each member that is possible to collect from the archives, seems to be exactly the one that would demand a statistical excercise as the one that has been roughly described above. It seems appropiate to present here some characteristics of the information that will be analyzed. All in all there were records for 585 cases; 285 monks and 300 nuns. The monks were 191 from Saint Agustin and 94 from Saint Francis. All nuns belonged to the Convent of Santa Clara.

If classified according to year of birth it is observed that the extreme years are 1655 and 1892. The median, i.e., the year of birth that divides the total group into two components of equal size, is 1765. Those born between 1655 and 1765 are named "olds"; those born starting in 1766 are called "moderns". The former are distributed around the year 1732 (the median of this group). The moderns are distributed around the year 1808. This breakdown has the purpose, as will be seen later, of estimating mortality for two periods in order to investigate if there is some indication of changes in the level of mortality for the duration. When analyzing this information it should be borne in mind that in order to delimitate the two periods of time we used the "year of birth" and not as could have been done more appropriately, but at the cost of greater effort, the "time lived" in different stages. It is not possible as a consequence, to know exactly in which years each of the two groups lived. This however, is not so important since what is aimed is just an approximation, not an exact measure, of the limits of the mentioned periods. It can be approximately established, that the "olds" lived in the convent mainly between 1757 and 1807, the approximate time of staying for the "moderns" runs between 1807 and 1867. The experience as a whole covers more than one century, since 1757 to 1867.

3. Definition of the studied group.

A first examination to the annual mortality rates computed for quinquennial age groups with all the information available (the 585 cases), shows for our first two age groups, a pattern that is not easy to interpret. (Refer to Table 2 and Figure 1). When the information was broken down by sex it was observed that the rates for these age groups (15-19 and 20-24 years) in the case of women were very high, higher than those for the following age groups; in the case of men the rates were too low, if compared with those corresponding to the following higher age groups.

It is possible that these two trends were real: that the mortality of very young women would have been higher than the one corresponding to women say, 25-34 years, and that the mortality of young men would have been low. A reason that might explain the former is the very well known feature (11) of the high incidence of tuberculosis among young females in the past; an explanation for the latter could be that a selective process was operating in the years immediately following the entrance to the convent. The applicants should be in good health, a fact that was recorded in a statement that they had to make.

These explanations, though possible, can not be accepted as valid simply because the number of cases is too small. There are only 8 deaths of males and 27 of females, registered 35 in total, for ages below 25 years. Moreover, in the case of women, there is a further reason for not considering mortality rates at very young ages: in a number of cases the age at entrance (16 years) has been asigned.

For all these reasons we decided to estimate mortality only since the age 25. The number of cases considered, consequently, was reduced from 585 to 550.

In Table 1 all the information that has been collected is presented: the 585 cases investigated classified according to age at entrance (recorded or assigned) and according to age at death. The information is also broken down by sex and by epoch (olds and moderns, according to the definition given above).

4. Computation of the time lived within an interval of ages.

For calculating the annual mortality rate, as stated above, it is required to measure the time lived by the cohort along an age interval.

Let us examine by means of an illustrative example how this value is computed: let us assume that the question is to measure, with the information appearing in Table 1 relative to the total number of cases, which was the time lived within the age interval defined by the exact ages of 30 and 31. In other words how many years were lived between the exact ages 30 and 31 by the 585 monks that are being investigated?

For practical reasons it is better to ask ourselves how many out of them could have attained the age 30 years, considering all those that had entered before that age, and how many could not reach that age because they died before. It could be argued reasonably that those who entered before age 30 and also died before age 30 should not be taken into account. As stated above it is convenient to consider them first as possible survivors (adding) and then as dead before age 30 (substracting). The contribution of these cases to the time lived between ages 30 and 31, is, of course, nil.

The time lived between ages 30 and 31 by those who entered before age 30, assuming that none of them died within the interval 30 to 31 years (this possibility is examined below) can be expressed as the difference between: (a) the total of those who entered at ages 12 to 29 inclusive (12 is the youngest age among the cases considered) and (b) the total of those who died between the same ages. If with n_x and d_x we represent those who entered and those who died at age x, respectively, the totals corresponding to (a) and (b) can be written as follows:

(a) total number of entrances before age 30 years: $\sum_{12}^{29} n_x = 554$

(b) total number of deaths before age 30 years: $\sum_{12}^{29} d_x = 59$

In order to complete the computation of the time lived between the exact ages 30 and 31 it remains: (c) to add the contribution of those who entered with attained age 30 and who lived, consequently, part of the year of life between 30 and 31 years as components of the cohort and (d) to subtract the time that was not lived, between ages 30 and 31 years by those who died after attaining age 30.

Instead of establishing exactly the time lived for each component of the groups (c) and (d) a simplyfied estimation is done: to assume that that time is, in all cases of half a year. In this way the contribution to the time lived by the cohort by those who entered and those who died at 30 years is the following:

(c) $\frac{1}{2}\, n_{30} = \frac{1}{2}\, 5 = 2{,}5$

(d) $\frac{1}{2}\, d_{30} = \frac{1}{2}\, 4 = 2{,}0$

It seems almost unnecessary to point out that those who entered at 31 or more do not contribute to the life span that we are considering.

The symbol E_{30} represents the time lived between ages 30 and 31 years. Its value is given, according to the analysis performed above, by the relation:

$$E_{30} = \sum_{12}^{29} n_x - \sum_{12}^{29} d_x + \tfrac{1}{2}\, n_{30} - \tfrac{1}{2}\, d_{30}$$

$$= 554 - 59 + 2{,}5 - 2$$

$$= 495{,}5$$

In general, for any age x, it can be written:

$$E_x = \sum_{12}^{x-1} n_x - \sum_{12}^{x-1} d_x + \tfrac{1}{2} n_x - \tfrac{1}{2} d_x$$

Table 1

MONKS CLASSIFIED ACCORDING TO AGE AT ENTRANCE, n_x, AND AGE AT DEATH, d_x, BY SEX AND BY EPOCH OF BIRTH (DURING OR BEFORE 1765, AND AFTER 1765).

Age	Total		By sex				By epoch of birth			
			Males		Females		During or before 1765		After 1765	
x	n_x	d_x	n_x	d_x	n_x	d_x	n_x	d_x	n_x	d_x
12	1	–	–	–	1	–	–	–	1	–
13	1	–	–	–	1	–	–	–	1	–
14	3	–	–	–	3	–	1	–	2	–
15	4	–	3	–	1	–	1	–	3	–
16	304	–	82	–	222	–	222	–	82	–
17	28	3	24	–	4	3	14	3	14	–
18	38	3	34	–	4	3	16	2	22	1
19	24	6	23	1	1	5	11	4	13	2
20	32	5	29	2	3	3	5	2	27	3
21	15	3	13	1	2	2	4	2	11	1
22	20	3	15	2	5	1	2	1	18	2
23	15	8	10	1	5	7	1	3	14	5
24	10	4	3	1	7	3	2	3	8	1
25	33	6	31	3	2	3	9	4	24	2
26	5	2	3	1	2	1	1	1	4	1
27	8	3	3	1	5	2	2	3	6	–
28	7	5	3	2	4	3	1	3	6	2
29	6	8	2	5	4	3	1	2	5	6
30	5	4	2	3	3	1	–	1	5	3
31	2	3	1	1	1	2	–	2	2	1
32	2	12	–	5	2	7	–	4	2	8
33	4	6	1	4	3	2	1	2	3	4
34	4	1	1	–	3	1	–	1	4	1

Table 1 (Continued)

