

SOCIOLOGICAL, ANATOMICAL AND PHYSIOLOGICAL CHANGES IN FIRST-YEAR STUDENTS ENTERING QUEEN'S UNIVERSITY, BELFAST, OVER THIRTY YEARS, 1948 - 77.

1. Preliminary Report.

by

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INTRODUCTION

THE Student Health Service at the Queen's University of Belfast has carried out compulsory routine medical examinations at the behest of the Senate and Academic Council on all first-year undergraduate students since 1948.

The original health records were designed by the first full-time Medical Officer appointed, Dr. Wilson Johnston. It is much to his credit that a very similar format is still considered suitable today. It is designed for A4 size paper and allows accurate recording and easy recall of basic medical and social data. Attempts were made at the outset to standardize examination techniques. Heights and weights are measured with light indoor clothes and without shoes. The blood pressure is recorded using a 22 cms cuff, with the student recumbent.

METHOD

In the preliminary study it was decided to examine 10 per cent of each year's records. Each student is allocated a number in sequence on his first attendance; thus the first student examination in the academic year 1948-9 is numbered 00001 while the last student examination in 1977-8 is numbered 30,398. The student health service number is quite separate and different from the University number, and it is not circulated to other departments, thus preserving confidentiality. The 10 per cent sample of each year's charts was selected by computerised random number selection technique.

From these records specific sociological and medical data were extracted and put on to punch cards for computer analysis. In the social section the following data were recorded, sex, year of birth, year of entry, number of siblings, religion, and the social class of the father's occupation. To this was added the medical data of height, weight, systolic and diastolic blood pressure, with menarchial age when appropriate.

To discover if the 10 per cent was statistically accurate the early results were compared with earlier published studies, (Johnston et al 1957 and 1962). It was confirmed that a 10 per cent sample was adequate for all general analyses, but some of the fine sub-divisions lacked statistical significance.

RESULTS

Changes in sex ratio

Figure 1 shows the growth of one red-brick university from an intake of less than 500 per annum to one nearly three times as large. The population of

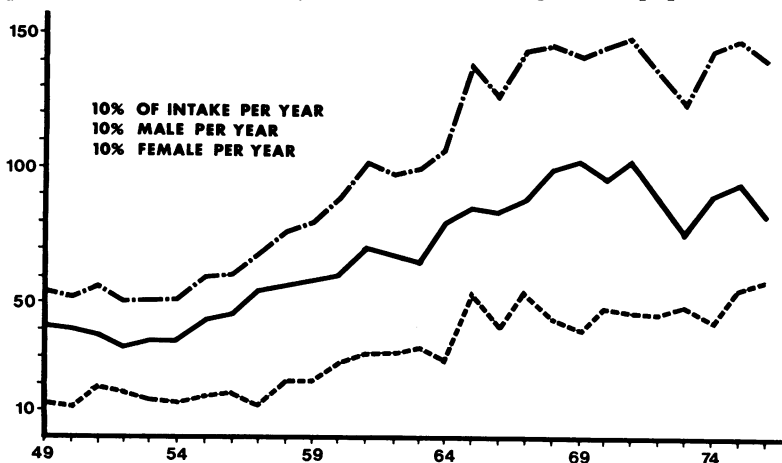


FIG. 1 Changes in sex ratio of a 10 per cent sample of the student intake.

Northern Ireland grew by some 16 per cent over the same period so the natural growth alone does not explain the huge explosion in the numbers entering tertiary education, especially between 1955 and 1965.

There have been more males than females in the general population of Northern Ireland, even back in the 1951 census, and this gap has grown as the male population increased by 17 per cent and the female population by 15 per cent since then. Nevertheless, women are well under-represented in the University. In the intake of the early fifties only some 20 per cent were women and there has been a gradual increase to 36 per cent in 1977.

