A comparison of random and self-selected samples of urban and rural residents, by age and sex

Blindness Prevalence Rates in Egypt

MOHYI-ELDIN SAID, D.O.M.S., HYMAN GOLDSTEIN, Ph.D., AHMAD KORRA, M.Ch., and KHALIL EL-KASHLAN, Dr.P.H.

UNLESS a sample is scientifically drawn from a defined population, it is not possible to generalize the findings of a study to a population with a known sampling error, as is known. What is not clear is the relationship, if any, that the findings of a study of a nonscientifically selected sample from a specific population may have to the findings from a study of a scientifically drawn sample. One type of nonscientifically drawn sample is the self-selected sample where the individual person, rather than the law of probability, determines his chances of being in a sample. In other words, a person selects himself to become a member of a sample.

Would the screening of a self-selected sample give a fair approximation to the true prevalence rate of a disease, defect, or disability in a population? Or, would factors such as the following help to explain any increase or decrease in the number of affected persons found in a self-selected sample compared with a random sample:

1. Those who come in voluntarily would likely include a larger percentage of nonaffected persons, possibly those who are prevention minded. Thus, lower rates would result for the condition under study in the self-selected sample.

2. Persons who know or fear that they have the condition under study would be anxious to be screened in the hope that they no longer have the condition or that their fears were groundless. This would result in higher rates for the condition under study.

3. If the condition under study is one that impedes mobility, it might be difficult or impossible for the affected person to report at the clinic for examination. This would result in lower rates.

4. If the condition is highly prevalent among the aged or is likely to be associated with other conditions that keep people bedridden, this also would probably prevent affected people from getting examined. Again, lower rates would result.

Objectives

The objectives of the study reported here were to determine (*a*) whether the composition of two samples from the same population in Egypt, one drawn randomly and the other self-selected for vision examination, differed and, if so, to what degree by age, sex, and urban or rural residence and (*b*) whether the blindness prevalence rates of these two samples differed and, if so, to what degree by age, sex, and urban or rural residence. In subsequent studies, we hope to determine the difference between the blindness prevalence rates

Dr. Said is professor and chairman of the department of ophthalmology and principal investigator of the blindness register survey; Dr. Korra is assistant professor of ophthalmology and project control officer; Dr. El-Kashlan is assistant professor of hygiene and public health at Tanta; all three are on the Faculty of Medicine, University of Alexandria, Egypt. Dr. Goldstein is research biostatistician, maternal and child health program, School of Public Health, University of California at Berkeley, and professor of biostatistics, department of obstetrics and gynecology, School of Medicine, University of California at San Francisco.

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by type of affection and etiology and between the distributions of visual acuity and field of vision of the two kinds of samples.

