PHYSIQUE OF SCHOOL BOYS AND SCHOOL LEAVERS WHO ARE NS REGISTRANTS

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SYNOPSIS

A study is made of the physique of 12,186 male Singapore youths who are 17½-year old and who have been registered and medically examined at CMPB (Central Manpower Base) for national service. Under examination are such aspects of physique as height, weight and PULHEEDS Employment Standard.

INTRODUCTION

The present report attempts to do two things: first, to give a selective description of the physique of a large group of school boys and school leavers in Singapore who are at or around the age of 17½ years; and second, to relate some measures of the boys' physical characteristics to such variables as race and education.

In this report the term 'physique' is used broadly to refer to a registrant's structural (eg. anatomical and physiological) characteristics. We cannot deal with all physique variables, but only those which have been measured and recorded. Attention is therefore given to such variables as height, weight and PES (i.e. PULHEEDS Employment Standard, which denotes a registrant's level of employability in the SAF).

In addition, we intended to correlate the physical characteristics under examination with socio-economic variables like family income, father's occupation, family size and education level. Unfortunately, data on most of these variables are unobtainable from the computer. Available for study are only data on race, educational level and language stream.

The group chosen for study covers male Singapore youths who had registered for national service (NS) and undergone medical examination at CMPB. Since all male citizens must present themselves for NS registration at 16½ years and for medical screening at 17½ years, to study all NS registrants at 17½ years (i.e. when physical and medical data are avail-

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TABLE I—Mean Height of Four National Groups

	Singapore	USA	HK	British
$\bar{x}$	64.7" (164.3 cm)	69.1" (175.5 cm)	66.3" (168.4 cm)	69.1" (175.5 cm)
s	2.3" (5.8 cm)	2.8" (7.1 cm)	—	Range 64.2" - 74.0" (163 - 188 cm)
n	11,533	243	—	—
Average age in years	17.5	17.5	17	18

able) is practically the same as to study all 17½-year-olds in Singapore at a particular point in time. Of course there are some 17½-year-olds who escape the screening net (eg. those who ask for deferment, etc.) but these form only a small number.

PROCEDURE

The manpower policy of the Ministry of Defence (MINDEF) is that medical data will be erased from the magnetic tape after every enlistment exercise. There is no archive on medical data in respect of the 17½-year-olds registered for national service in the past 6 or so years. At any time therefore, an investigator looking for physique data can get them from those 17½-year-olds who have most recently come up for NS medical examination but who have not yet been enlisted. For the present project, the group of NS registrants on which we can obtain information belongs to the intake born within the period from 1.10.1954 to 31.3.1955, and medically examined by CMPB from 12.6.72 to 22.11.72. This source yields a total number of 12,186 subjects.

Out of the 12,186 registrants under study, 9,713 are Chinese, 1,623 Malay, 658 Indian and 192 'Others'. The racial composition approximates closely to that of the general population of Singapore.

Special attention is given to medical rejects. They number 333, constituting about 2.7% of the total intake. Each of their personal files was scrutinized and information on socio-economic variables gathered.

RESULTS

Analysis of the physique of the subjects is presented in terms of distribution by height, weight, visual acuity, colour perception and PES. In the following, for each of the physique variables analysed, only measures of central location and dispersion will be examined.

TABLE II—Height by Ethnic Groups

Race / Statistics	Chinese	Malay	Indian	Others
$\bar{x}$ cm	64.7" (164.3)	64.0" (162.6)	65.1" (165.3)	66.1" (167.9)
s	2.2" (5.6)	2.3" (5.8)	2.3" (5.8)	2.6" (6.6)
n	9198	1550	608	177