Age	Total		By sex				By epoch of birth			
			Males		Females		During or before 1765		After 1765	
x	n_x	d_x	n_x	d_x	n_x	d_x	n_x	d_x	n_x	d_x
35	2	4	–	1	2	3	–	4	2	–
36	2	4	1	3	1	1	1	3	1	1
37	1	5	–	2	1	3	–	2	1	3
38	1	3	–	1	1	2	–	3	1	–
39	1	12	–	7	1	5	–	4	1	8
40	1	9	–	8	1	1	–	5	1	4
41	4	11	1	2	3	9	1	4	3	7
42	–	6	–	4	–	2	–	3	–	3
43	–	7	–	3	–	4	–	3	–	4
44	–	7	–	5	–	2	–	3	–	4
45	–	9	–	4	–	5	–	3	–	6
46	–	9	–	7	–	2	–	4	–	5
47	–	7	–	3	–	4	–	3	–	4
48	–	8	–	6	–	2	–	6	–	2
49	–	12	–	7	–	5	–	5	–	7
50	2	10	–	6	2	4	1	7	1	3
51	–	10	–	3	–	7	–	5	–	5
52	–	9	–	6	–	3	–	5	–	4
53	–	8	–	4	–	4	–	5	–	3
54	–	15	–	8	–	7	–	6	–	9
55	–	15	–	8	–	7	–	9	–	6
56	–	8	–	5	–	3	–	2	–	6
57	–	18	–	8	–	10	–	11	–	7
58	–	6	–	5	–	1	–	3	–	3
59	–	10	–	3	–	7	–	2	–	8
60	–	20	–	16	–	4	–	7	–	13
61	–	10	–	3	–	7	–	8	–	2
62	–	17	–	12	–	5	–	9	–	8
63	–	6	–	3	–	3	–	3	–	3
64	–	10	–	5	–	5	–	5	–	5
65	–	14	–	8	–	6	–	8	–	6
66	–	12	–	8	–	4	–	4	–	8
67	–	8	–	3	–	5	–	2	–	6
68	–	16	–	12	–	4	–	10	–	6
69	–	11	–	6	–	5	–	2	–	9

Table 1 (Continued)

Age	Total		By sex				By epoch of birth			
			Males		Females		During or before 1765		After 1765	
x	n_x	d_x	n_x	d_x	n_x	d_x	n_x	d_x	n_x	d_x
70	–	11	–	1	–	10	–	5	–	6
71	–	6	–	1	–	5	–	3	–	3
72	–	12	–	3	–	9	–	5	–	7
73	–	7	–	4	–	3	–	4	–	3
74	–	12	–	5	–	7	–	5	–	7
75	–	11	–	4	–	7	–	3	–	8
76	–	7	–	4	–	3	–	6	–	1
77	–	8	–	6	–	2	–	7	–	1
78	–	9	–	3	–	6	–	8	–	1
79	–	7	–	2	–	5	–	4	–	3
80	–	9	–	5	–	4	–	7	–	2
81	–	7	–	1	–	6	–	4	–	3
82	–	5	–	2	–	3	–	5	–	–
83	–	1	–	–	–	1	–	–	–	1
84	–	6	–	4	–	2	–	4	–	2
85	–	6	–	3	–	3	–	2	–	4
86	–	5	–	3	–	2	–	3	–	2
87	–	3	–	2	–	1	–	1	–	2
88	–	3	–	–	–	3	–	1	–	2
89	–	3	–	2	–	1	–	3	–	–
90	–	5	–	1	–	4	–	2	–	3
91	–	3	–	1	–	2	–	1	–	2
92	–	–	–	–	–	–	–	–	–	–
93	–	–	–	–	–	–	–	–	–	–
94	–	1	–	–	–	1	–	–	–	1
95	–	1	–	–	–	1	–	–	–	1
96	–	1	–	–	–	1	–	1	–	–
97	–	–	–	–	–	–	–	–	–	–
98	–	–	–	–	–	–	–	–	–	–
99	–	5	–	–	–	5	–	2	–	3
TOTAL	585	585	285	285	300	300	297	297	288	288

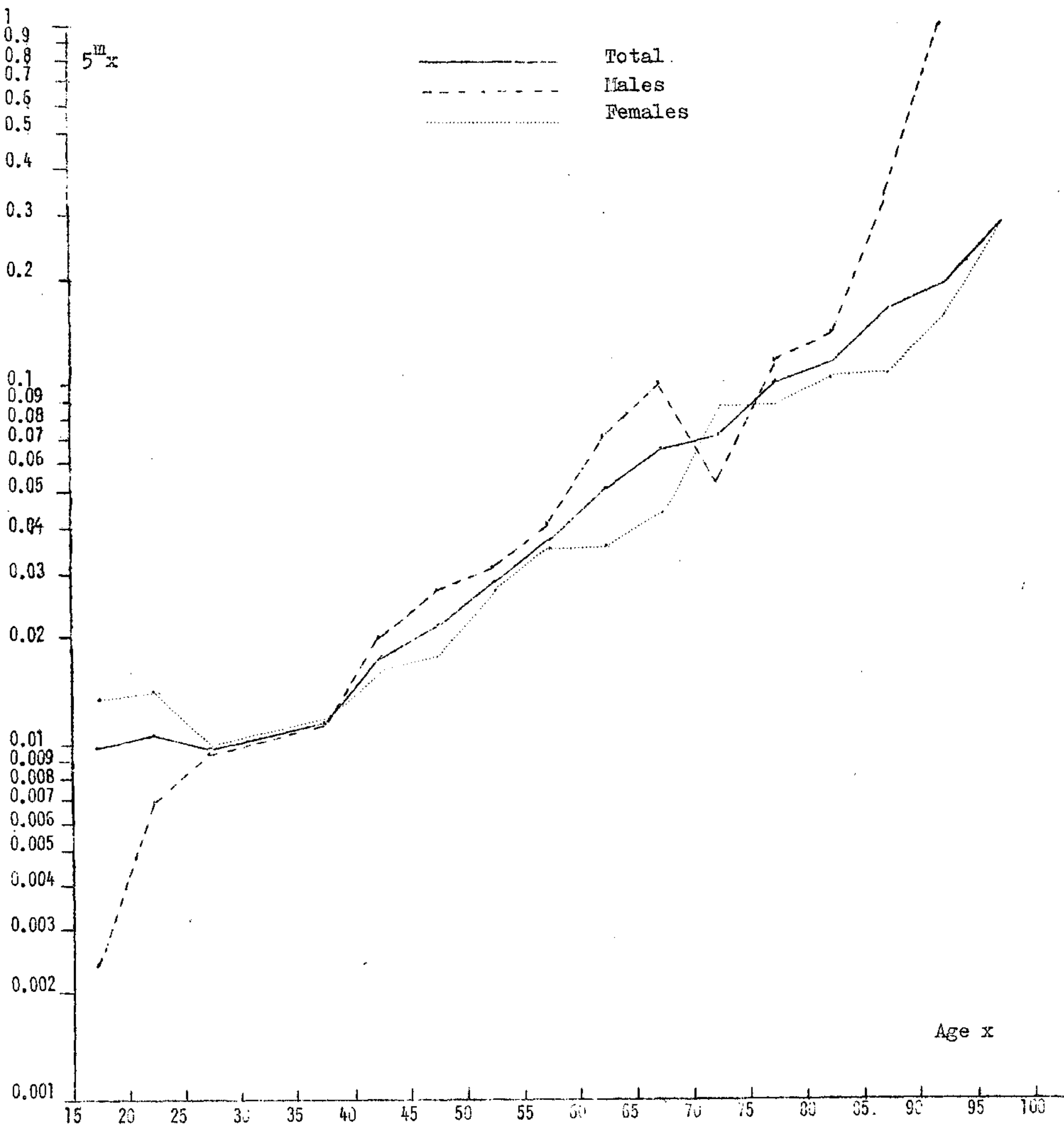
Table 2

DEATHS, TIME LIVED AND CENTRAL MORTALITY RATES BY SEX.

