A comparison of random and self-selected samples of urban and rural residents

Distribution of Visual Acuity in Egypt

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IT IS GENERALLY UNDERSTOOD that if one intends to undertake a sample survey of the prevalence or distribution of a characteristic in the population of a community, the sample should be representative of the population. It must be drawn scientifically so that the results may be generalized to the population with a known sampling error. Every individual in the population sampled will, in scientific sampling, have a known probability of falling into the sample. If the individual is able to change that probability by self-selection, the sample is no longer scientific.

It is of some interest to determine just what happens to the sample as reflected in the distribution of normal or of severely impaired vision when

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This paper is based on data from the Blindness Register Demonstration Project in Egypt supported by Agreement No. 522518, National Institutes of Health Special Foreign Currency Program. Tearsheet requests to Hyman Goldstein, PhD, Maternal and Child Health Program, School of Public Health, Berkeley, Calif. 94720.

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self-selection replaces scientific sampling, such as random sampling. What would be the relationship of the distributions of visual acuity by age, sex, eye, and urban-rural residence in samples based on random selection to those found by use of self-selected samples?

In a previous paper (*1*) we compared differences in blindness prevalence rates found in (*a*) a 4 percent random sample of households (consisting of approximately 11,000 persons of all ages and socioeconomic levels) visually screened in some urban and rural areas in and around Alexandria, Egypt, with (*b*) those of a self-selected sample of approximately 145,000 persons in the same geographic areas. The crude blindness rate for the random sample was almost 2½ times that for the self-selected sample. The self-selected sample was characterized by reduced percentages of older males and females in urban and rural areas—percentages that were statistically significant—as were the reduced percentages of females in both areas in the self-selected sample.

Since, in general, age-specific blindness prevalence rates among the elderly are higher than among the young and since overall rates for females are higher than those for males, it is possible that the differences in composition by age and sex, aforementioned, might explain the differences in the crude prevalence rates of the two samples. The greatest percentage decrease in rates of the self-selected sample occurred in the rural areas.

Objectives

This study was based on the data secured in the earlier study (*1*). The objectives were to determine whether significant differences by age, sex, eye, and urban-rural residence exist between the distributions of visual acuity in two samples from the same populations in Egypt—one drawn randomly and the other self-selected.

This study was ancillary to a long-term investigation with these objectives: (*a*) to determine, by scientific sampling and vision screening, baseline prevalence rates and causes of blindness in some urban and rural areas in Egypt and their relationship to age, sex, and urban-rural residence and (*b*) to set up a blindness register in these areas based on voluntary self-selection of a population for vision screening so that needed restorative and rehabilitative services could be provided to those screened and confirmed as blind. That study has been described elsewhere (*2*).

In determining baseline prevalence rates, the sample selected must be random so that generalization may be made to the population from which it is drawn. On the other hand, in setting up a blindness register to identify as many blind as possible for the purpose of offering them services, the sample is usually self-selected.

Methods

Data for this study were obtained during phases 1 and 2 of the Blindness Register Demonstration Project in Egypt (*2*).

Visual acuity and field of vision were determined by examination of persons in each sample by a trained physician or ophthalmologist. Acuity of vision of each eye was measured metrically by the Titmus optical vision tester and a tumbling E slide. Equipment and methodology have been described in detail elsewhere (*3*). The conversion table used for distance visual acuity follows:

Snellen

English	*Metric*
20/20	6/6
20/30	6/9
20/40	6/12
20/50	6/15
20/60	6/20
20/100	6/30
20/200	6/60

Phase 1

Phase 1 of the investigation was concerned with prevalence rates derived from random samples of urban and rural populations. The two districts

selected as the urban sampling frame did not necessarily represent Alexandria, nor did the 23 villages selected as the rural sampling frame represent all villages in the area around Alexandria. The results from the samples may be generalized only to the populations of these sampling frames. The goal was to have approximately 5,000 persons in each of the urban and rural samples. Households, rather than persons, were used as sampling units because it was impossible to secure listings for any locality of persons in the general population.