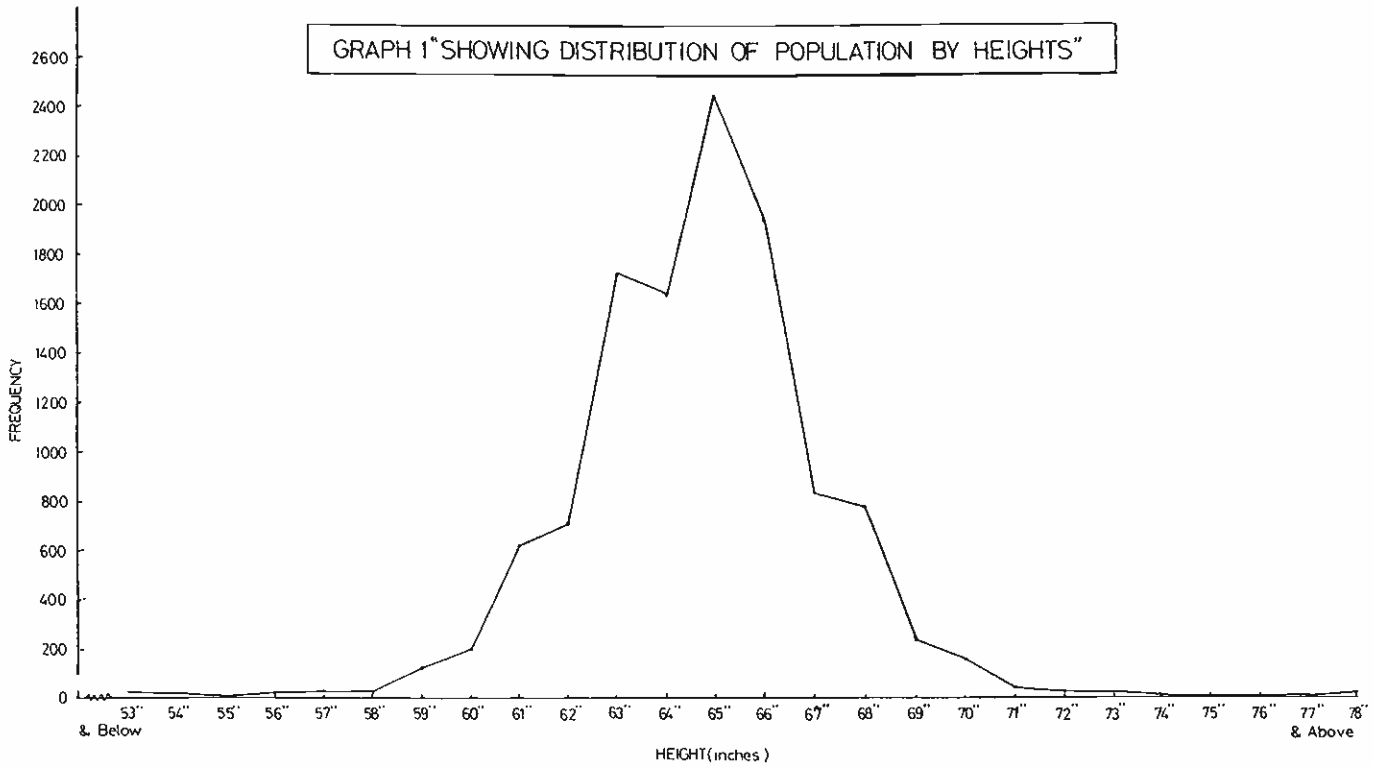
STATURE

The overall mean height of our subjects is 5' 4.7" or 164.3 cm, and the standard deviation 2.3" or 5.8 cm. As shown by Graph 1, the heights are almost normally distributed, with the most numerous class (64"-66") near the centre and a fairly symmetrical reduction in numbers on either side of the peak.

Table I compares the Singapore figures on height with those of other national groups.

When comparisons are made among the various ethnic groups in Singapore in respect of average height, significant differences emerge. This is shown in Table II.

The mean height of the Chinese is significantly higher ($p < 0.01$) than that of the Malays, while the mean height of the Indian is significantly higher ($p < 0.01$) than that of the Chinese.