Age	Total			Males			Females		
	$_5D_x$	$_5E_x$	$_5m_x$ o/oo	$_5D_x$	$_5E_x$	$_5m_x$ o/oo	$_5D_x$	$_5E_x$	$_5m_x$ o/oo
10-14	-	5.5	-	-	-	-	-	5.5	-
15-19	12	1 231.0	9.75	1	422.5	2.37	11	808.5	13.61
20-24	23	2 174.5	10.58	7	1 035.5	6.76	16	1 139.0	14.05
25-29	24	2 446.5	9.81	12	1 278.0	9.39	12	1 168.5	10.27
30-34	26	2 449.5	10.61	13	1 269.0	10.24	13	1 180.5	11.01
35-39	28	2 395.5	11.69	14	1 228.5	11.40	14	1 167.0	12.00
40-44	40	2 235.5	17.89	22	1 128.5	19.49	18	1 107.0	16.26
45-49	45	2 042.5	22.03	27	1 017.5	26.54	18	1 025.0	17.56
50-54	52	1 812.0	28.70	27	882.5	30.59	25	929.5	26.90
55-59	57	1 520.5	37.49	29	727.5	39.86	28	793.0	35.31
60-64	63	1 208.5	52.13	39	545.5	71.49	24	663.0	36.20
65-69	61	920.5	66.27	37	377.5	98.01	24	543.0	44.20
70-74	48	653.0	73.51	14	261.0	53.64	34	392.0	86.73
75-79	42	419.0	100.24	19	162.5	116.92	23	256.5	89.67
80-84	28	238.0	117.65	12	87.0	137.93	16	151.0	105.96
85-89	20	122.0	163.93	10	30.0	333.33	10	92.0	108.70
90-94	9	46.5	193.55	2	2.0	1000.00	7	44.5	157.30
95-99	7	24.5	285.71	-	-	-	7	24.5	285.71
15-24	35	3 405.5	10.28	8	1 458.0	5.49	27	1 947.5	13.86
25-99	550	18 539.5	29.67	277	8 997.0	30.79	273	9 542.5	28.61
Total	585	21 945.0	26.66	285	10 455.0	27.26	300	11 490.0	26.11

Figure 1

CENTRAL MORTALITY RATES



5. The computation of the annual death rates.

In an ideal situation, that is, if the data being analyzed were very numerous and free from errors, the computation of the death rates could be done by single years of age determining the value of the time lived E_x and establishing the quotient D_x / E_x, defining the central mortality rate.

This is not the usual case. The information is not frequently very numerous and it is affected by errors, making it inappropriate to make the analyses by single age intervals. If the quantity of the information permits, annual death rates are often computed for five year age groups. By summing the number of deaths, and the time lived, separately, of each of the single years making up a quinquennial age group, the numerator and the denominator of the rate are obtained.

This is the exercise done in Table 2 for the total of the information and its components by sex. The resulting rates appear in the same Table and are represented in Figure 1. In the following chapters we will examine and smooth this rates. First, in Chapter 3, we will consider all cases together and then in Chapter 4 we will examine the mortality experience of some sub-groups. These are defined according to sex (males, females) and by time at birth (olds, moderns).

III. THE MORTALITY OF THE TOTAL POPULATION STUDIED.

In Table 2 and Figure 1 the annual death rates are presented for quinquennial age groups corresponding to the total number of cases being studied. In this Chapter we will be concerned with the examination and adjustment of these rates starting as indicated before, with the age group 25-29.

The Graphic representation in the logarithmic scale (Figure 1) shows that the death rates for quinquennial age groups follow a clear ascending trend with age, between the first, corresponding to the age groups 25-29 years, and the last, corresponding to the age group 95-99 years, that can be approximately described by a straight line.

This way of varying the death rates with age or, more properly, the logarithms of the rates of mortality within the broad age interval considered, i.e., over the ages 25, has been repeatedly observed and described by the well known Gompertz law, which was established in 1825 (12). It seems justified, consequently, to adjust the observed rates assuming that they follow the Gompertz law. The details of this exercise is given in Appendix 1. Table 3 shows the resulting life table.

In that table it can be observed that the expectation of life at age 25 for the total population studied is 34.37 years.

The expectation of life at any age, and in particular at birth, is a synthetic index of the mortality table.

Later on, when considering life tables by sex (for monks and nuns, separately) the resulting values of the expectation of life at different ages are compared with those corresponding to life tables of European countries for the same period of time.

Table 3

LIFE TABLE FOR THE TOTAL POPULATION STUDIED

Age	$_5m_x$	$_5q_x$	l_x	$_5d_x$	$_5L_x$	T_x	$\overset{o}{e}_x$
25–29	0.00831	0.040704	100 000	4 070	489 771	3 437 288	34.37
30–34	0.01066	0.051916	95 930	4 980	467 167	2 947 517	30.73
35–39	0.01369	0.066185	90 950	6 020	439 737	2 480 350	27.27
40–44	0.01756	0.084108	84 930	7 143	406 777	2 040 613	24.03
45–49	0.02254	0.106688	77 787	8 299	358 180	1 633 836	21.00
50–54	0.02894	0.134937	69 488	9 377	324 015	1 265 646	18.21
55–59	0.03714	0.169923	60 111	10 214	275 013	941 631	15.66
60–64	0.04767	0.212969	49 897	10 627	222 928	666 618	13.36
65–69	0.06118	0.265319	39 270	10 419	170 301	443 690	11.30
70–74	0.07852	0.328179	28 851	9 468	120 581	273 389	9.48
75–79	0.10078	0.402492	19 383	7 802	77 416	152 808	7.88
80–84	0.12935	0.488713	11 581	5 660	43 757	75 392	6.51
85–89	0.16602	0.586622	5 921	3 473	20 919	31 635	5.34
90–94	0.21308	0.695113	2 448	1 702	7 988	10 716	4.38
95–99	0.27349	1.000000	746	746	2 728	2 728	3.66

IV. THE MORTALITY OF THE FOUR SUBGROUPS DEFINED.

In this Chapter we will deal with the analysis of the information broken down according to two criteria: first by sex, males and females and second by epochs olds and moderns. It has already been clarified the sense of the latter classification.

A problem had to be solved before, when studying the mortality rates of the total population, that is, the inestability due to random errors derived from the scanty information considered, is now emphasized when each of the four subgroups studied is constituted, approximately, by only half of the information of the whole.

The procedure described in Appendix 1 was applied to death rates calculated for quinquennial age groups. If these were computed for the subgroups, the resulting rates would probably show very wide variations with age, probably too wide. It is convenient for this reason, to arrange the basic information in such a way that the resulting mortality rates are affected by random errors of similar importance.

This objective can be approximately attained by defining the length of the age intervals in such a way that the registered number of deaths in each of them be approximately the same. The length of the age interval, of course, usually results different from one case to another, i.e., from one age group to the following.

In Table 4 the results of this exercise can be observed for each of the four subgroups being analyzed. In each case, eight age intervals have been defined, of different amplitude, in order to group an uniform number of deaths in each case. The span of the age interval is now variable from case to case and it is symbolized with the letter $\underline{n}$. Up to this point we have been considering annual rates for an n=5; now the value of n will vary as can be observed in the mentioned table.

In Appendix 2 it is described the way this information, i.e., the eight mortality rates observed for each of the four sub-groups, is adjusted and how from these smoothings four life tables result. These are presented in tables number 5, 6, 8 and 9 corresponding respectively to males, females, olds and moderns.