The Alexandria Department of Social Affairs had complete up-to-date listings of households in Alexandria by districts and subdistricts. The population of the rural sample was determined by population counts of the local health authority. A household was defined as those persons sharing one dwelling unit. When the study was started in April 1965, the urban and rural areas in the study each had a population of about 127,000. In view of the fact that census data showed that an average Egyptian household consisted of five persons, samples of approximately 1,000 urban households and 1,000 rural households were randomly selected. These households constituted, in effect, a sample of approximately 4 percent from each area. All age groups were represented in the sample studied, except for the great majority of those under 5 years of age for whom it was difficult to get reliable data under conditions of the survey. All examinations were given in the homes.

Phase 2

Phase 2 was concerned with prevalence rates as derived from study of self-selected samples of the urban and rural populations. After phase 1 was completed, an attempt was made to set up a blindness register for the total population in the urban and rural areas selected for study in phase 1. A 6½-month interval separated the starting dates for phases 1 and 2. Publicity, offering visual examinations (exactly like those given to members of the random samples in phase 1) to any interested residents, was directed to the urban and rural areas. Examination teams set up conveniently located clinics for this purpose, and they also made these examinations available at times suitable for those who found it inconvenient to come during working hours.

With a Titmus Optical Company vision tester to measure visual acuity by means of a tumbling-E slide, each eye was examined separately, starting with the right eye. The person was examined with his eyeglasses if he normally wore them.

Table 1. Percentage distribution of persons examined in urban and rural areas, by age and sex, for phase 1 (random sample) and phase 2 (self-selected sample)

Age in years	Urban			Rural			Total		
	Males	Females	Both sexes	Males	Females	Both sexes	Males	Females	Both sexes
Phase 1									
Number	2,087	3,026	5,149	2,879	2,956	5,835	4,966	6,018	10,984
Under 10	16.7	12.4	14.2	12.6	10.4	11.5	14.3	11.5	12.8
10–19	33.4	32.5	32.9	31.2	28.0	29.6	32.2	30.3	31.1
20–29	12.4	17.6	15.5	12.3	17.9	15.1	12.3	17.7	15.3
30–39	12.4	16.0	14.6	15.9	21.4	18.7	14.4	18.7	16.3
40–49	11.5	9.8	10.5	13.8	11.1	12.4	12.8	10.4	11.5
50–59	8.0	6.6	7.2	8.6	7.0	7.8	8.4	6.8	7.5
60 or older	5.5	5.0	5.2	5.6	4.2	4.9	5.5	4.6	5.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Phase 2									
Number	40,716	36,112	76,828	36,201	31,325	67,526	76,917	67,437	144,354
Under 10	17.6	19.1	18.3	12.6	9.4	11.1	15.3	14.6	14.9
10–19	42.2	35.9	39.2	38.3	28.8	33.9	40.4	32.6	36.7
20–29	11.2	13.2	12.2	13.8	19.3	16.3	12.4	16.0	14.1
30–39	10.2	13.6	11.8	16.0	19.2	17.5	13.0	16.2	14.5
40–49	10.7	8.7	9.7	9.8	9.6	9.7	10.3	9.1	9.7
50–59	5.1	6.2	5.6	6.2	7.6	6.8	5.6	6.9	6.2
60 or older	2.9	3.4	3.1	3.3	6.0	4.6	3.1	4.6	3.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 2. Percentage distribution of visual acuity of males and females in urban areas by sex, age, and eye for phase 1 (random sample) and phase 2 (self-selected sample)