GRAPH 1 "SHOWING DISTRIBUTION OF POPULATION BY HEIGHTS"
FREQUENCY
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
53" & Below
54"
55"
56"
57"
58"
59"
60"
61"
62"
63"
64"
65"
66"
67"
68"
69"
70"
71"
72"
73"
74"
75"
76"
77"
78" & Above
HEIGHT (inches)

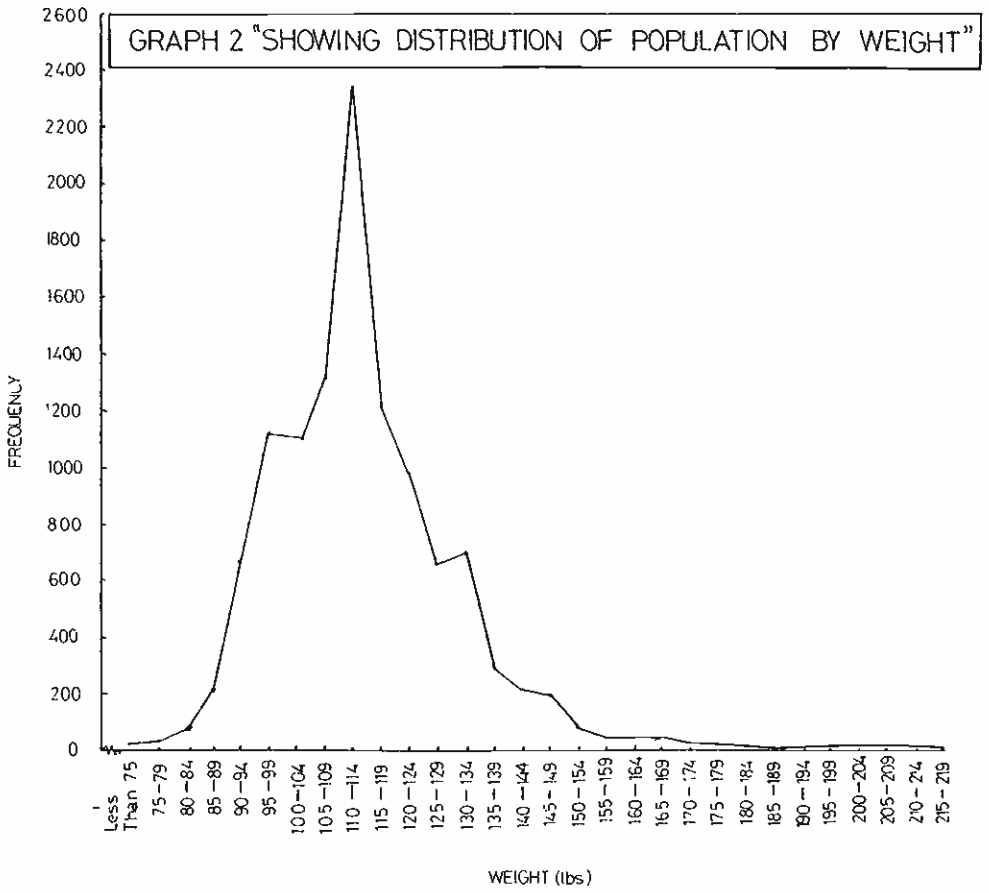

GRAPH 2 "SHOWING DISTRIBUTION OF POPULATION BY WEIGHT"
FREQUENCY
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Less Than 75
75-79
80-84
85-89
90-94
95-99
100-104
105-109
110-114
115-119
120-124
125-129
130-134
135-139
140-144
145-149
150-154
155-159
160-164
165-169
170-174
175-179
180-184
185-189
190-194
195-199
200-204
205-209
210-214
215-219
WEIGHT (lbs)