1. Mortality by sex.

The life tables by sex, Tables 5 and 6 and Figures 2 and 3, show that the level of mortality of males was higher, clearly higher, than that of women. This is a universal trend though, when considering mortality levels as high as the one being examined in this case, not always the mortality differential by sex appears so clearly. At 25 years in our study, the expectation of life of a man was 33,04 years, while that of a women was 35,72.

It is of interest to compare these life tables with those existing for European populations living approximately at the same time that the population being studied. In Table 7 and Figure 4 the values of the expectation of life at different ages, namely 30, 40, 50, 60 and 70 years, are presented for the population being studied and for several European selected populations, of the XIX Century. Table 7 also shows values of that function corresponding to model mortality tables, with an expectation of life at the age of 30 years, approximately similar to the one estimated for the chilean monks.

The careful examination of the mentioned tables and figure makes evident that the values obtained are plausible: they show levels and trends, with age, similar to the ones of the populations with which they are compared. We could conclude that the mortality of the group studied was approximately equivalent to that of European countries of the same epoch, although it can also be observed that mortality in the Chilean experience, shows lower levels, especially in the case of women, as age increases.

This might be reflecting that monacal life, probably more methodical than that of the population in general, determines a lower mortality in adult and advanced ages. It is only a reasonable conjecture, not a proven fact. What was intended with this comparison was only to prove that the estimated mortality by age is more or less similar to the one known for European populations of the XIX Century.

Table 4

DEATHS, TIME LIVED AND CENTRAL MORTALITY RATES BY SEX AND EPOCH.

Age	Interval	Males			Age	Interval	Females		
x	n	$_nD_x$	$_nE_x$	$_nm_x$ o/oo	x	n	$_nD_x$	$_nE_x$	$_nm_x$ o/oo
25	15	39	3 775.5	10.330	25	13	32	3 053.5	10.480
40	8	36	1 754.5	20.519	38	10	36	2 194.0	16.408
48	6	32	1 108.0	28.881	48	7	32	1 330.0	24.060
54	5	34	759.0	44.796	55	6	32	936.0	34.188
59	4	34	483.0	70.393	61	7	35	859.5	40.721
63	6	39	514.5	75.802	68	6	36	529.0	68.053
69	9	34	431.0	78.886	74	7	34	361.0	94.183
78	14	29	171.5	169.096	81	18	36	274.0	131.387

Age	Interval	Olds			Age	Interval	Moderns		
x	n	$_nD_x$	$_nE_x$	$_nm_x$ o/oo	x	n	$_nD_x$	$_nE_x$	$_nm_x$ o/oo
25	14	35	3 568.5	9.808	25	15	39	3 485.0	11.191
39	10	38	2 219.5	17.121	40	7	33	1 512.5	21.818
49	6	33	1 123.0	29.386	47	8	37	1 473.0	25.119
55	6	34	915.0	37.158	55	5	30	746.0	40.214
61	5	33	598.5	55.138	60	6	37	677.5	54.613
66	8	35	690.5	50.688	66	5	35	396.5	88.272
74	6	33	320.5	102.964	71	9	34	377.0	90.186
80	19	36	203.0	177.340	80	19	28	228.0	122.807

Table 5

MALE LIFE TABLE

Age	l_x	$_5d_x$	$_5q_x$	$_5L_x$	T_x	e_x
25-29	100 000	2 968	0.006025	492 580	3 304 054	33.04
30-34	97 032	4 588	0.009686	473 690	2 811 474	28.97
35-39	92 444	6 182	0.013837	446 765	2 337 784	25.29
40-44	86 262	7 871	0.019121	411 632	1 891 019	21.92
45-49	78 391	9 552	0.025951	368 075	1 479 387	18.87
50-54	68 839	10 994	0.034713	316 710	1 111 312	16.14
55-59	57 845	11 866	0.045716	259 560	794 602	13.74
60-64	45 979	11 883	0.059359	200 188	535 042	11.64
65-69	34 096	10 899	0.076093	143 232	334 854	9.82
70-74	23 197	9 009	0.096392	93 462	191 622	8.26
75-79	14 188	6 604	0.121330	54 430	98 160	6.92
80-84	7 584	4 179	0.152119	27 472	43 730	5.77
85-89	3 405	2 199	0.190753	11 528	16 258	4.77
90-94	1 206	863	0.222882	3 872	4 730	3.92
95-99	343	343	0.399767	858	858	2.50

Table 6

FEMALE LIFE TABLE

Age	l_x	$_5d_x$	$_5m_x$	$_5L_x$	T_x	$\mathring{e}_x$
25-29	100 000	4 579	0.009373	488 552	3 572 393	35.72
30-34	95 421	4 923	0.010592	464 798	3 083 841	32.32
35-39	90 498	5 652	0.012894	438 360	2 619 043	28.94
40-44	84 846	6 506	0.015947	407 965	2 180 683	25.70
45-49	78 340	7 443	0.019950	373 092	1 772 718	22.63
50-54	70 897	8 393	0.025166	333 502	1 399 626	19.74
55-59	62 504	9 244	0.031941	289 410	1 066 124	17.06
60-64	53 260	9 871	0.040853	241 622	776 714	14.58
65-69	43 389	10 088	0.052617	191 725	535 092	12.33
70-74	33 301	9 702	0.068204	142 250	343 367	10.31
75-79	23 599	8 573	0.088782	96 562	201 117	8.52
80-84	15 026	6 753	0.115935	58 248	104 555	6.96
85-89	8 273	4 542	0.151350	30 010	46 307	5.60
90-94	3 731	2 337	0.182407	12 812	16 297	4.37
95-99	1 394	1 394	0.400000	3 485	3 485	2.50