Age group	Number	Visual acuity, right eye							Visual acuity, left eye						
		6/6	6/9	6/12	6/15	6/20	6/30	6/60 or less	6/6	6/9	6/12	6/15	6/20	6/30	6/60 or less
Males															
Phase 1															
Total, age-adjusted	2,087	45.3	21.0	11.8	5.9	4.6	3.2	8.3	41.6	24.2	12.1	4.6	5.6	3.8	8.3
Under 10	348	43.1	29.6	11.5	4.0	4.3	1.4	6.0	38.8	29.3	12.1	3.4	6.6	4.9	4.9
10–19	698	54.9	21.8	8.0	4.9	3.6	1.6	5.3	50.6	26.5	8.9	3.6	3.2	2.4	4.9
20–29	259	52.9	18.5	10.8	5.4	3.1	2.7	6.6	51.0	18.2	12.4	5.8	4.2	.8	7.7
30–39	260	48.1	16.9	12.7	5.0	3.8	3.8	9.6	43.1	23.1	13.5	3.1	6.2	2.7	8.5
40–49	240	28.8	20.0	18.8	8.3	7.1	4.2	12.9	25.4	22.1	16.2	7.5	9.2	7.9	11.7
50–59	167	21.0	18.0	21.0	13.8	7.2	6.0	13.2	18.6	25.8	16.8	9.6	9.6	3.6	16.2
60 or older	115	7.0	13.9	14.8	8.7	13.0	16.5	26.1	6.1	11.3	18.3	3.5	11.3	16.5	33.0
Phase 2															
Total, age-adjusted	40,716	46.4	24.4	16.7	3.8	5.2	1.6	2.0	44.8	24.8	13.4	6.3	4.1	4.0	2.6
Under 10	7,171	47.9	24.5	17.5	3.8	4.9	.9	.5	48.4	22.0	18.4	5.9	3.8	1.2	.3
10–19	17,194	54.8	25.0	15.6	2.2	1.6	.5	.4	55.2	24.9	12.4	4.1	1.3	1.2	1.0
20–29	4,583	57.6	16.9	12.4	3.6	5.0	3.0	1.4	55.4	25.9	7.9	4.3	2.3	2.0	2.1
30–39	4,162	48.1	23.4	16.4	4.5	5.1	.9	1.6	44.4	30.4	14.0	2.8	4.3	2.4	1.8
40–49	4,357	30.8	31.8	21.7	6.1	5.2	1.7	2.7	24.1	32.6	14.7	14.8	5.7	5.5	2.7
50–59	2,079	13.7	30.0	18.6	7.5	17.9	5.8	6.6	11.3	14.0	15.1	13.5	18.6	15.9	11.7
60 or older	1,170	6.7	22.0	24.5	4.7	20.5	5.5	16.2	4.6	9.4	16.3	15.2	8.9	29.8	15.7
Females															
Phase 1															
Total, age-adjusted	3,062	33.6	24.0	12.9	6.6	7.8	4.5	10.7	30.6	27.3	12.7	6.3	6.3	5.7	11.0
Under 10	381	38.0	29.0	13.3	3.7	6.4	4.3	5.3	34.8	30.6	12.8	6.1	4.5	5.8	5.3
10–19	994	44.2	26.4	11.6	5.2	3.3	2.2	7.1	40.7	30.7	10.6	4.2	4.5	3.2	6.0
20–29	539	37.3	23.0	11.0	7.4	7.4	3.9	10.0	34.3	26.3	13.7	6.9	6.5	5.0	7.2
30–39	491	26.3	23.2	12.8	9.0	11.8	4.3	12.6	23.8	29.1	14.5	7.3	6.5	4.9	13.8
40–49	300	20.0	22.0	16.7	7.7	10.7	7.7	15.3	16.3	25.3	14.7	9.0	8.7	10.3	15.7
50–59	203	10.3	16.3	17.2	11.3	18.2	5.9	20.7	10.3	14.3	14.8	9.8	11.8	11.8	27.1
60 or older	154	3.2	6.5	13.6	9.7	16.9	18.2	31.8	2.0	6.5	13.6	7.1	13.0	13.0	44.8
Phase 2															
Total, age-adjusted	36,112	35.0	24.4	16.1	7.6	6.7	5.1	5.0	37.3	25.6	13.9	7.1	7.8	4.5	3.6
Under 10	6,886	50.9	25.9	12.2	4.7	4.0	2.0	.3	51.1	28.5	11.4	4.5	4.5	.....	.....
10–19	12,952	45.3	27.9	15.5	5.0	2.9	2.6	.8	49.1	27.2	12.8	4.4	3.9	2.1	.5
20–29	4,757	39.1	20.7	21.9	8.5	3.6	2.0	4.2	40.6	24.5	15.0	9.0	5.9	2.7	2.3
30–39	4,914	24.9	28.9	17.1	10.7	9.8	4.4	4.2	25.6	32.7	15.8	7.3	8.2	6.8	3.6
40–49	3,133	12.4	23.7	21.8	10.8	12.2	10.7	8.5	17.5	24.4	19.2	12.0	13.6	8.4	4.9
50–59	2,248	8.2	8.3	13.2	16.1	20.6	14.1	19.6	8.2	8.8	16.1	16.5	22.8	10.8	16.8
60 or older	1,222	3.1	11.6	2.7	5.5	16.4	24.4	36.2	5.2	8.4	6.6	7.9	23.0	22.8	26.2