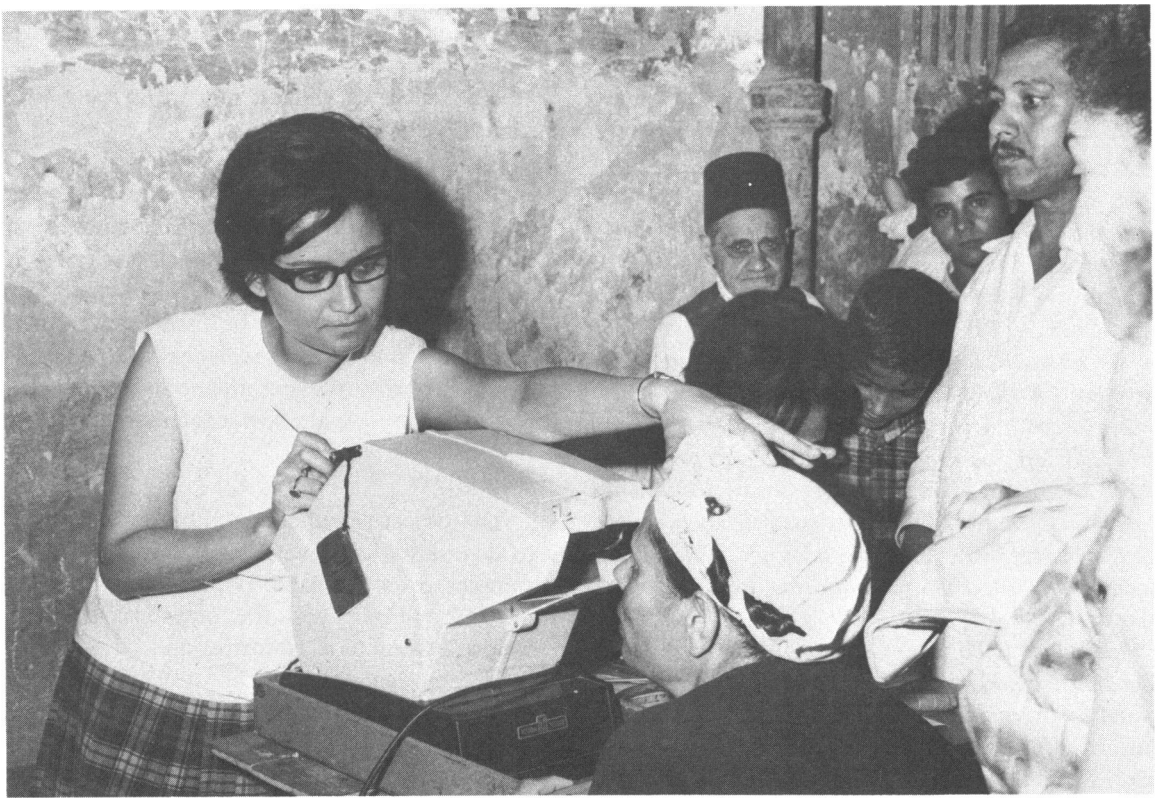
The present investigation was ancillary to a long-term study (*1*) undertaken to (*a*) determine, by scientific sampling, and vision screening baseline prevalence rates, incidence rates, and causes of blindness in some urban and rural areas of Egypt and their relationship to age, sex, and environment and (*b*) set up a blindness register in these areas, based on a self-selected sample of a population for vision screening, so that necessary restorative and rehabilitative services could be provided to the blind.

In determining blindness prevalence rates, it is essential that the sample selected be random and, therefore, representative of the population from which it was drawn. However, in setting up a blindness register where the objective is to identify as many blind people as possible in order to offer them services, the sample is usually self-selected.

Methods

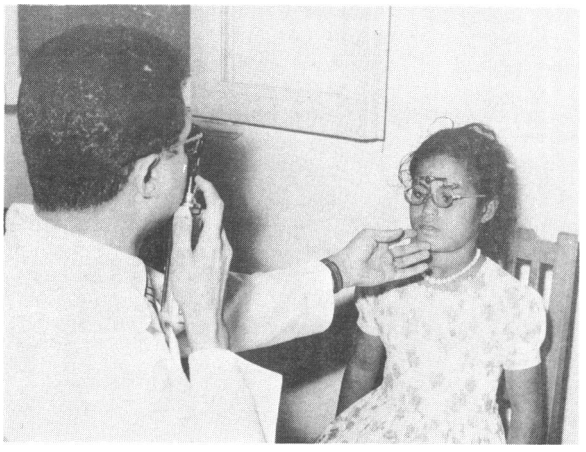
Data for this study were obtained during phases 1 and 2 of the Blindness Register Demonstration Project in Egypt (*1*). During phase 1, 10,984 persons were screened in randomly selected households. Portable equipment was used to determine visual acuity, field of vision, and cause of blindness (affection or diagnosis and etiology). Of those examined, 5,149 were in urban areas (two contiguous districts in Alexandria containing a representative cross-section of persons of various socioeconomic strata) and 5,835 were in rural areas (23 villages within a radius of 20 miles of Alexandria). In the urban areas, 2,087 of those screened were males and 3,062 were females. In the rural areas, 2,879 were males and 2,956 were females. Each of the urban and rural areas in the study had a population, as of April 1965 when the study was started, of about 127,000.