Figure 2

MORTALITY RATES

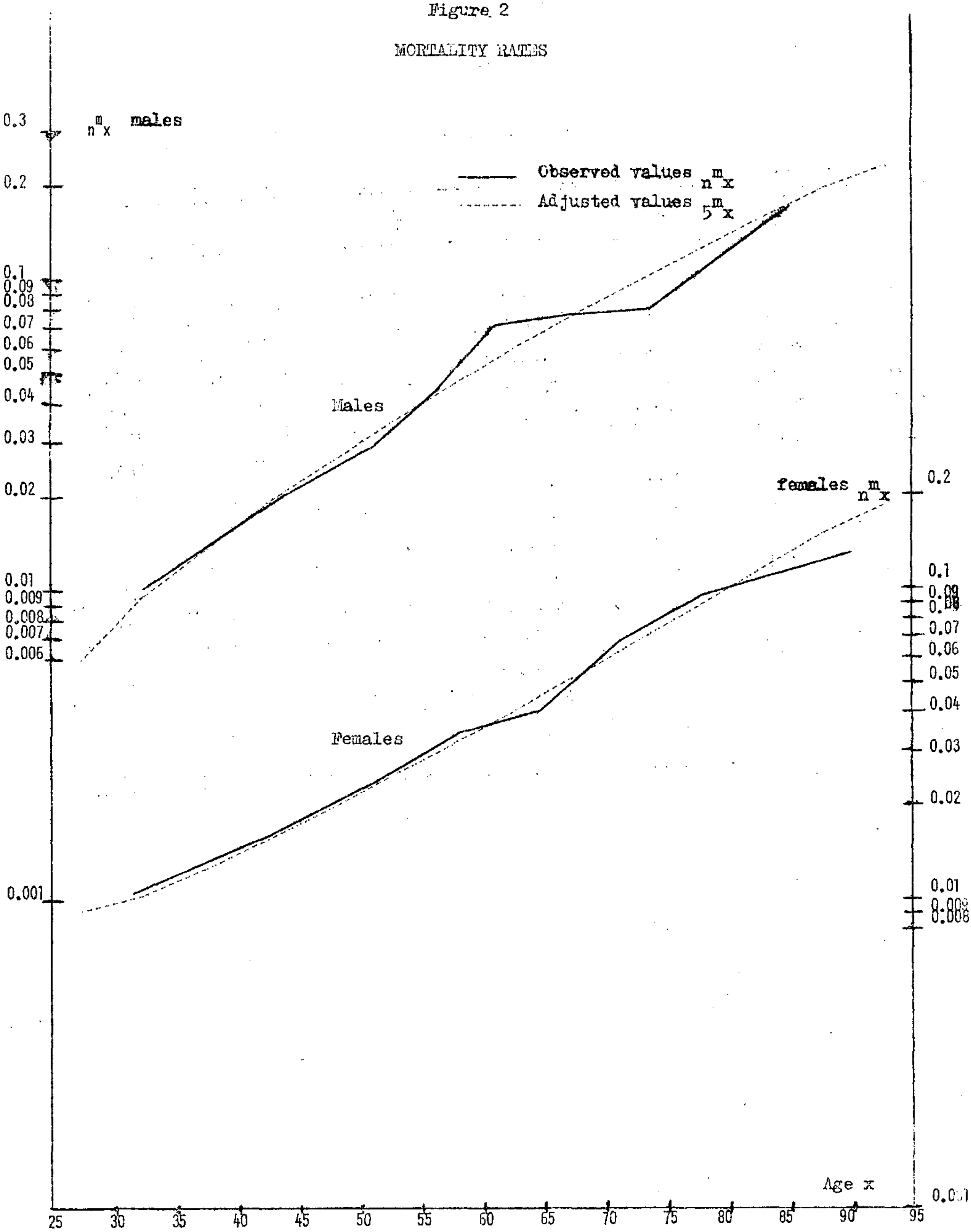


Figure 3

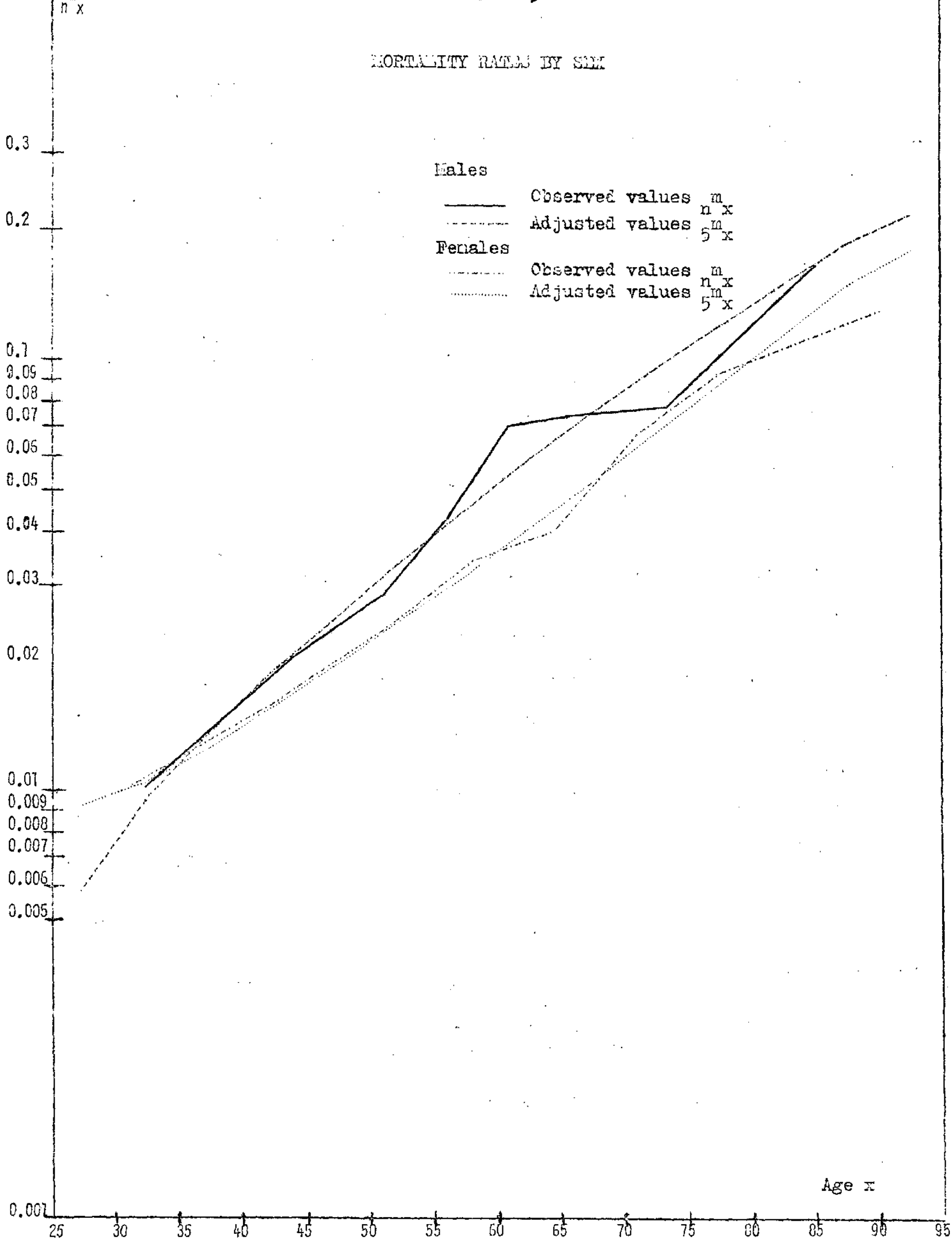

MORTALITY RATES BY SEX
Males
Observed values $_nm_x$
Adjusted values $_5m_x$
Females
Observed values $_nm_x$
Adjusted values $_5m_x$
$_nm_x$
0.3
0.2
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.009
0.008
0.007
0.006
0.005
0.001
Age x
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

Table 7

EXPECTATION OF LIFE AT 30, 40, 50, 60 AND 70 YEARS IN SELECTED LIFE TABLES.

Males	$\overset{\circ}{e}_x$				
	30	40	50	60	70
Chilean monks 1757-1867	28.97	21.92	16.14	11.64	8.26
Sweden 1816-1840	30.25	23.66	17.55	12.07	7.35
Netherlands 1816-1825	27.60	21.86	16.41	11.60	7.47
England and Wales 1841	33.13	26.56	20.02	13.50	8.51
Model Life Table Level 9; Coale-Demeny	30.04	23.54	17.45	11.95	7.46