Table 3. Percentage distribution of visual acuity of males and females in rural areas by sex, age, and eye for phase 1 (random sample) and phase 2 (self-selected sample)

Age group	Number	Visual acuity, right eye							Visual acuity, left eye						
		6/6	6/9	6/12	6/15	6/20	6/30	6/60 or less	6/6	6/9	6/12	6/15	6/20	6/30	6/60 or less
								Males							
Phase 1															
Total, age-adjusted	2,879	22.9	19.6	17.1	11.5	10.7	8.0	10.2	19.5	21.8	16.8	9.2	11.5	8.7	12.4
Under 10	364	15.7	21.4	19.5	10.7	14.0	13.2	5.5	16.5	21.7	16.8	9.1	14.3	15.4	6.3
10–19	899	29.1	20.6	17.9	11.4	8.8	6.3	5.9	23.7	25.2	16.1	9.5	9.6	7.4	8.4
20–29	353	25.8	19.0	15.6	15.0	11.3	4.0	9.4	23.5	20.1	19.0	7.4	11.9	7.6	10.5
30–39	458	25.5	21.4	17.2	9.4	7.9	7.2	11.4	20.3	20.7	19.4	7.6	10.7	7.0	14.2
40–49	396	20.2	20.0	14.4	11.4	11.6	8.6	13.9	15.9	21.0	15.9	12.4	13.6	6.6	14.7
50–59	248	8.9	14.9	16.9	13.3	15.7	11.7	18.6	7.7	14.9	15.7	10.5	13.7	12.1	25.4
60 or older	161	2.5	6.8	12.4	8.1	14.3	13.0	42.9	3.1	13.0	10.6	8.7	11.2	6.2	47.2
Phase 2															
Total, age-adjusted	36,201	41.8	23.1	16.2	6.3	4.6	3.6	4.5	37.9	29.3	14.0	5.0	4.0	4.6	5.3
Under 10	4,578	42.0	28.0	20.6	5.8	3.1	..	.5	39.8	32.0	15.8	4.0	.9	7.5	..
10–19	13,866	51.1	25.6	14.6	4.2	2.2	1.0	1.2	48.8	30.4	12.3	3.5	2.2	.8	2.1
20–29	4,979	45.1	23.8	13.4	5.7	3.7	4.6	3.8	41.0	30.6	10.6	5.9	3.7	3.7	4.5
30–39	5,807	41.2	17.0	18.4	7.0	6.3	5.3	5.0	36.6	27.2	16.0	4.2	5.0	3.6	7.5
40–49	3,544	31.3	22.7	18.2	6.4	8.1	6.9	6.3	23.1	32.4	13.6	5.8	8.2	7.1	9.8
50–59	2,233	21.6	17.3	16.3	13.0	9.1	11.8	10.9	12.9	23.5	20.8	12.1	8.0	10.8	11.9
60 or older	1,194	3.4	11.7	10.3	15.2	12.0	10.1	37.2	1.8	13.6	17.2	8.2	13.6	18.5	27.0
								Females							
Phase 1															
Total, age-adjusted	2,956	11.6	17.0	16.0	13.4	14.6	12.7	14.7	9.7	16.0	16.2	11.4	16.8	13.3	16.5
Under 10	309	10.4	21.7	16.8	10.4	14.6	18.8	7.4	10.4	19.1	16.5	9.7	17.2	19.1	8.1
10–19	827	15.1	20.6	17.5	13.7	13.8	10.5	8.8	12.9	19.7	18.6	11.6	16.7	9.4	11.0
20–29	528	14.4	17.6	18.4	17.4	11.7	10.6	9.8	10.6	21.2	16.7	15.3	14.6	10.4	11.2
30–39	634	9.9	19.2	18.1	14.5	15.6	10.1	12.5	9.0	12.5	18.9	12.1	17.8	13.6	16.1
40–49	328	8.5	7.6	13.1	15.6	18.6	16.8	19.8	4.6	8.8	14.0	11.6	20.1	19.2	21.6
50–59	206	3.4	3.4	8.7	8.7	20.4	14.6	40.8	3.4	5.3	6.3	8.2	18.0	16.5	42.2
60 or older	124	..	1.6	1.6	4.0	10.5	13.7	68.6	..	.8	3.2	4.0	8.9	17.7	65.3
Phase 2															
Total, age-adjusted	31,325	32.8	22.2	15.7	5.6	8.4	6.1	9.2	28.8	25.5	15.1	5.6	9.1	6.9	9.1
Under 10	2,939	39.0	29.4	19.9	4.8	4.1	1.5	1.4	35.5	35.9	16.5	3.6	5.5	1.5	1.5
10–19	9,026	43.8	26.4	14.3	5.1	6.2	1.9	2.3	37.8	29.8	14.6	5.4	6.5	3.0	3.0
20–29	6,041	40.0	21.9	17.4	5.1	8.4	3.8	3.4	35.1	24.4	16.4	6.0	10.1	4.4	3.7
30–39	6,006	28.8	20.4	19.1	5.7	11.8	6.8	7.5	22.5	24.2	19.8	4.4	11.8	9.6	7.7
40–49	3,025	9.4	19.3	16.8	10.9	17.4	16.7	9.5	13.4	17.5	16.6	9.3	15.7	15.4	12.1
50–59	2,394	2.7	4.7	8.1	5.1	10.7	21.6	47.0	3.1	7.7	6.2	8.0	12.9	25.4	36.8
60 or older	1,894	3.1	..	4.3	2.5	6.6	15.7	67.7	1.8	3.4	2.3	4.4	10.8	10.4	66.8