The definition of blindness used in this study is that used by the U.S. Model Reporting Area for Blindness Statistics (a group of States with blindness registers that have voluntarily agreed to a common definition of blindness and to uniform methods of data collection and classification of causes of blindness so that the data obtained will be as comparable as possible). The definition is: "Visual acuity of 20/200 (6/60) or less in the



The vision screening machine is adjusted to the comfort of the examinee

A rural woman's field of vision is measured



The correction needed by this young girl is determined

better eye with best correction or visual acuity of more than 20/200 if the widest diameter of the field of vision subtends an angle no greater than 20 degrees."

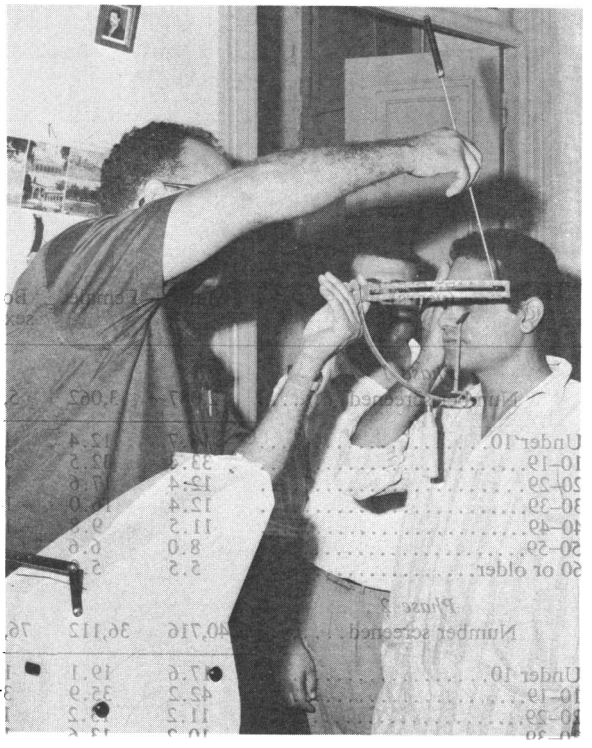
In this study visual acuity and field of vision were determined by a physician trained to do these examinations or by an ophthalmologist. Senior ophthalmologists supervised the examining teams and not only confirmed the determination of blindness but also the specific affection and etiology in each case. Visual acuity was measured by the Titmus optical vision tester using a tumbling-E slide; field of vision was measured by the Schweigger hand perimeter. The equipment and methodology have been described in detail previously (*2*).

Phase 1

Phase 1 of the study was concerned with prevalence rates derived from study of random samples of urban and rural populations. The two districts selected as the urban sampling frame did not represent Alexandria, nor did the 23 villages selected as the rural sampling frame represent all the villages in the area around Alexandria. The results from the samples studied may be generalized to these sampling frames. It had been hoped 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 obtain listings for any locality of persons in the general population.

Fortunately, 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 local health authorities.

Household was defined as persons sharing one dwelling unit. Because census data showed that an average Egyptian household consisted of five persons, samples of about 1,000 urban households and 1,000 rural households were randomly selected. These households constituted, in effect, a sample of about 4 percent from each area. All age groups were represented in the sample studied, except for the great majority of those under 5 years old for whom it was difficult to get reliable



Field of vision is measured with a Schweigger hand perimeter

data under the conditions of the survey. Examinations were given in the homes.

Phase 2

Phase 2 of the study was concerned with the prevalence rates derived from study of self-selected samples of the urban and rural populations. After phase 1 had been completed, an attempt was made to set up a blindness register covering the total population in the urban and rural areas studied in phase 1. On the average, an 18-month interval separated the starting dates for phases 1 and 2 in each of the areas.

Publicity, offering visual acuity examinations (exactly like those given to members of random samples in phase 1), was directed to the people of the urban and rural areas in the study. Examination teams set up conveniently located clinics. In addition to holding regular clinic hours, the teams offered examinations at times suitable for people who could not attend during their working hours. During phase 2, 144,354 persons were screened. Of these, 76,828 were urban residents and 67,526 were rural residents. In the urban areas 40,716 were males and 36,112 were females. In the rural areas 36,201 were males and 31,325 were females.