TABLE III—Weight of Males of Different National Groups

	Singapore	HK	USA	British
$\bar{x}$	114.1 lb (51.9 kg)	111.7 lb (50.7 kg)	151.5 lb (68.7 kg)	138.4 lb (62.8 kg)**
s	17.1 lb (7.8 kg)	—	25.2 lb (11.4 kg)	Range 115.7—167.6lb (52.5—76.0 kg)
n	11533	—	243	—
Age	17½	17	17½	18

**50th Percentile

WEIGHT

The average weight of our 11,533 young men is 114.1 lb or 51.8 kg, with a standard deviation of 17.1 lb or 7.8 kg. Unlike that of stature, the distribution of weight is found not to be normal but is asymmetrical or skewed. For the present intake, and as shown by Graph 2, the distribution is positively skewed, with most weights massed at the low end of the scale (i.e. 119 lbs and below) and some weights tapering off very gradually towards the high end.

Weight data concerning other national groups at or around 17½ years are also difficult to obtain. What information we succeeded in getting is scanty and incomplete. This is shown in the Table III. It would be of greater interest to look at our intra-population variation according to race (Table IV).

The Chinese tends to be heavier than his Malay counterpart ($p < 0.01$). He tends also to weigh heavier than his Indian comrade.

It has generally been observed that height and weight are positively correlated. This relationship emerges from the present data. Correlation between height and weight of our 11,533 subjects is highly significant ($r = 0.48$, $p < 0.01$). In this connection, one interesting finding is that though in height Indians are on the average taller than Chinese, yet in weight the former is on the average lighter than the latter. (Of course, within the set of Indians, it is likely that one who is taller will also be heavier). It seems that the physique of the average Indian tends towards the ectomorph paradigm whereas that of the average Chinese towards the endomorph model. Chinese youths tend on the average to be taller and heavier than Malay youths. Members of the 'Others' category such as Eurasians tend on the average to be both taller and heavier than members of the 3 other racial groups.

TABLE IV—Weight by Ethnic Groups

Race / Statistics	Chinese	Malay	Indian	Others
x	114.4 lb 51.9 kg	112.6 lb 51.1 kg	112.1 lb 50.8 kg	118.4 lb 53.7 kg
s	17.5 lb 7.9 kg	15.0 lb 6.8 kg	17.6 lb 8.0 kg	17.8 lb 8.1 kg
n	9198	1550	608	177

PES AND RACIAL GROUPS

One task of medical examination at CMPB is to assign to a NS registrant a measure of his PES. This is a measure of some importance as it is used to determine the nature and the level of a young man's employability within the SAF. "PES" stands for PULHEEDS Employment Standard. Originally SAF doctors used the PULHEEMS system, which consists of the assessment of 8 variables, namely, general physical status, upper limb status, lower limbs status, hearing status, eyesight status, mental status and stability status. Subsequently, one variable—mental status—was merged with another variable—stability status, and at the same time a new variable known as the dental status was introduced. The new system is abbreviated as PULHEEDS. It constitutes the whole medical basis of PES.

In the assessment of PES, five grades are used, which range from A to E representing 'fit for front-line employment' to 'reject'. A breakdown of our intake in terms of PES is given at Table V.

TABLE V—Distribution of Intake by Race/Language Stream and PES

Race/Language Stream \ PES	A	B	C	D	E	Blank	Others	Total
C/E	3839 (79.3%)	362 (7.4%)	18 (0.4%)	484 (10.0%)	131 (2.7%)	3 (0.1%)	3 (0.1%)	4840 (100%)
C/C	3854 (79.1%)	313 (6.4%)	28 (0.6%)	495 (10.2%)	182 (3.7%)	—	1 (0%)	4873 (100%)
M/E	754 (84.2%)	46 (5.1%)	3 (0.3%)	73 (8.2%)	18 (2.0%)	1 (0.1%)	1 (0.1%)	896 (100%)
M/M	624 (85.8%)	26 (3.6%)	5 (0.7%)	55 (7.6%)	16 (2.2%)	1 (0.1%)	—	727 (100%)
I/E	522 (79.3%)	50 (7.6%)	3 (0.5%)	72 (10.9%)	11 (1.7%)	—	—	658 (100%)
O/E	148 (77.1%)	17 (8.9%)	—	20 (10.4%)	7 (3.6%)	—	—	192 (100%)
Total	9741 (79.9%)	814 (6.7%)	57 (0.5%)	1199 (9.8%)	365 (3.0%)	5 (.04%)	5 (0.04%)	12186 (100%)