The best visual acuity of each eye was determined by starting with a visual acuity of 6/60 (20/200) and by successive steps reaching the eye's best visual acuity. If the better eye had a visual acuity of 6/60 or less, correcting lenses were added after retinoscopy to improve the visual acuity to at least 6/30. If the person's visual acuity was 6/60 or less in the better eye with the best correction, he was referred to the ophthalmologist as blind for confirmation of the findings and, if confirmed as blind, for possible determination of the cause.

Results

Urban and rural samples by age and sex. Table 1 shows the distribution by age and sex of persons screened visually in urban and rural areas in phase 1 (random sample) and in phase 2 (self-selected sample). Among urban residents the self-selected sample showed increases in percentages of persons under age 20 who were examined and decreases in percentages of persons 50 and over examined as compared with the random sample. Among rural residents an increase in the percentage examined under age 30 was seen in the self-selected sample and a decrease in the percentage of persons examined aged 50 and over, as compared with the random sample.

Visual acuity. The percentage distribution by age for the random and self-selected samples of visual acuity in the right and left eye of all males and females examined in urban areas is shown in table 2. Also shown are the age-adjusted percentages for each visual acuity by sex and eye.

For urban males the age-adjusted percentage with visual acuity of 6/6 in the right eye for the random sample was 45.3 percent, and for the self-selected sample, 46.4; in the left eye for the random sample, 41.6, and for the self-selected sample, 44.8. (Age adjustment was accomplished by using as a standard population the age distribution of persons comprising the random sample and the self-selected sample.) In both samples and each eye the percentage of urban males with 6/6 visual acuity dropped rapidly after age 40 to 7.0 in the right eye and 6.1 in the left eye in the random sample, and to 6.7 in the right eye and 4.6 in the left eye in the self-selected sample in the age group 60 or older.

Employers in Egypt accept 6/12 as the average level of vision needed for most jobs. In the random sample 78.1 percent had 6/12 or better visual acuity in the right eye and 77.9 in the left eye; in the self-selected sample the respective percents were 87.5 and 83.0. It appears that, in general, the acuity of the right eye is somewhat better than that of the left eye. The reason for superiority of the right eye, which is also evident in other comparisons, is not clear.

