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The Cardiff Cervical Cytology Study†

Enumeration and definition of population and initial acceptance rates

By the Editorial Committee of the Cardiff Cervical Cytology Study*

SUMMARY The Cardiff Cervical Cytology Study began in 1965. Its primary aim was to evaluate screening for neoplasia of the cervix uteri. The study population was all ever-married women, aged 25–69, resident within the Cardiff City area. The basic objective was that all such women should be screened three times. The population was enumerated by house-to-house visiting of the entire city and a register of eligible women was compiled. The first round of visiting finished early in 1971. The defined population numbered 70 869, of whom 45 915 (65%) had had one or more tests. The method of defining the population is described and details are given of the initial response rates in respect of the major demographic factors. The response rate varied with age and with social class. It declined from 92% in the age group 25–29 to 26% in the age group 65–69, and from 81% in Social Class I to 52% in Social Class V. The response was 5% to 10% lower among widowed, divorced, and separated women than among married women but was independent of age at first marriage and age at first pregnancy. Nulliparae showed a lower response rate than multiparae.

By the early 1960s exfoliative cytology was being widely practised for the detection of possible precancerous lesions (dysplasia, carcinoma-in-situ, and microinvasive carcinoma) of the cervix uteri. The procedure was also shown to be suitable for population screening on a large scale (Kaiser *et al.*, 1960; Bryans *et al.*, 1964).

The Cardiff cervical cytology study, which was set up in 1965 to obtain information about the natural history of the disease, was based on a total population of all ever-married women between the ages of 25 and 69 resident within the Cardiff City area. The aim was that every woman should be screened at least three times.

This paper describes the method of defining the population and the initial acceptance rates obtained. The detailed methods and organisation of the study have been described elsewhere (Evans *et al.*, 1977).

ENUMERATION AND DEFINITION OF STUDY POPULATION

Criteria for eligibility

To be included in the study, a woman had to be aged 25–69 years, resident within the Cardiff City boundaries, and married, widowed, separated, or divorced. The study population comprised all such eligible women.

Enumeration of population

The Cardiff City area was divided into 19 smaller areas and the population enumerated by door-to-door visiting of every house. The field workers made out a card for every eligible woman, recording basic demographic data: age, marital status, social class, and age at first marriage; when relevant, age at first pregnancy, number of pregnancies, and whether or not the woman had had a hysterectomy were also recorded. Every eligible woman was then offered a cervical smear at a time of her own choosing at a clinic set up in her area. Women who refused and those who made, but did not keep, appointments, were re-visited, the latter group often more than once, in an attempt to persuade as large a percentage as possible to have a smear test.

In all, more than 96 000 women were visited. Information on age and marital status was obtained

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†In this paper the old style of citing references is used because the manuscript was set before the changeover to Vancouver style (see page 1).

from nearly 99%; of these, some 70% met the criteria for eligibility. It was decided that the 1% of women from whom data regarding one or more of the criteria could not be obtained should be included in the study population. It was felt that the majority of these women would refuse the test, and excluding them from the study population would therefore artificially inflate the acceptance rate, albeit by a small amount. This proved to be the case. The enumerated population finally numbered 66 983 eligible women.

Final definition of the study population

It was originally intended that, when the visiting of an area was complete, and when further effort was unlikely to bring much increase in response, the population for that area would be considered completely enumerated. It would then be divided into tested and non-tested groups according to whether the woman had, or had not, had a smear test during the visiting period. Thus the study population would be built up in stages as visiting progressed, and eventually the total study population would be precisely defined.

This method of definition proved, in practice, to be unworkable. The computer records for tested women did not show whether the woman was a member of the enumerated population. There was no way of determining whether eligible women who were tested at times other than during the visiting of their area were actually resident and eligible at the time of visiting (and hence were members of the enumerated population) except by checking every single computer record against the enumerated population of 66 983. This formidable task was beyond the resources of the research team and, as will be shown below, the likely benefits in improvement of precision of definition of the population would have been slight. Therefore the following amended method of defining the study population was used (Fig. 1).

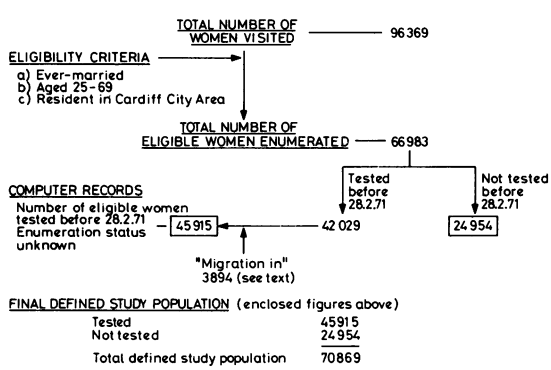

Fig. 1 *Definition of study population.*

The study population was defined as consisting of two groups of women, those tested and those not tested, as follows:

Tested women	All eligible women who had a smear test before the end of the first round of visiting of the city, taken as 28 February, 1971.
Not tested women	All eligible women enumerated during the visiting who did not have a test before 28 February, 1971.