Changes in social class

Figure 2 shows 10 per cent of the number of students enrolling annually from each social class. The class is determined by the reported occupation of the student's father. It is common knowledge that Social Class I and Social Class II children do better in higher education than children from lower social classes. In the 1971 census, Social Class I comprises 2.4 per cent and Social Class II 20.4 per cent. In the same year in the Queen's sample Social Class I made up 12.4 per cent and Social Class II 31 per cent. Conversely, Social Classes IV and V are under-represented (4.8 per cent instead of an expected 22.8 per cent in Class IV, and 2.8 per cent instead of a predictable 10 per cent in Class V). Only Social Class III at Queen's matched the whole population figure, although this is more true of 1977 figures than the 1971 figures.

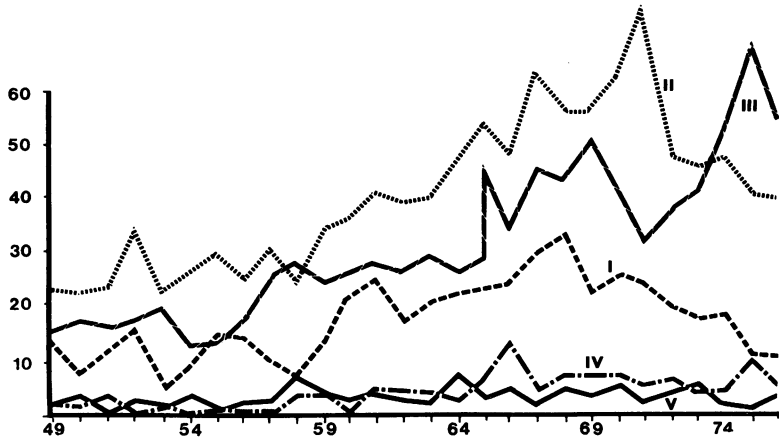


FIG. 2 Enrolment of students according to social class of father. I, Professional; II, Intermediate occupations; III, Skilled occupations; IV, Partly skilled occupations; V, Unskilled occupations.

A more surprising finding is the remarkable fall in the overall numbers of Social Class I and Social Class II students during the past decade. Although the total annual first year enrolments has remained around 1,400 per annum, Social Class I intakes dropped from 330 in 1968 to 100 in 1977. Social Class II students, after a high peak of 750 students in 1971 dropped to a 1977 intake of 460. Conversely, Social Class III intakes have risen nearly as steeply, almost doubling in the same seven-year period from 310 to 550 students.



FIG. 3 Height in centimetres of male and female students on enrolment.

Changes in height and weight

Figure 3 shows the height of Queen's students in centimetres from 1949 onwards. The mean height of men born before the second world war was 171 cms (5' 7.3") while women of that period were 160 cms (5' 3") on average. These figures change quite dramatically with children born during the war years, with both men and women being 3 cms taller. This upward trend has continued but with a much more gentle gradient. Female students of 1977 are some 4 cms taller than the young ladies of 30 years before while the men are on average 6 cms taller. The mean weights of male and female students in kilograms from 1949 onwards are shown in Figure 4. Tanner (1965) stated that men born later in the century are consistently heavier and taller than those born earlier, and that women on the other hand are decidedly lighter than formerly. This study confirms the latter statement with a remarkable fall in the mean weight of women of 6 kg (13 lb), but in the Queen's University of Belfast men have also shown a small but significant decrease of between 1 and 2 kg (2 to 4 lb).