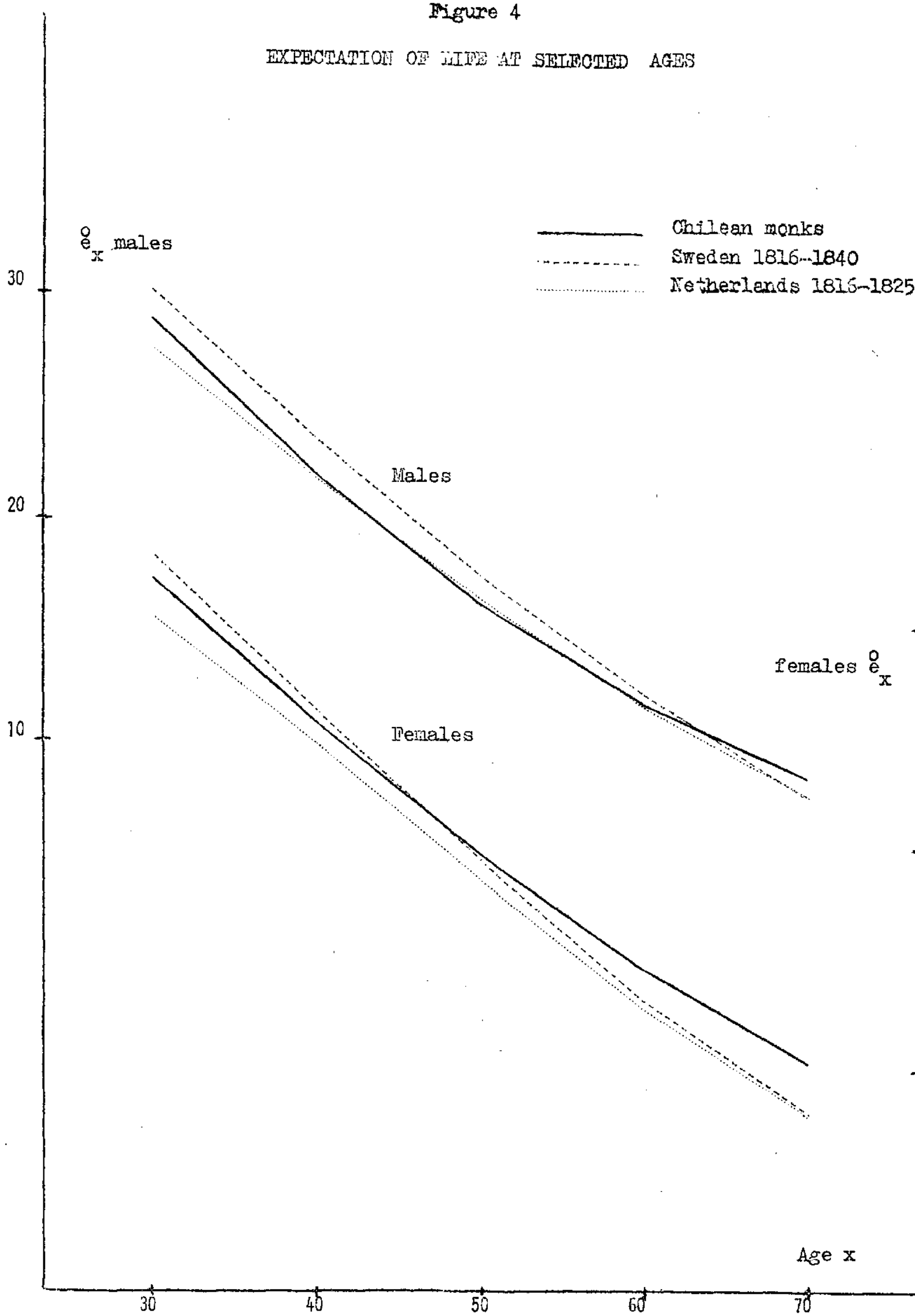
Females	$\overset{\circ}{e}_x$				
	30	40	50	60	70
Chilean monks 1757-1867	32.32	25.70	19.74	14.58	10.31
Sweden 1816-1840	33.40	26.41	19.60	13.22	8.03
Netherlands 1816-1825	30.68	24.84	18.70	12.84	8.01
England and Wales 1841	34.25	27.72	21.07	14.40	9.03
Model Life Table Level 9; Coale-Demeny	32.46	25.99	19.32	13.09	8.04

SOURCE: Louis J. Dublin, Alfred J. Lotka and Mortimer Spiegelman, Length of Life, 1949.

Ansley J. Coale and Paul Demeny, Regional Model Life Tables, 1966.

Figure 4

EXPECTATION OF LIFE AT SELECTED AGES



2. Mortality by epochs.

Comparing the mortality experience of monks born before or during 1765 with that of the ones born after that year (see Tables 4, 8, and 9) it can be observed that the mortality was lower in the case of the former group. The difference, however, is not as clear as when comparing classes defined by sex.

At 25 years, the expectation of life of the "olds" results 35,28 years, of the "moderns" 33,51. The trend is clearly shown by the observed values and is kept, persistently, in the adjusted rates by age.

This finding is of interest and also, as in the case of the difference in mortality by sex, corroborates the trends observed in Europe at the beginning of the XIX Century. It is frequently observed, examining life tables of that epoch, that there was no clear trend in the variation of mortality with time; some times it increased others it descended.

V. CONCLUSIONS

We consider it convenient to end up this document making a brief summary of the main conclusions derived from the analysis conducted above.

a) With regard to methods, an exercise has been conducted that illustrates how to analize information on deaths, collected mainly from conventual registers. The procedures that have been used, because of their simplicity and efficiency, seem to be appropriate for dealing with scant information though apprently of very good quality, as the one that has been analyzed.

b) Regarding the findings, it can be said that the estimated levels of mortality, representing probably the experience of a selected group of the total population, were similar to those observed in European populations at the same epoch -mainly at the beginning of the XIX Century-; a clear sex differential in mortality appears favourable to female and, regarding the changes in mortality along time, if two epoch are compared, one corresponding mainly to the end of the XVIII Century and the other to the beginning of the XIX Century, the conclusion is that a slight increase in mortality has occured.

Table 8

OLD MONKS LIFE TABLE (Born during 1765 or before).

Age	l_x	$_5d_x$	$_5m_x$	$_5L_x$	T_x	$\mathring{e}_x$
25-29	100 000	3 948	0.008055	490 130	3 527 596	35.28
30-34	96 052	4 713	0.010060	468 478	3 037 466	31.62
35-39	91 339	5 661	0.012792	442 542	2 568 988	28.13
40-44	85 678	6 720	0.016327	411 590	2 126 446	24.82
45-49	78 958	7 851	0.020927	375 162	1 714 856	21.72
50-54	71 107	8 960	0.026896	333 135	1 339 694	18.84
55-59	62 147	9 904	0.034632	285 975	1 006 559	16.20
60-64	52 243	10 507	0.044721	234 948	720 584	13.79
65-69	41 736	10 541	0.057813	182 328	485 636	11.64
70-74	31 195	9 836	0.074864	131 385	303 308	9.72
75-79	21 359	8 335	0.096966	85 958	171 923	8.05
80-84	13 024	6 221	0.125504	49 568	85 965	6.60
85-89	6 803	3 925	0.162177	24 202	36 397	5.35
90-94	2 878	1 878	0.193708	9 695	12 195	4.24
95-99	1 000	1 000	0.400000	2 500	2 500	2.50