Each eye in both samples showed, in general, an increase in the percentage of those with visual acuity of 6/60 (20/200) or less with increase in age, rising sharply in the random sample at age 60 or older and in the self-selected sample at age 50. In every age group, as well as in all age groups combined (age-adjusted total), the self-selected sample had lower percentages of these severely impaired males for each eye than did the random sample.

For urban females the age-adjusted percentage with visual acuity of 6/6 in the right eye was, for the random sample, 33.6, and for the self-selected sample, 35.0; in the left eye these respective percentages were 30.6 and 37.3.

The percentages in both samples and in each eye for urban females with 6/6 visual acuity dropped rapidly after age 30, to 3.2 in the right eye and 2.0 in the left eye in the random sample and to 3.1 in the right eye and 5.2 in the left eye in the self-selected sample in the age group 60 or older (table 2).

"Normal" visual acuity in urban females was generally poorer, began to decline at an earlier age, and in old age reached a lower level than in urban males.

There was an increase with age in the percentage with visual acuity of 6/60 or less in each eye among urban females; the percentage increased sharply at age 50 in both the random and self-selected samples. In general, as with urban males, the age-specific percentages in the self-selected sample were lower than those in the random sample. A higher percentage of visual acuity 6/60 or less was found in urban females in either eye and in both samples than was evident in urban males.

Table 3 shows the percentage distribution by age for the random and self-selected samples of visual acuity in the right and left eyes of all males and females by age examined in rural areas.

For rural males the age-adjusted percentage with visual acuity of 6/6 in the right eye for the random sample was 22.9 and for the self-selected sample, 41.8; in the left eye, for the random sample, 19.5, and for the self-selected sample, 37.9. The percentages are lower than they were

for the urban males. The percentage difference, however, is much greater in the random sample than in the self-selected sample. In the random sample, the rural male percentage is about half that of the urban male. In both samples, the percentage of rural males with 6/6 visual acuity decreased rapidly after age 50 to 2.5 in the right eye and 3.1 in the left eye in the random sample in the age group 60 or older, and after age 40 to 3.4 percent in the right eye and 1.8 percent in the left eye in the self-selected sample in the oldest age group.

In the random sample 59.6 percent of the males had 6/12 or better visual acuity in the right eye and 58.1 percent in the left eye; in the self-selected sample these percentages were 81.1 and 81.2 respectively. The percentages with visual acuities of 6/12 or better in the random sample of rural males are considerably below similar percentages for the urban males. Although 6/12 is the average level of acuity needed for employment in most jobs in Egypt, it is probable that persons with less acuity can get by in rural occupations, because these occupations do not demand as keen a vision.

As in urban areas, the percentage of rural males with visual acuity of 6/60 or less in either eye rose with age in both samples, increasing rapidly in the random sample in both eyes after age 50; in the self-selected sample the increases were marked in each eye after age 60 or older. The percentages for every age group and for the age-adjusted total were lower for each eye in the self-selected sample than in the random sample. The rural male percentages were higher than similar percentages among urban males for the age-adjusted totals and for practically every age-specific percentage for both samples and each eye.

The data on rural males indicated, as did those on urban males, that in general the visual acuity of the right eye is better than that of the left.

For rural females the age-adjusted percentage with visual acuity of 6/6 in the right eye was, for the random sample, 11.6, and for the self-selected sample, 32.8; in the left eye these percentages were 9.7 and 28.8. The percentages are lower than they were in the case of urban females, with the greatest differences observed in the random sample, where the rural female percentage is about one-third that of the urban female.