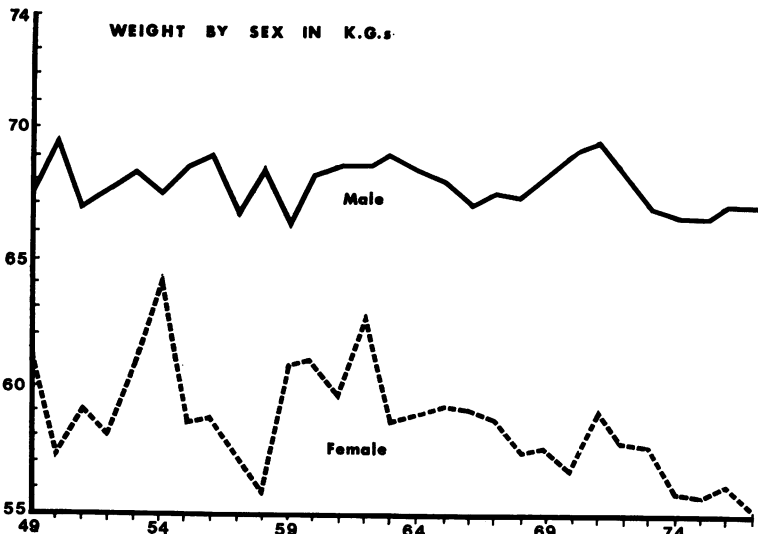


FIG. 4 Mean weights in kilograms of male and female students on enrolment.

Changes in the obesity index

The obesity index is a mathematical formula designed to overcome the fairly clear disadvantages of a straight comparison of height and weight. The index is the weight in kilograms multiplied by 100 and divided by the height in centimetres squared. This usually gives ranges from 0.180 for the thinner, taller subject, i.e. 'the more linear' person and up to 0.400 for the very obese. From Figure 5 one can see a consistent downward trend in the thirty-year period confirming that

students of today are of much more linear build than their counterparts of 30 years ago.

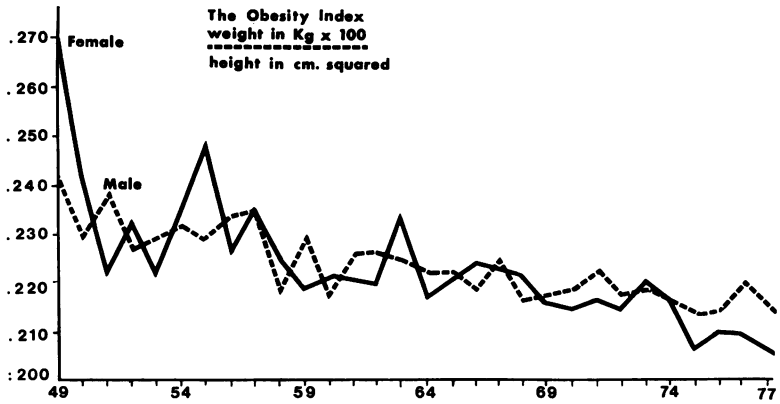


FIG. 5 Obesity index of male and female students on enrolment.

Changes in blood pressure

Figure 6 shows a continuing gradual fall in both the systolic and diastolic blood pressures in both sexes. It appears that the average systolic B.P. in the male is consistently higher by nearly 10 mm Hg than females of the same era. Men who enrolled in Q.U.B. in 1948 had average readings of B.P. of $131/78$. The gradual steady fall recorded a 1977 figure of $123/72$. In the female the comparable fall was from $122/78$ to $110/70$.

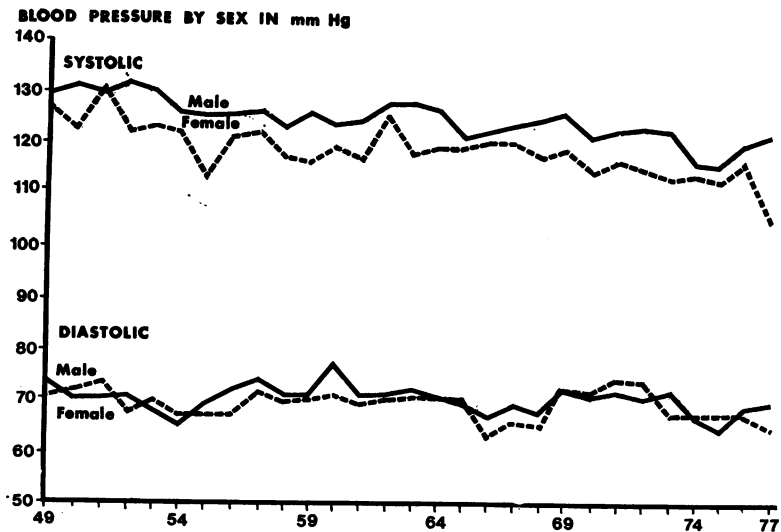


FIG. 6 Systolic and diastolic blood pressure in students on enrolment.