C = Chinese, E = English, M = Malay, I = Indian, O = Others

TABLE VI—Distribution of Registrants by Race and PES

Race \ PES	A*	B	D	C + E	Total
Chinese	7693	675	979	359 (3.7%)	9706
Malay	1378	72	128	42 (2.5%)	1620
Indian	522	50	72	14 (2.1%)	658
Others	148	17	20	7 (3.6%)	192
Total	9741	814	1199	422 (3.5%)	12176

$X^2 = 37.64$ df = 9 $p < 0.01$

*A —Fit for frontline employment in any capacity.
B —Fit for frontline employment in a service capacity only.
C —Fit for base employment only (not fit to undergo prescribed military training).
D —Temporarily unfit and under review.
E —Reject.

Table VI shows the distribution of PES grading in terms of race.

When compared to other racial groups, the Indian and the Malay have lower percentages (2.1% and 2.5% respectively) with low or poor PES.

VISUAL ACUITY

There appears an association between visual acuity and race (Table VII).

Just as they possess better PES, so the Malays also possess better visual acuity. The difference between the Malay and the non-Malay groups

TABLE VII—Race and Visual Acuity

Race \ Vision Category	Perfect *	Imperfect	Total
Chinese	3272 (33.7%)	6441 (66.3%)	9713 (100%)
Malay	903 (55.6%)	720 (44.4%)	1623 (100%)
Indian	299 (45.4%)	359 (54.6%)	658 (100%)
Others	86 (44.8%)	106 (55.2%)	192 (100%)

*Perfect vision—Not less than 6/6
Imperfect vision—6/9 and above

$X^2 = 310.3$ df = 3 $p < 0.01$

TABLE VIII—Relative Defectiveness of the Eye

	Right Eye %	Left Eye %	Total No. of Visual Defectives (in absolute numbers)
Chinese	84.3	15.7	6441
Malay	75.7	24.3	720
Indian	86.1	13.9	359
Others	87.7	12.3	106

comes out clearly if we arbitrarily use only 2 categories of visual acuity—the perfect vision (i.e. 6/6) and the imperfect vision (i.e. 6/9 and above).

Thus, the Malay has the highest percentage of perfect vision whereas the Chinese has the lowest percentage. As demonstrated by chi-square test, these findings are statistically significant.

It must be pointed out that in this report imperfect vision does not always mean defectiveness in *both* eyes. The criterion is defectiveness in at least one eye, be it the left or the right. Further, we determine a person's overall visual acuity by referring to his 'worse' eye.

Table VIII demonstrates the predominance of defectiveness in the right eye. This means that the tendency is for the right eye either to be the only defective eye or to be worse in visual acuity than the left in cases of binocular defectiveness. This trend manifests itself in all ethnic groups.

Another visual failing found among our youths is defect in colour perception. This, however, is less frequent in occurrence, as is shown in Table IX.