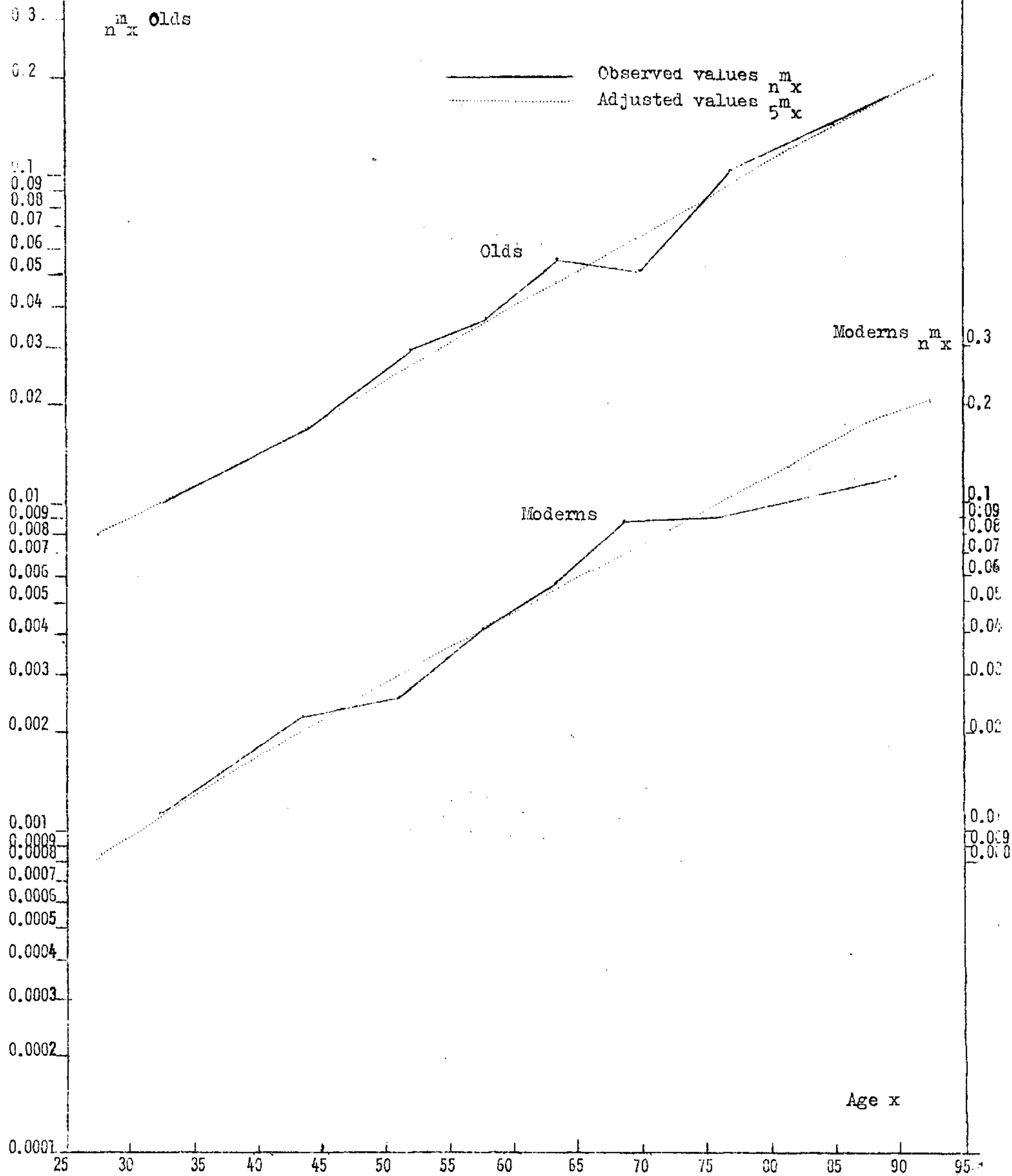
Table 9

MODERN MONKS LIFE TABLE (Born after 1765).

Age	l_x	$_5d_x$	$_5m_x$	$_5L_x$	T_x	$\mathring{e}_x$
25-29	100 000	3 844	0.007839	490 390	3 350 565	33.51
30-34	96 156	5 058	0.010805	468 135	2 860 175	29.75
35-39	91 098	6 295	0.014315	439 752	2 392 040	26.26
40-44	84 803	7 593	0.018747	405 032	1 952 288	23.02
45-49	77 210	8 875	0.024391	363 862	1 547 256	20.04
50-54	68 335	10 008	0.031605	316 655	1 183 394	17.32
55-59	58 327	10 780	0.040728	264 685	866 739	14.86
60-64	47 547	10 984	0.052236	210 275	602 054	12.66
65-69	36 563	10 452	0.066707	156 685	391 779	10.72
70-74	26 111	9 147	0.084940	107 688	235 094	9.00
75-79	16 964	7 213	0.107998	66 708	127 406	7.51
80-84	9 751	4 979	0.137132	36 308	60 618	6.22
85-89	4 772	2 897	0.174329	16 618	24 310	5.09
90-94	1 875	1 274	0.205816	6 190	7 692	4.10
95-99	601	601	0.400133	1 502	1 502	2.50

Figure 5

MORTALITY RATES



APPENDIX I

CONSTRUCTION OF A LIFE TABLE FOR THE TOTAL POPULATION STUDIED

1. The starting point in the construction of the life table for the population being studied is a set of 15 quinquennial death rates appearing in Table 2. The last two, namely those corresponding to the age interval 90-94 and 95-99, are based in so scant information (9 and 7 deaths, respectively) that we have considered it proper not to take them into account in the construction of the table. As a result we consider only 13 rates extending from the age group 25-29 to the age group 85-89.

2. The graphical representation of the observed rates, see Figure 1, shows that the points represented in a logarithmic scale can be satisfactorily described by a straight line. In other words, if a straight line were drawn following the trend of the observed points, the deviations between these points and the points in the straight line could be explained as due to random errors.

3. It is assumed that the annual mortality rate, for a quinquennial age group, has the mathematical form:

$$_5m_x = B.c^x$$

where B and c are parameters which have to be determined starting from the observed points.

This mathematical law was proposed first by Gompertz in 1825 for the force of mortality, μ (x), which is closely related to the central mortality rate $_5m_x$. For practical reasons we prefer to express the law in terms of this latter rate.

4. From the latter expression, taking logarithms, it is derived:

$$\log.\ _5m_x = \log.\ B + x.\log.\ c$$

that shows that the annual mortality rate ${}_5m_x$, in logarithmic scale, has the form of a straight line. In fact, the starting point of the reasoning is rather the latter expression than the former one: in view of the fact that the logarithms of the rates observed show a trend that is clearly lineal, it is adopted the assumption proposed by Gompertz.

5. It is necessary to adjust the information because of the fact that there are 13 observed points, the 13 observed central mortality rates, which are redundant in order to define the two parameters B and c. Only two points are necessary in order to do that. A very simple procedure was utilized, akin with the crudeness of the information being handled. We should not forget that the data being analyzed are scanty and that, consequently, the observed rates are affected by important random errors. With the adjustment, what is intended is simply to smooth the variation of the rates by age, not to obtain refined results.

6. The procedure that was used was: to compute two points chosen from the observed values and from them to determine the two parameters of the expression. The first of these points results from an average of the log. ${}_5m_x$ of the first seven observed rates and it was assigned to an age group that was central to those seven points. The resulting age group was 40-44 years. The second, derived from the last seven points corresponds to the age group 70-74.

The values are:

(a) first point $\quad \log.\ {}_5m_{40} = -1{,}7553398$

(b) second point $\quad \log.\ {}_5m_{70} = -1{,}1050060$

Starting from these points the derivation of the parameters B and c in the expression considered above is inmediate. The resulting law is:

$${}_5m_x = (0{,}00238533).1{,}051181704^x$$

7. As indicated above, for practical reasons, it was adopted Gompertz's law to adjust the central mortality rate for quinquennial age groups (${}_5m_x$) and not, as it would have been a more proper procedure, the force of mortality ((x)).

Following this procedure, the set of observed points is adjusted directly, without the necessity of previously estimating the set of instantaneous mortality rates.

The shortcoming of the procedure appears when it is required to derive from the adjusted rates the other functions in the life table. If a rigorous procedure were used it would be necessary to derive relations between the central mortality rate,m, expressed according to the mathematical law adopted for it, and the rest of the functions in the table. These relations are not simple and, consequently, the rigorous procedure is not a practical one. It does not seem to be justified a complex handling of data affected by serious limitations, as the ones that are being adjusted. As stated before, what is looked after is an approximate description, not a precise measure, of the level of mortality implied in the observed data.

Because of these considerations it was prefered to follow a simple procedure to derive the life table. Forgetting about the mathematical law that was utilized in the adjustment of the central mortality rates it was used the relation:

$$ {}_5q_x = \frac{2,5\ {}_5m_x}{2+5\ {}_5m_x} $$

in order to derive the probabilities of dying ${}_5q_x$, starting from the adjusted values of m_x, for all age groups except the one corresponding to the age group 95-99. For this group it was assumed that ${}_5q_{95}=1$. In other words, it was adopted as the final age in the table age 100.