In phase 1, only 18 of some 1,000 urban households refused to cooperate. In the rural areas not one household refused. It is estimated that in phase 2 about 60 percent of the urban population and about 53 percent of the rural population self-selected themselves for examination. The ratio of the size of the phase 2 sample to the phase 1 sample, by sex and urban and rural residence, is shown in table 1.

Table 2 shows the percentage distribution by age and sex of urban and rural residents examined in phase 1 (random sample) and phase 2 (self-selected sample).

In practically every comparison the percentage of both sexes under age 20 is statistically significantly less in phase 1 than in phase 2. Furthermore, the percentage of persons 50 years and over

Table 1. Ratio of size of phase 2 sample to phase 1 sample, by sex and urban and rural residence

Phase	Urban			Rural			Total		
	Male	Female	Both sexes	Male	Female	Both sexes	Male	Female	Both sexes
1	2,087	3,062	5,149	2,879	2,956	5,835	4,966	6,018	10,984
2	40,716	36,112	76,828	36,201	31,325	67,526	76,917	67,437	144,354
Ratio, phase 2 to phase 1	19.5	11.8	14.9	12.6	10.6	11.6	15.5	11.2	13.1

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

Age group (years)	Urban			Rural			Total		
	Male	Female	Both sexes	Male	Female	Both sexes	Male	Female	Both sexes
Phase 1									
Number screened	2,087	3,062	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	16.8
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
Phase 2									
Number screened	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

Table 3. Differences between phase 1 (random sample) and phase 2 (self-selected sample) in percentages of examined persons under 20 years old and percentages 50 years and over, by urban and rural residence and sex

Residence and sex	Under age 20			Age 50 and over		
	Phase 1	Phase 2	Difference [1]	Phase 1	Phase 2	Difference [2]
Urban, total	47.1	57.5	−10.4	12.4	8.7	3.7
Male	50.1	59.8	−9.7	13.5	8.0	5.5
Female	44.9	55.0	−10.1	11.6	9.6	2.0
Rural, total	41.1	45.0	−3.9	12.7	11.4	1.3
Male	43.8	50.9	−7.1	14.2	9.5	4.7
Female	38.4	38.2	0.2	11.2	13.6	−2.4
Total, urban and rural	43.9	51.6	−7.7	12.5	10.0	2.5
Male	46.5	55.7	−9.2	13.9	8.7	5.2
Female	41.8	47.2	−5.4	11.4	11.5	−0.1

[1] All differences except that for rural female are statistically significant at the 5 percent level.
[2] All differences except that for total female are statistically significant at the 5 percent level.

is significantly greater in phase 1 than in phase 2 (table 3). This is generally true irrespective of sex and residence. Both of these differences tend to indicate that a higher total blindness rate would probably be found in phase 1 than in phase 2, since the blindness prevalence rates are low at early ages and considerably higher among older persons.

In phase 1 the percentage of females exceeded that of males in urban as well as rural areas. In phase 2 the reverse was true. Table 4 shows the differences between percentages of males and females examined in phases 1 and 2 by urban and rural residence. In every comparison, the percentage of females in phase 2 was lower than in phase 1; the reverse was true for males. The differences were statistically significant. This finding is important because overall blindness prevalence rates are greater for females than for males.

The percentage distribution of urban and rural residents confirmed as blind in phases 1 and 2 is shown in table 5 by age and sex. Table 6 shows the distribution of blindness prevalence rates for phases 1 and 2 by age, sex, and residence. For urban males the ratio of the blindness rate for phase 1 to that of phase 2 was 2.1; for urban females 1.6; for rural males 2.8; and for rural females 1.9.

Statistical significance of the results of the study was tested with the *t* test at the 5 percent level. Among urban males all but two age groups, 20–29 and 60 or over, showed decreases in age-specific rates from phase 1 to phase 2; however, only the decreases for urban males as a whole and for the age group under 10 are statistically significant. Among urban females, the age groups 10–19, 30–39, 40–49, and 50–59 years showed decreases in age-specific rates from phase 1 to phase 2. Each of these decreases, as well as that for urban females as a whole, is statistically significant (table 7).