Changes in the menarchial age

Figure 7 shows the mean recorded menarchial age of students by their year of birth from 1934 onwards. Students born before that year were excluded because of insufficient sample size. The mean of the students interviewed over the 30 year period 1948 — 1977 was 12.7 years. This is not an easy graph to interpret. One possibility is that the menarchial age, which had been falling since Victorian times continued to fall until 1946, but that this trend became reversed at this time. Professor J. M. Tanner in a personal communication warns against such simple deductions. He points out that “the 1939-born figure is something of a maverick, and even the ’45, ’46 and ’47 figures constitute a run that may not be significant”. He suggested that another interpretation of the graph could be that there has been no change other than random fluctuations over this time.

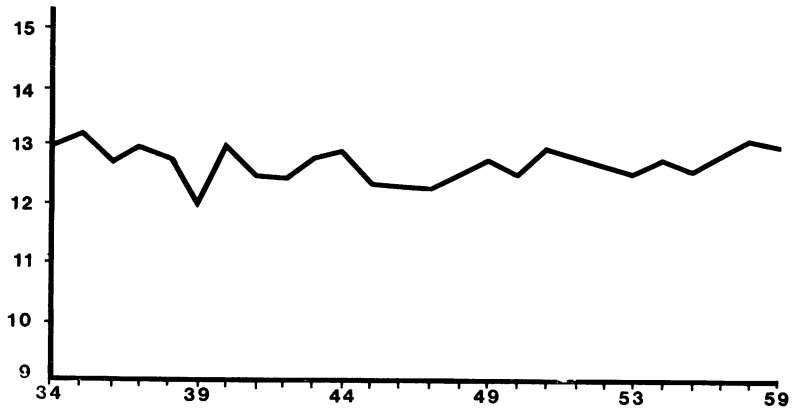


FIG. 7 Changes in menarchial age by year of birth from 1934 onwards.

DISCUSSION

Dann (1969) emphasizes an inherent difficulty of interpretation wherein each successive sample is heterogenous, and where there is differential representation in particular sub-samples. The Queen's University of Belfast is essentially a provincial university for the Province of Ulster. The political upheavals since 1969 have tended to emphasize this fact, with the flow of overseas students gradually drying up, especially those coming from England and Wales. The projected study of a larger sample with a breakdown by country or even county of origin should help in overcoming these difficulties.

Another source of inaccuracy in such a study is variation of methods of collecting the data. The importance of such vital standardization is essential if reliable comparisons are to be made, and most critics will start by doubting these figures rather than any subsequent interpretation. For example, Tanner reports a 3 cm difference in height in his sample compared with Rosenbaum (1954) which he attributes to different measuring techniques. Avoidance of this basic error must

therefore be emphasized. (Johnston 1957, Tanner 1966 and Dann 1969). The nursing and medical staff of this Student Health Service have worked continuously and consecutively in one building and have passed to one another the basic tenets laid down by Dr. Wilson Johnston.