Table 4. Differences between random sample and self-selected sample in age-adjusted percentages of persons with visual acuity of 6/6, 6/15, and 6/60 or less, by urban-rural residence, sex, and eye

Visual acuity	Urban		Rural	
	Males	Females	Males	Females
Right eye:				
6/6	[1]−1.1	[1]−1.4	−18.9	−21.2
6/15	2.1	−1.0	5.2	7.8
6/60 or less	6.3	5.7	5.7	5.5
Left eye:				
6/6	−3.2	−6.7	−18.4	−19.1
6/15	−1.7	[1]− .8	4.2	5.8
6/60 or less	5.7	7.4	7.1	7.4

[1] Not statistically significant at the 5 percent level.
NOTE: Minus sign indicates that the self-selected sample percentage exceeds the random sample percentage. All differences except the 3 footnoted items are significant at the 5 percent level.

As in the case of urban females, the percentage of rural females with visual acuity of 6/6 in both samples and in each eye decreased with age. It dropped sharply in the random sample in the right eye after age 50 to a low of 0 percent, and in the left eye after age 40 to a similar low; in the self-selected sample it decreased rapidly in the right eye after age 40 to 3.1 and in the left eye, after age 30, it dropped to 1.8 in the age group 60 or older.

The percentage of rural females with visual acuity of 6/60 or less in either eye increased with age in both samples, rising rapidly in the random sample in each eye after age 50; in the self-selected sample the percentage in each eye also rose rapidly after age 50. For practically every age group and for the age-adjusted total, the percentages for each eye were lower in the self-selected sample than in the random sample. The rural female percentages were higher than similar percentages among urban females for the age-adjusted totals and for practically every age-specific percentage for both samples in each eye.

Table 4 presents differences in age-adjusted percentages between the random sample and the self-selected sample of persons with visual acuity of 6/6, 6/15, and 6/60 or less by urban-rural residence, sex, and eye. It is evident that with respect to urban males and females, there is no significant difference in 6/6 visual acuity of the right eye between that found in the random sample and that in the self-selected sample. At the

6/15 level, males show a statistically significantly increased percentage for the random sample, but the females show statistical significance for an increased percentage in the self-selected sample. However, at a visual acuity of 6/60 or less, both urban males and females show increased percentages for the random sample.

For the left eye in urban males and females, the percentage with visual acuity of 6/6 in the self-selected sample was statistically significantly greater than that in the random sample; however, the percentage with visual acuity of 6/60 or less was decreased significantly in both sexes when compared with that in the random sample. Again, only in the 6/15 visual acuity level is there some uncertainty. Both sexes showed decreased percentages at that level in the random sample, but only in males was the difference statistically significant.

In rural males and females the findings are consistent for both sexes and for each eye at each of the three visual acuity levels. In each eye males and females show statistically significant increases at the 6/6 visual acuity level in the self-selected sample, as compared with the random sample. At the 6/15 level and the 6/60 or less level, however, the reverse picture is evident. At each of these visual acuities the percentage found in the random sample is significantly greater than that in the self-selected sample.

It is obvious that at any given age the percentages of the different visual acuities must total 100 percent. As age increases, the percentage for 6/6 decreases while that for 6/60 increases. In view of the fact that the age-adjusted 6/6 percentage for the self-selected sample is greater than that for the random sample and that the age-adjusted 6/60 percentage for the self-selected sample is less than that for the random sample, it is obvious that a graph of these two curves would show a crossover at some visual acuity level between 6/6 and 6/60. The differences in the findings pertaining to the 6/15 level between urban and rural areas, mentioned previously, might be related to the rates of decrease of the two curves and the visual acuity level at which they cross. For instance, if the curves cross at a visual acuity level better than the 6/15 level, such as those in the rural areas, the random sample percentage at the 6/15 level will exceed that of the self-selected sample at that same level. If they cross at a visual acuity level worse than the 6/15 level, such as those for the left eye of males or females in urban areas, the self-selected sample percentage at the 6/15 level will exceed that of the random sample at that same level.

Discussion

Before this study no data were available on visual acuity on a communitywide basis in developing countries, including Egypt. Therefore, the data obtained in this study have special significance because all groups of the population were represented, and standard techniques and equipment were used.