Among rural males every age group showed a decrease in age-specific rates from phase 1 to phase 2. All the decreases, as well as that for rural males as a whole, are statistically significant except those for the age groups 30–39 and 40–49. Finally, among rural females every age group, as well as rural females as a whole, showed decreases between the age-specific rates of phase 1 and phase 2 which are statistically significant except for the age groups under 10 and 20–29 years (table 7).

The data in table 7 indicate that when a random sample is compared with a self-selected sample statistically significant decreases occur in the

Table 4. Percentage distribution of persons examined in phase 1 (random sample) and phase 2 (self-selected sample), by urban and rural residence and sex

Residence and sex	Phase 1	Phase 2
Urban, male	40.5	53.0
Urban, female	59.5	47.0
Rural, male	49.3	53.6
Rural, female	50.7	46.4
Total, male	45.2	53.3
Total, female	54.8	46.7

self-selected sample in blindness prevalence rates by sex and residence. The decrease is greater in the rural areas compared with the urban areas in both sexes. The decrease in the rate among rural females exceeds that of rural males, but there is little difference in the decreases occurring in urban females compared with urban males.

When the age groups in which statistically significant decreases in age-specific rates occurred are arranged in descending order of percentage decrease in rate, the greatest percentage decreases occur in the younger age groups and the least percentage decreases occur in the older age groups. This is more evident in females than in males (table 8).

Discussion

The findings from this study indicate that self-selected samples of persons screened for severe visual impairment and blindness have lower overall prevalence rates for blindness than found in random samples of the same population. This might be attributed to the statistically significantly higher proportions of younger persons in the vol-

Table 5. Percentage distribution of urban and rural residents confirmed as blind, by age group and sex in phase 1 (random sample) and in phase 2 (self-selected sample)

Age group (years)	Urban			Rural			Total		
	Male	Female	Both sexes	Male	Female	Both sexes	Male	Female	Both sexes
Phase 1									
Number blind	25	48	73	89	164	253	114	212	326
Under 10	8.0	.....	2.7	2.2	0.6	1.2	3.5	0.5	1.5
10–19	4.0	4.2	4.1	5.6	4.9	5.1	5.3	4.7	4.9
20–29	.....	.....	.....	5.6	2.4	3.6	4.4	1.9	2.8
30–39	8.0	10.4	9.6	6.7	9.1	8.3	7.0	9.4	8.6
40–49	12.0	10.4	11.0	7.9	11.6	10.3	8.8	11.3	10.4
50–59	24.0	25.0	24.7	25.8	30.5	28.8	25.4	29.2	27.9
60 or older	44.0	50.0	47.9	46.1	40.8	42.7	45.6	42.9	43.9
Phase 2									
Number blind	229	344	573	398	895	1,293	627	1,239	1,866
Under 10	0.4	.....	0.2	1.8	0.3	0.8	1.3	0.2	0.6
10–19	6.6	0.6	3.0	4.0	3.6	3.7	5.0	2.8	3.5
20–29	6.6	2.0	3.8	7.3	3.1	4.4	7.0	2.8	4.2
30–39	3.0	3.8	3.5	8.5	5.8	6.7	6.5	5.3	5.7
40–49	10.0	4.9	7.0	10.8	7.9	8.8	10.5	7.1	8.2
50–59	20.1	19.5	19.7	21.1	26.5	24.8	21.7	24.5	23.3
60 or older	53.3	69.2	62.8	46.5	52.8	50.8	49.0	57.3	54.5

Table 6. Blindness prevalence rates in phase 1 (random sample) and phase 2 (self-selected sample) per 1,000 persons examined, by age group, sex, and urban and rural residence