This modification presented two problems. Firstly, it was possible for women to 'migrate' into the tested group by attaining the lower age limit, by getting married, or by moving into the area during the six years of the first round of visiting, but 'migration' into the not-tested group was not possible. Secondly, the tested group could have contained women who initially refused, but who later had a test. In many cases this would have occurred, not as a result of a change of attitude, but because of the development of symptoms necessitating a visit to a gynaecologist. This group could have biased estimates of the prevalence of any state which was associated with symptoms. Nevertheless, they have been considered as tested rather than not-tested, but their computer records have been flagged so that they were known to be initial refusals who were transferred. The study population under this amended method of definition numbered 70 869. The enumerated population of 66 983 was a subset of the 70 869 and hence approximately 4000 women had 'migrated' into the tested section of the population.

Results

Table 1 shows a breakdown of the defined study population by age and by whether or not the woman had had a test. The figure of 10 012 for the defined population in the age group 25–29 indicates that the majority of the 'migration' into the tested population occurred in the youngest group. This is exactly as would be expected because, of the three possible methods of migrating in, attaining the minimum eligible age during the six years of the first round of visiting is clearly the most likely method. Cross-checks with the sample census of 1966 and the census of 1971 suggested that about 75% of the 'migration in' occurred in the age group 25–29, 20% in the age group 30–34, and 5% in the age group 35–39. Above these ages the total defined population was very close to that expected as estimated from the two censuses.

Table 1 *Study population and initial acceptance of cervical cytology by age*

Group	No. of women										
	Age group (years)										
	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	Not known	All ages
Tested	9 186	6835	6593	6369	5461	4253	3351	2434	1421	12	45 915
Not-tested	826	893	1241	2007	2820	3285	3993	4431	4095	1363	24 954
Total study population	10 012	7728	7834	8376	8281	7538	7344	6865	5516	1375	70 869
Acceptance rate	91·7	88·4	84·2	76·0	65·9	56·4	45·6	35·5	25·8	0·9	64·8

INITIAL ACCEPTANCE RATES

Overall

The overall initial acceptance rate was 64·8% (Table 1). The 'migration' into the tested group clearly inflated this overall acceptance rate. Recalculation of the rate excluding the 'migrants' (estimated at approximately 4000) suggested that the true rate was about 63%. The variation in the initial acceptance rate with the demographic factors associated with cervical neoplasia is described below.

Age

The acceptance rate decreased markedly with increasing age (Table 1): from 91·7% in the age group 25–29 to 25·8% in the age group 65–69. This trend was slightly exaggerated by the 'migration' into the tested group at the younger ages.

Social class

The distribution of the total study population by social class is given in Table 2. Students, wives of servicemen, and those with insufficient information have been grouped together as 'unclassified'. Acceptance decreased with decreasing social class. The initial acceptance in relation to both age and social class is shown in Fig. 2. Within each age group, except the oldest (65–69), the acceptance rate decreased steadily from Social Class I through to Social Class V. The maximum difference in acceptance rate between Social Classes I and V was 28% in the age group 50–54. The minimum was 9% in the age group 25–29.

Table 2 *Distribution of total study population, and acceptance of cytology by social class*

Social class	No. (%) of women in defined population	No. of tested women	Acceptance rate (%)
I	3 870 (5·5)	3 149	81·4
II	11 957 (16·9)	8 387	70·1
III	35 258 (49·8)	23 761	67·4
IV	8 285 (11·7)	4 903	59·2
V	6 659 (9·4)	3 437	51·6
Unclassified	4 840 (6·8)	2 278	47·1
Total	70 869 (100·1)	45 915	64·8

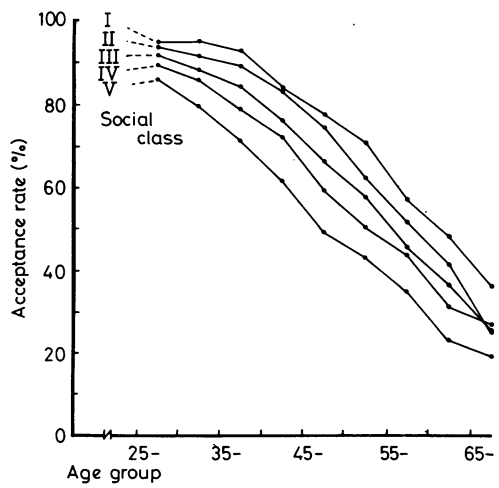

Fig. 2 *The effect of age and social class on initial acceptance of cervical cytology.*

Marital status

Table 3 shows the initial acceptance rate by marital status, subdivided by both age and social class. Some grouping of the age and social class categories was necessary because of the relatively small numbers in the widowed, divorced, and separated categories. Acceptance was marginally higher among married women in every age and social class group.