Again, following a simple procedure it was computed the value of L starting from the values of l.

$$_5L_x = 2{,}5\ (l_x + l_{x+5})$$

8. In Table 3 the life tables are presented for the total population studied in the usual way, i.e., using the actuarial symbols to represent the various functions included in the table.

APPENDIX 2

CONSTRUCTION OF LIFE TABLES FOR SUBGROUPS OF THE POPULATION STUDIED.

1. For the construction of these tables, that are four (males, females, olds, moderns), we already had a life table for the total. The construction of the life tables corresponding to the subgroups is done taking advantage of that life table that is named "standard life table".

2. An assumption is adopted, following Brass (13), namely that it is possible, approximately, to relate two life tables according to the expression:

$$Y(x) = A + B.YS(x)$$

where Y is the logit of the function $(1-l_x)$ of the table (with root equal to 1). The logit is defined:

$$\text{logito}\ (1-l_x) = 1/2\ \ln \frac{1-l_x}{l_x}$$

3. In Table 1 the logits of the standard life tables are presented starting from age 30 (it has been assumed that in the table, $l_{25}=1$). These values are necessary for the elaboration that follows.

Table 1

LOGITS OF THE STANDARD LIFE TABLE

$$YS(x) = \text{logit}\ (1-l_x^S) = \tfrac{1}{2}\ \ln \frac{1-l_x^S}{l_x^S}$$

Age	Logit YS(x)	Age	Logit YS(x)	Age	Logit YS(x)	Age	Logit YS(x)
30	-1.57999						
31	-1.47775	51	-0.36989	66	0.26296	81	1.08382
32	-1.38520	52	-0.32848	67	0.30870	82	1.15401
33	-1.30110	53	-0.28725	68	0.35529	83	1.22710
34	-1.22431	54	-0.24612	69	0.40280	84	1.30329
35	-1.15377	55	-0.20505	70	0.45132	85	1.38281
36	-1.08854	56	-0.16395	71	0.50094	86	1.46598
37	-1.02773	57	-0.12275	72	0.55179	87	1.55316
38	-0.97057	58	-0.08139	73	0.60396	88	1.64471
39	-0.91638	59	-0.03980	74	0.65754	89	1.74103
40	-0.86456	60	0.00206	75	0.71266	90	1.84256
41	-0.81449	61	0.04428	76	0.76945	91	1.94974
42	-0.76574	62	0.08692	77	0.82808	92	2.06308
43	-0.71818	63	0.13004	78	0.88868	93	2.18308
44	-0.67182	64	0.17371	79	0.95139	94	2.31032
45	-0.62665	65	0.21799	80	1.01636	95	2.39158
46	-0.58243						
47	-0.53889						
48	-0.49593						
49	-0.45349						
50	-0.41152						

4. For each of the four subgroups we have eight observed mortality rates. Following an approximate and simply procedure it was possible to derive from the "observed rates" the value of the function l_x, that is written l^o_x, in order to point out that it is derived from "observed values".

The procedure is derived as follows: starting from the definition of force of mortality ($\mu(x)$)

$$\mu(x) = -\frac{d\, l_x}{l_x dx}$$

it can be deduced

$$d.\ln l_x = -\mu(x)\, dx$$

If we integrate between ages x and x+n

$$\ln \frac{l_{x+n}}{l_x} = -\int_x^{x+n} \mu(x) dx \doteq -n._n m_x$$

where $$l_{x+n} \doteq l_x \,.\, e^{-n._n m_x}$$

Using this expression starting from $l^o_{25} = 1$, eight values of l^o_{x+n} were derived.

5. The logits were computed for $1-l^o_x$, that can be named "observed". One for each of the values of l^o_x, except the first. Accordingly seven values were obtained of $Y^o(x) = \text{logit}\ (1-l^o_x)$.

6. In order to define the general expression:

$$Y(x) = A + B.YS(x)$$

it is necessary to determine the value of the parameters A and B. We have seven points and, in order to define the parameters, two points only are required. There are consequently, a redundancy of observed points and it is necessary to apply a procedure of adjustment.

7. Again in this case, as in the one considered in Appendix 1, it was decided to follow a simple procedure. An average of the first four points of $Y^{o}(x)$ was computed that correspond to a similar average for the same ages, in the standard life table. We can design these two values as Y_1^{o} and YS_1 respectively. A similar average for the last four points defines values that can be represented in symbols as Y_2^{o} and YS_2.

From these points it was possible to write the system that defines the values of A and B.

In Table 2 of this Appendix values of l^{o} and Y^{o} and if the parameters A and B for each of the four subgroups are presented.

8. Once the values of the two parameters have been defined the life table can be derived for each of the four subgroups. These are presented in Tables 5, 6, 8 and 9. Figures 2 and 5 show the values of the observed rates for age intervals of different amplitude (eight points) and the quinquennial mortality rates resulting from the life tables. A careful examination of these figures will permit the reader to verify that the smoothing of the information maintained the levels and the trends of the observed rates.

Table 2

DETERMINATION OF THE PARAMETERS A AND B

Age x	Interval n	Males $_n m_x$	Males $_n p_x$	Males l_x	Males Y(x)	Age x	Interval n	Females $_n m_x$	Females $_n p_x$	Females l_x	Females Y(x)
25	15	0.010330	0.856458	100 000		25	13	0.010480	0.872633	100 000	
40	8	0.020519	0.848613	85 646	-0.8931	38	10	0.016408	0.848674	87 263	-0.9622
48	6	0.028081	0.840897	72 680	-0.4892	48	7	0.024060	0.844999	74 058	-0.5245
54	5	0.044796	0.799331	61 116	-0.2261	55	6	0.034188	0.814543	62 579	-0.2571
59	4	0.070393	0.754597	48 852	0.0230	61	7	0.040721	0.751979	50 973	-0.0195
63	6	0.075802	0.634567	36 864	0.2691	68	6	0.068053	0.664767	38 331	0.2378
69	9	0.078886	0.491657	23 393	0.5931	74	7	0.094183	0.517223	25 481	0.5366
78	14	0.169096		11 501	1.0203	81	19	0.131387		13 179	0.9426
				$\overset{\circ}{Y}_1$	-0.3964					$\overset{\circ}{Y}_1$	-0.4408
				$\overset{\circ}{Y}_2$	0.4764					$\overset{\circ}{Y}_2$	0.4244
				A	0.0782					A	-0.0672
				B	1.1530					B	0.9185

Age x	Interval n	Olds $_n m_x$	Olds $_n p_x$	Olds l_x	Olds Y(x)	Age x	Interval n	Moderns $_n m_x$	Moderns $_n p_x$	Moderns l_x	Moderns Y(x)
25	14	0.009808	0.871698	100 000		25	15	0.011191	0.845468	100 000	
39	10	0.017121	0.842645	87 170	-0.9580	40	7	0.021818	0.858365	84 547	-0.8498
49	6	0.029386	0.838353	73 453	-0.5089	47	8	0.025119	0.817952	72 572	-0.4865
55	6	0.037158	0.800156	61 579	-0.2359	55	5	0.040214	0.817855	59 360	-0.1894
61	5	0.055138	0.759048	49 273	0.0145	60	6	0.054613	0.720596	48 548	0.0290
66	8	0.050688	0.666641	37 401	0.2575	66	5	0.088272	0.643161	34 983	0.3099
74	6	0.102964	0.539138	24 933	0.5511	71	9	0.090186	0.444114	22 500	0.6184
80	20	0.177340		13 442	0.9312	80	20	0.122807		9 993	1.0990
				$\overset{\circ}{Y}_1$	-0.4221					$\overset{\circ}{Y}_1$	-0.3742
				$\overset{\circ}{Y}_2$	0.4386					$\overset{\circ}{Y}_2$	0.5141
				A	-0.0469					A	0.0469
				B	0.9803					B	1.0485

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