A comparison of visual acuities of each eye of random and self-selected samples of urban and rural residents indicated that for males and females the distributions of visual acuity were different in the two samples. In the self-selected sample, the age-adjusted percentage of so-called "normal" vision (6/6) was significantly greater in both urban and rural areas for each eye of males and females than it was in the random sample. Similarly, the percentage of those with severely impaired vision or blindness (6/60 or less) was significantly less in the self-selected sample than that in the random sample. These findings tie in well with those found in a previous study (*1*) with the same samples in which it was found that binocular blindness prevalence rates in the self-selected sample were significantly lower than those in the random sample for males and females in urban and rural areas in Egypt.

What would explain the findings mentioned previously? It is true that in the urban areas a significantly greater percentage of persons under age 20 were in the self-selected sample (57.5 percent) than in the random sample (47.1 percent). The same is true for the rural areas; a greater proportion of the under age 20 group are in the self-selected sample (45.0 percent) than in the random sample (41.1 percent). Younger people, in general, have better visual acuity than older people. But, even when age-adjustment was undertaken, the adjusted findings show the same picture.

It is possible that a person who feels confident that he is normal or near normal in a function being tested is more likely to self-select himself for the test. Though refusal to cooperate is possible, of course, for persons randomly selected for a sample, that possibility occurred much too infrequently to be of significance in this study. In the urban areas 1,000 families were randomly selected for the study, and of these only 18 (1.8

percent) refused to cooperate. In the rural sample every one of the 1,000 families randomly selected cooperated.

In a random sample, within the limits of sampling error, what is found in the sample reflects what exists in the community sampled. Therefore, what is found in a self-selected sample or any other type of biased sample represents the effects of factors that distort to a greater or lesser extent the distribution in the community of what is being measured.

The effect of self-selection on increasing the percentage with 6/6 visual acuity in the sample was more evident in rural than in urban areas. The effect of self-selection on the proportion of persons with visual acuity of 6/15 was not clear in the urban area but was evident in the rural area. Finally, self-selection resulted in decreased percentages of persons in the sample with visual acuity of 6/60 or less. Males and females showed about the same change in percentage. Urban and rural area residents showed about the same percentage change.

In both the random and self-selected samples, the urban males and females had better vision than their rural counterparts. This was true, in general, for each eye. Among the possible causes for such differences may be the greater exposure to eye infections in the rural areas and the scarcity of services, preventive or curative, available in these areas. An additional explanation for the differences may lie partly in the fact that people in rural areas are less educated than in urban areas. This lack of education may result in poor sanitary procedures in the home, such as the use of a common towel, and often the failure of rural persons to take proper care of their eyes. The lower socioeconomic levels of people in rural areas and the difficulties in getting transportation from village to city may also contribute to delays in seeking medical attention and care. As a result, visual disorders of people in rural areas are, in general, not detected or treated early.

In both the random and the self-selected samples, males had better visual acuity than females in both urban and rural areas. This may be related to the fact that males are the breadwinners of the family in Egypt. Thus, they are more likely than females to seek medical advice and to have their vision corrected by glasses. Furthermore, females may be somewhat reluctant to wear glasses for cosmetic reasons.

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SAID, MOHYI-ELDIN (University of Alexandria, Egypt), GOLDSTEIN, HYMAN, KORRA, AHMAD, and EL-KASHLAN, KHALIL: *Distribution of visual acuity in Egypt. A comparison of random and self-selected samples of urban and rural residents. Health Services Reports, Vol. 89, May–June 1974, pp. 247–255.*

A comparison was made of the results of house-to-house vision screening of a 4 percent random sample of households (consisting of about 11,000 persons of all ages and socioeconomic levels) in some urban and rural areas in and around Alexandria, Egypt, with the results of screening of a self-selected sample of about 145,000 persons in the same geographic areas.

Comparisons were made of age-adjusted percentages of the various visual acuities for each eye by sex and urban-rural residence for the random and self-selected samples.

The self-selected, age-adjusted percentages for visual acuity of 6/6 (20/20) were significantly increased over those of the random sample. This was true for the age-adjusted percentages for each sex and for each eye and by urban-rural residence. When comparisons were made of similar percentages for visual acuity of 6/60 (20/200) or less, the findings show that the percentages were significantly decreased in the self-selected sample when compared with the counterpart percentages in the random sample. Generally, the changes in percentages because of self-selection were greater in rural areas than in urban areas.