The sociological changes in Figures 1 and 2 are in part common knowledge. The gradual uptake of more university places in faculties such as the Faculty of Medicine and the Faculty of Science by females explains part of the increase in the number of women students. But perhaps one should rather ask why the number of women is still only 36 per cent of the total intake in 1977-8. Presumably the answer to this question lies in the fields of sociology or education, and not in medicine. The remarkable drop in Social Classes I and II students over the past decade, and at the same time the opposite rise in the Social Class III students requires amplification and explanation. Why should this have happened? One possible explanation is the political unrest in Ulster. Because of the undoubted tensions, some families may well choose to send their children to other parts of Ireland or to Great Britain. If this were the case one might postulate that there would be different presentations in the religious groupings. In fact this study shows that there have been equivalent changes in both Protestant and Roman Catholic classes. Apart from The Troubles, another important event occurred in 1965 which could well explain these trends. There was the introduction of the Universities Central Council on Admissions which offered a broad choice of British Universities or Polytechnics to all A-level candidates. It seems likely that children from middle class homes who had already had opportunities to visit Great Britain started to choose to go there, once given the express invitation of UCCA.

One other factor which has to be considered is the means test method of issuing grants to middle class students which mitigates against them so severely that they are often the paupers among the undergraduates. Research among school leavers could only produce the explanation of these changes.

The physical changes noted in students at Queen's over 30 years reflect in many ways findings from other parts of the world. Tanner (1965) states that there has been a secular trend in West European young adults since about 1870 to increase in height at the rate of 0.6 to 0.8 cm per decade. In his other paper (1966) he wrote that "there is no really satisfactory data from mature height of twenty-year old men in Gt. Britain".

The National Study of Health and Growth was set up in 1972 to monitor growth in primary school children. Scottish children are lighter and shorter in all age-sex groups (Rona & Altman 1977). The same authors (1978) studied the social factors which might explain some of these variations. They report that non-social factors, especially the parents' height and the child's birth weight were perhaps more significant, but nevertheless sibship size, father's social class and his employment status were also very important. It is interesting to see that there are significant differences between English and Scottish children in their response to these social factors.

Tanner (1966) reports a mean height of 175 cm for young men in the early sixties. This corresponds very closely with these figures. Tuddenham's (1954) famous study of middle class children in Berkeley reported a mean of some 6 cm taller for both boys and girls in California. Guatemalan middle class seventeen year old boys and girls on the other hand (Johnston, F. E. et al, 1976) were 171.1 cm and 159.2 cm respectively. These children were born in the early fifties and would compare more correctly with the Queen's students entering around 1968 than Berkeley children who were born in 1928 and 1929 — fifty years ago! Johnston, F. E. (1976) had another group of children in his study. They were American children living in Guatemala. This group corresponds very closely to Queen's students of the same vintage. Similarly, Swansea girls (Dawn and Roberts, 1969) entering university between 1959 and 1970 are less than 1 cm smaller than the Queen's ladies. It has been claimed that there are gradients of increasing stature as one travels from the North West to the South East of the British Isles (Roberts, 1952) although Tanner (1966) feels that these differences may be trifling. They have now been confirmed by Rona and Altman (1978).

Measurements of obesity are much more complex than the traditional average weight against height charts which are to be found in commercial weighing machines in the market place. Skin-fold thickness is perhaps the most popular measurement of obesity but other mathematical formulae are very reliable. Seltzer (1966) favoured the Ponderal Index which is the height in inches divided by the cubed root of the weight in pounds. The Ponderal Index gives numbers in the region of 14.7 for the most linear and 10.6 for the most obese. Another ratio, the one illustrated here, and described by Khosla (1967) is the Obesity Index or the Body Mass Index. The Editorial B.M.J. (April 1978) confirmed that this is an extremely accurate calculation.

Both male and female students at Queen's today are much more linear than those of 30 years ago. Indeed they are considerably less obese than the declared desirable heights and weights of the Metropolitan Life Assurance Company, which can be re-stated as 0.217 for women and 0.231 for men of moderate build. The present day Queens students index is 0.209 for women and 0.219 for men. In the Berkeley study, the Californian children born 50 years ago (Tuddenham 1954) were much more linear than the equivalent age groups at Queen's (0.217 c.f., 0.240). This present study does not confirm the findings of Montegriffo (1974) who stated that the present male population is becoming more obese and the secular change has progressed. However, one can confirm that the female population is quite clearly much less obese.