Age at first marriage and at first pregnancy

The acceptance rate decreased steadily with increasing age at first marriage and at first pregnancy. However, both of these factors are strongly associated with current age. After standardisation for age and social class there was no independent association of age at first marriage or at first pregnancy with the response rate.

Table 3 *Initial acceptance rate (%) by marital status, age, and social class*

Social class	Marital status	Age group (years) 25-34	35-44	45-54	55-69
I and II	M	93·7	87·0	70·4	43·2
	W/D/S	85·7	76·2	64·6	39·3
III	M	90·5	80·6	63·0	37·6
	W/D/S	86·3	70·8	54·8	35·6
IV and V	M	85·8	71·8	52·1	31·2
	W/D/S	83·2	65·8	44·3	30·1

M = married
W/D/S = widowed, divorced or separated.

Total pregnancies

Acceptance by age and total pregnancies is shown in Fig. 3 for all social classes combined. Acceptance was lowest among nulligravidae. In these women it was about 10% lower than in those with two pregnancies, and women with one pregnancy occupied an intermediate position. In those with more than two pregnancies the acceptance rate was approximately constant. This was broadly true for all ages and all social classes.

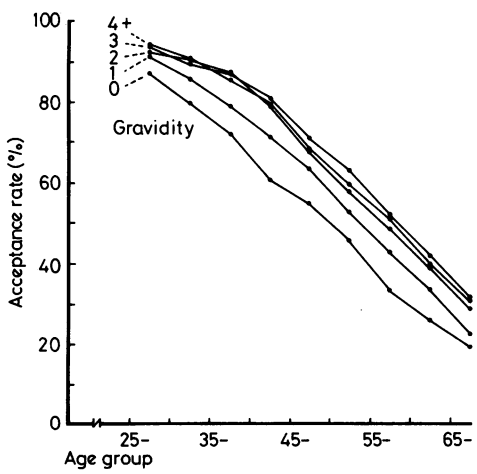

Fig. 3 *The effect of age and gravidity on initial acceptance of cervical cytology.*

Discussion

Dunn (1953) and Knox (1966) have argued that to draw inferences about the natural history of cervical cancer it is necessary to obtain accurate estimates of the incidence and prevalence of the various cytological and histological states. To estimate incidence, each woman must be screened at least three times. For the estimates to be accurate, selection bias should be minimal, and it is well recognised that the optimum method of ensuring this is to use a well-defined total population and to obtain a high acceptance rate. This study was based on a total population but the method of defining it was not ideal because we permitted in-migration of women who accepted screening; these were particularly numerous in the age group 25–29. Nevertheless we consider that we have gone a long way towards defining a total population as the basis for the study.

Although considerable efforts were made (Evans *et al.*, 1977) to get as high an initial acceptance rate as possible, the final overall rate of 64·8% (Table 1) was sufficiently low for considerable selection bias to have occurred. However, because basic demographic data were collected from virtually all of the target population important selective biases are known and their effects can be estimated.

The pattern of acceptance by age, with a markedly decreasing trend from high rates in the younger women to low rates among the older, was very similar to that obtained in a number of other studies (Kaiser *et al.*, 1960; MacGregor, 1967; Sansom *et al.*, 1970; 1971). The very low acceptance rate among the oldest women means that estimates of prevalence and incidence in these groups will have to be interpreted with some caution.

The other major factor associated with the acceptance rate was social class. Overall, the acceptance decreased from 81% in Social Class I to 52% in Social Class V (Table 2). In virtually every age group there was a steady decline in acceptance as social class declined. This differential acceptance was of sufficient magnitude to necessitate its being taken into account when estimating prevalence and incidence in this population.

After standardising for age and social class effects, acceptance did not vary with either age at first marriage or age at first pregnancy. Variations in the acceptance rate did occur with both marital status and number of pregnancies but in both cases the effect was small and is unlikely to bias estimates of prevalence and incidence.

Overall, accurate estimates of prevalence and incidence can be expected for younger age groups provided that allowance is made for the differential social class acceptance rate. For older women the estimates must be interpreted with some caution, because of the low acceptance rate which could result in exaggeration of the prevalence.

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