TABLE IX—Distribution on Intake by Race and Colour Perception

Race \ Colour Perception *	2	3	Others	Total
Chinese	8814 (90.8%)	422 (4.3%)	477 (4.9%)	9713 (100%)
Malay	1492 (91.9%)	60 (3.7%)	71 (4.4%)	1623 (100%)
Indian	590 (89.7%)	21 (3.2%)	47 (7.1%)	658 (100%)
Others	170 (88.5%)	9 (4.7%)	13 (6.8%)	192 (100%)

* 2 = normal colour perception
3 = partial colour blindness
Others = no information

$X^2 = 12.4$ df = 6 $p > 0.05$ (NS)

TABLE X—Distribution of Intake by Educational Level and PES

Educ Level \ PES	A + B	D	C + E	Total
Sec 1 and Above	5861 (89.1%)	558 (8.5%)	161 (2.4%)	6580 (100%)
Pr 6 and Below	4694 (83.9%)	641 (11.5%)	261 (4.6%)	5596 (100%)
Total	10555	1199	422	12176

$X^2 = 79.46$ df = 2 $p < 0.01$

It can be seen that no significant association exists between race and colour perception.

EDUCATION VS PHYSICAL PROFILE

It is probable that a person's physique and his educational attainment are related. This in fact is clearly demonstrated. Table X indicates a statistically significant association between educational attainment and PES. There appears to be a tendency for those who had attained the educational level of Sec 1 and above to possess better 'physique' (better PES) than those who had only primary school education. Possibly, poor physique militates against scholastic success. Equally

possible as a causal factor is poor environment (eg., poor nutrition) which gives rise simultaneously to poor physique and to underdeveloped brain (and hence to low scholastic attainment).

MEDICAL REJECTS

As previously indicated, about 1,621 or 13.3% of our intake of about 12,176 could be described as having low or poor physique as they came under the PES C and PES E categories. However, only PES E entitles a registrant to be totally rejected and permanently exempted from national service as he is then considered to be unfit for military service in any capacity. The rejects numbered 365. This constitutes about 3.0% of the total intake of 12,186.

A breakdown of these medical rejects into the various ethnic groups is presented in Table XIA.

The data on medical rejects shown in the above table are obtained from the computer print-out. Additionally, there were 33 cases classified as rejects which were from the group 292 registrants missed out by the present project. Altogether therefore there were 398 cases of rejects. However, an actual examination of the personal files of these 398 cases of medical rejects disclosed that only 333 cases were actually classified under PES E (as rejects), presumably as a result of error at the coding stage when information was fed from personal files into the computer.

Breakdown of the 333 rejects according to ethnic groups is as shown in Table XIB.

It is apparent that the percentage of Chinese rejects was higher than that for any of the other ethnic groups. This is consistent with the earlier finding that the Chinese have a significantly higher proportion of low or poor PES than the other ethnic groups.

We were unable to obtain strictly comparable figures on medical rejects in the armed forces of other countries. Some information was, however, made available to us concerning the intakes of regulars, not NS men, in UK and New Zealand. As against our overall 2.73% between 10% and 12% of applicants in UK were rejected as medically unfit at the pre-service examination (according to the British studies of Corsham and Shorncliffe) and between 2.5% and 3% were rejected in the first 3 months of service. In New Zealand the percentage of medical rejects among applicants for regular service for the period 1 Jan-31 Dec 1972 is 8.44%.

Concerning our own 333 medical rejects, the major defects cited as reasons for rejection are tabulated in Table XII.

TABLE XIA—Breakdown of Rejects by Ethnic Origins

Ethnic Group	No. Examined	No. of Rejects	% for each ethnic group
Chinese	9713	313	3.2%
Malay	1623	34	2.1%
Indian	658	11	1.7%
Others	192	7	3.6%
All Ethnic Groups	12186	365	3.0%

TABLE XIB—Breakdown of Medical Rejects by Ethnic Groups

Ethnic Group	No. Examined	No. of Rejects	% for each ethnic group
Chinese	9713	287	2.96%
Malay	1623	30	1.84%
Indian	658	12	1.82%
Others	192	4	2.08%
All Ethnic Groups	12186	333	2.73%

The most frequent defect is in the category of disorders of the musculoskeletal system. It accounts for 27.5% of the Chinese rejects, 40.1% of the Malay and 25.0% of the Indian. Ranking second is the category of ophthalmic disorders. This accounts for 20.6% of the Chinese rejects, 16.7% of the Malay and 8.3% of the Indian.