The steady and continuing downward trend of both systolic and diastolic blood pressure, but particularly the former, is seen in both sexes. This finding was reported by Johnston (1962) and it was claimed by him that the blood pressure was definitely higher in those with bigger arm girths. The female arm girth average was 24.5 cms in his study and the male arm girth was 26.0 cms. It is well known (Pickering et al 1954; Mann 1974) that one finds higher blood pressure readings when either the arm girth or the obesity are correlated and this has been attributed by some to be due to the size of the sphygmomanometer cuff. If the

encased rubber bag fails to completely encompass the whole arm then there may be higher blood pressure readings. Similarly, sphygmomanometers with extra long tubing, such as wall-fitted machines, will give higher readings. Further research is clearly needed to explain this finding, for one might hope that the downward trend heralds an improvement in the incidence of degenerative arterial disease of the middle-aged. Perhaps it is in such extended studies that the aetiology of essential hypertension, or cardiovascular disease in middle age (Pickering et al 1954; Reid 1974) might be explained. Perhaps too we can take some comfort in the fact that the last decade's civil unrest has not caused any alteration in the downward trend of B.P. readings.

The menarche has long been regarded as one of the best measurements of the rate of maturation in females and it has been falling at the rate of 3 to 4 months since Victorian times. Tanner (1973) shows figures from several different European countries which reported the age of menarche as high as 17 years in 1840 in Oslo, but this had fallen to between 12.6 and 13.2 years by 1970. Brundtland and Walloe (1973) have reported that this trend has stopped, in their study of Oslo schoolgirls, with mean ages as 13.27 years in 1952 and 13.24 in 1970. Tanner's paper goes on to show that the downward trend has also halted in London school-girls giving a mean of 13.02 years. Roberts and Dann (1975) in their study among Swansea students confirmed the change with their lowest mean being 12.46 years in students born in 1946. The Queen's University students showed a mean of 12.36 years in that same year, whereas those born in 1959 gave a mean menarchial age of 13.02 years.

The cause of the downward trend in the menarche was usually stated to be due to better nutrition and less inter-marrying as transport became easier. It has been stated that the decline in menarchial age started with the invention of the bicycle. Dann (1969) stated that the socio-economic class of the father influences stature, though in contrast it did not have any effect on menarchial age. Roberts (1975) points to other variables, including the number of siblings and the position in the family, although his sample sizes are perhaps on the small side for a true analysis. He also reports that girls of more linear physique experience a later menarche. That corresponds with the findings here, but it would be rash to assume a cause and effect connection.

There are perhaps more questions raised, than answers given by this preliminary report. A further study of larger groups will be necessary which will allow for more detailed analysis. It is planned to study each fifth year starting with 1953. Further mathematical analysis of the menarchial age, and a relationship with social class will be undertaken.

SUMMARY

There have been significant changes in the sociological, anatomical and physiological characteristics of first-year students at Queen's University, Belfast, over the period 1948-1977. Among these are:—

- (1) the gradual increase in the number of women students from 20 per cent to 36 per cent.

- (2) a marked fall in students from Social Class I and II homes over the past decade of at least 50 per cent. In contrast Social Class III families have sent many more of their children to Queen's.
- (3) Male students are on average 6 cm taller now than 30 years ago and women over 3 cm taller. Male students are some 3 kilograms lighter than 30 years ago while women are as much as 7 kilograms lighter. These findings indicate a much more linear population with an obesity index falling from .240 to nearly .210.
- (4) Physiological differences include a fall in both systolic and diastolic pressure readings in both sexes; means have fallen from $^{131}/78$ to $^{123}/72$ in males and $^{122}/78$ to $^{110}/70$ in females. A further important physiological finding is that the age of onset of the menarche, which had been falling since Victorian times has now ceased to fall, and indeed is tending to rise again. Girls born in 1946 had an average menarchial age of 12.36 years while those born in 1959 had an average menarchial age of 13.02 years.

Tentative explanations for these findings have been put forward.

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