Age group (years)	Male		Female		Both sexes	
	Phase 1	Phase 2	Phase 1	Phase 2	Phase 1	Phase 2
Urban, total	12.0	5.6	15.7	9.5	14.2	7.5
Under 10	5.8	0.1	.....	.....	2.8	0.1
10–19	1.4	1.0	2.0	0.2	1.8	.6
20–29	.....	3.2	.....	1.4	.....	2.3
30–39	7.6	1.6	10.1	2.6	9.3	2.1
40–49	12.6	5.3	16.6	5.3	14.7	5.3
50–59	36.0	22.1	59.1	29.6	48.6	26.1
60 or older	95.7	104.3	155.9	194.8	130.0	150.5
Rural, total	30.9	11.0	55.5	28.6	43.4	19.1
Under 10	5.4	1.5	3.2	1.0	4.5	1.3
10–19	5.5	1.2	9.7	3.5	7.7	2.1
20–29	14.1	5.8	7.6	4.6	10.2	5.2
30–39	13.1	5.8	23.7	8.8	19.2	7.3
40–49	17.7	12.1	57.8	23.5	35.9	17.4
50–59	92.3	37.6	242.7	99.0	160.4	69.4
60 or older	256.2	154.9	540.4	249.2	380.2	212.8

Table 7. Differences in blindness prevalence rates between phase 1 (random sample) and phase 2 (self-selected sample) per 1,000 persons examined, by age group, sex, and urban and rural residence

Age group (years)	Urban [1]			Rural [1]		
	Male	Female	Both sexes	Male	Female	Both sexes [2]
Under 10	[2] 5.7	([3])	[2] 2.7	[2] 3.9	2.2	3.2
10–19	0.4	[2] 1.8	[2] 1.2	[2] 4.3	[2] 6.2	5.6
20–29	−3.2	−1.4	−2.3	[2] 8.3	3.0	5.0
30–39	6.0	[2] 7.5	[2] 7.2	7.3	[2] 14.9	11.9
40–49	7.3	[2] 11.3	[2] 9.4	5.6	[2] 34.3	18.5
50–59	13.9	[2] 29.5	[2] 22.5	[2] 54.7	[2] 143.7	91.0
60 or older	−8.6	−38.9	−20.5	[2] 101.3	[2] 291.2	167.4
Total [2]	6.4	6.2	6.7	19.9	26.9	24.3

[1] Minus sign indicates that phase 2 rates exceed phase 1 rates.
[2] Statistically significant at 5 percent level.
[3] The blindness prevalence rate in both phases 1 and 2 was zero.

untary sample (such as the age group under 20 where blindness prevalence rates are lower) than in the random sample and significantly lower proportions of older persons (such as those 50 years and over where blindness prevalence rates are higher). This was true in every comparison by sex except for rural females. These findings may reflect the need for screening and preventive measures among younger persons.

Another factor that may account for the lower prevalence rates for blindness in the self-selected sample, compared with the random sample, is the decreased proportion of females in the self-selected sample in both urban and rural areas. These decreases were statistically signficant. Overall, the total blindness rates for females exceeded those for males. Consequently, a decreased proportion of females tends to lower the total blindness prevalence rate.

Table 8. Age groups in which statistically significant decreases in age-specific blindness prevalence rates occurred between phase 1 (random sample) and phase 2 (self-selected sample)

Residence	Age group (years)		
	Male	Female	Both sexes
Urban			
Greatest percent decrease	1. under 10	1. 10–19 2. 30–39 3. 40–49 4. 50–59	1. under 10 2. 30–39 3. 10–19 4. 40–49
Least percent decrease	.....	.....	5. 50–59
Rural			
Greatest percent decrease	1. 10–19 2. under 10 3. 50–59 4. 20–29 5. 60 or older	1. 10–19 2. 30–39 3. 40–49 4. 50–59 5. 60 or older	1. 10–19 2. under 10 3. 30–39 4. 50–59 5. 40–49 6. 20–29
Least percent decrease	.....	.....	7. 60 or older

A number of considerations seem to influence a person's decision whether or not to select himself for a screening program. These considerations, as well as the nature of the population from which the sample is drawn, would affect the composition of a self-selected sample. Some knowledge of priorities between the sexes concerning preventive care might be helpful in interpreting the results.