Of the disorders of the musculoskeletal system, poliomyelitis and its sequelae constitute the largest proportion. This is shown in Table XIII.

As for the disorders of the ophthalmic system, the commonest are amblyopia, cataracts and high myopia (Table XIV).

Of the cardiovascular system the most frequent disorders are congenital heart disease (mainly V.S.D.), which accounts for 13 cases or 46% and rheumatic heart disease, which accounts for 7 cases or 25% cardiovascular disorders. Under the category of central nervous system disorders, epilepsy occurs in 12 cases (52%) and cerebral palsy in 5 cases (21%). Of the otorhinolaryngeal

TABLE XII—Disease Classification of Medical Rejects

Disease Classification \ Ethnic Group	Chinese	Malay	Indian	Others	Total	%
1. Musculoskeletal	79	12	3	2	96	28.83
2. Ophthalmic Disorders	59	5	1	0	65	19.52
3. Mentally Defective	45	0	1	1	47	14.11
4. Cardiovascular System	21	6	1	0	28	8.41
5. Central Nervous System	18	2	3	0	23	6.90
6. Otorhinolaryngeal Disorders	18	0	1	0	19	5.71
7. Respiratory System	14	2	1	0	17	5.11
8. Genitourinary System	11	1	1	0	13	3.90
9. Psychiatric Disorders	5	2	0	1	8	2.40
10. Endocrine System	6	0	0	0	6	1.80
11. Dermatolcgical Disorders	5	0	0	0	5	1.50
12. Gastrointestinal System	3	0	0	0	3	0.90
13. Congenital Multi-systemic disease	3	0	0	0	3	0.90
Total	287	30	12	4	333	100%

TABLE XIII—Specific Types of Musculoskeletal Disorders

Type	No. of Cases	Expressed as % of Musculoskeletal Disorders
Poliomyelitis and sequelae	31	32.29%
Disease and deformities of Limb joints	12	12.50%
Spinal Deformities	9	9.38%
Traumatic Amputations	7	7.27%
Sequelae of fracture (Malumon etc.)	5	5.21%

TABLE XIV—Specific Disorders of the Ophthalmic System

Type	No. of Cases	Expressed as % of Total Ophthalmic Disorders
Amblyopia and/or Anisometropia	18	27.7%
Cataracts and Corneal Opacities	17	26.2%
High Myopia	12	18.5%
Blindness false eye	5	7.7%

disorders, almost 90% are cases of deafness, and of these about half are dumb as well.

CONCLUSIONS

Singapore youths on the average are shorter in stature and lighter in weight than youths of similar age group from UK, USA and Hong Kong. Within the set of Singapore youths, the ethnic subsets differ significantly on a number of physical variables.

(a) In stature, the relation, "taller than" (">"), among the ethnic groups is as follows: 'Others' (Eurasians, etc.) > Indian > Chinese > Malay.

(b) In weight, the relation "heavier than", among the ethnic groups is as follows: 'Others' > Chinese > Malay > Indian.

(c) In terms of PES that determines a young man's employability within the SAF, Chinese are significantly more prone than Malays to poorer PES.
(d) Malays have better eye sight than non-Malays. In contrast, the Chinese has the highest percentage of imperfect vision.

When PES was related to educational level, it was found that those who had attained educational level of Sec 1 and above tended to possess better 'physique' (better PES) than those who had only primary school education.

Out of the intake of 12,186 17½ year-olds, 333 or 2.73% were discovered through scrutiny of personal files to be medical rejects, i.e. registrants classified as medically unfit for military service in any capacity. Among the ethnic groups, the Chinese has the highest percentage of medical rejects.

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