In urban as well as rural areas of Egypt the health of the male "breadwinner" is given higher priority than that of his wife. This priority also holds for unmarried males over unmarried females. This situation may explain the lower percentage of females in the self-selected sample and the significantly lower overall blindness prevalence rates for females in the self-selected sample compared with the random sample in both urban and rural areas. This was particularly true in the rural areas, where every female age group 30 years or over had statistically lower rates in the self-selected sample. Perhaps this indicates that females most likely to select themselves for examination are those (*a*) with no or with relatively minor vision impairment or (*b*) with a smaller percentage of serious impairments. The same phenomenon was apparent among rural males, indicating perhaps that fewer rural males could afford time away from their farming for a vision examination. Urban females showed a similar but less pronounced pattern.

The ratio of the blindness prevalence rates of phase 1 to phase 2 by sex and residence showed interesting variation. The rural ratios were greater

than the urban ratios by sex, and the male ratios were greater than the female ones by residence, perhaps reflecting that when self-selection determines the composition of a sample for free vision examination in Egypt, the rural sample is more likely to contain more persons with normal or nonseverely impaired vision than an urban sample, regardless of sex, and in the male sample compared with the female sample, regardless of residence.

The effect of self-selection in decreasing age-specific prevalence rates of blindness is apparently related to age, with the younger ages showing the greatest percentage decrease and the older ages showing the least. Females showed this relationship more clearly than males. Thus, the age groups in which men are gainfully employed or women are tending families may be the ones in which persons with severely impaired vision are least likely to enter a self-selected sample.

Because the self-selected sample was examined about 18 months after the random sample, it is possible, but not probable, that blindness prevalence rates decreased during that interval. However, decreases in rates of the magnitude observed are practically unknown over so short a time, even if prevention programs had been in effect. No attempt was made during this time period to institute preventive measures.

A number of questions come to mind. Are the findings of this study equally true for conditions other than blindness in Egypt? Would the findings for blindness screening in Egypt be equally true in other countries? Would the same results occur in a country of higher socioeconomic status which has little, if any, sex differential in priority for preventive care? These questions are difficult to answer when specific data are not available.

Blindness primarily affects mobility and communication. In phase 2 of this study, the self-selected sample had to go to a clinic for examination. Therefore, if other conditions affect mobility or if age is a factor in reduced mobility, such as it is in blindness, the same findings for conditions other than blindness probably would be revealed. Also, the same findings would likely hold if other countries have similar socioeconomic differentials between urban and rural residents and between preventive care for males and females as in Egypt.

Finally, in a country with a generally higher socioeconomic status than that of Egypt there should be little difference between males and females in the impact of self-selection on the proportion of males and females who come for examination compared with a random sample.

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SAID, MOHYI-ELDIN (University of Alexandria, Egypt), GOLDSTEIN, HYMAN, KORRA, AHMAD, and EL-KASHLAN, KHALIL: ***Blindness prevalence rates in Egypt. A comparison of random and self-selected samples of urban and rural residents, by age and sex. HSMHA Health Reports, Vol. 87, February 1972, pp. 177–184.***

A comparison was made of (*a*) 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 (*b*) the results of screening a self-selected sample of about 145,000 persons in the same geographic areas. A total of 326 persons in the random sample were confirmed as blind by an ophthalmologist (blindness prevalence rate of 29.7 per 1,000 examined) and 1,866 persons in the self-selected sample were so confirmed (blindness prevalence rate of 12.9 per 1,000 examined).

The self-selected sample had statistically significantly decreased percentages of older males and females in both urban and rural areas compared with the random sample. The self-selected sample also had decreased percentages of females in both areas. Both of these changes make for statistically significant decreases in total blindness prevalence rates in urban and rural areas, with the greatest percentage decrease evident in the younger age groups and the least among the elderly. The percentage decrease in rates was greater among males than among females in both urban and rural areas. In rural areas the percentage decrease in rates was greater for both sexes than in urban areas.