

# Useful Indices in Evaluating A Cervical Cytology Program

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THE USE of exfoliative cytology has increased phenomenally during the last two decades, and today there is no question regarding the acceptance of the cytologic method for the early detection of cervical cancer. Cytology has made detection of early asymptomatic cancer possible, thus enabling treatment before invasion has started; it has also been used for prompt diagnosis of recurrence and in measuring response to treatment. Much has been written about the various cytology programs carried out by communities, States, or countries. Very little has been said about methods of evaluating a cervical cytology program.

There is a need for identifying certain indices of evaluation so that health officers can measure progress in cytology programs, compare the effect of their programs with similar projects in other areas, and have some measure of effectiveness to cite when requesting funds for expansion of program activities. The simpler these indices are, the more useful and easily remembered they will be.

Since most public health officials are aware of the value of cervical cytology and are concerned with promoting its use, this discussion will be confined to three indices which have been found useful in New York State in evaluating progress in cervical cytology programs. The first

was developed to analyze the program in New York State; the other two have been used by many others. These indices are the cytology activity index, the ratio of in situ to invasive cancer, and the mortality rate from cancer of the cervix.

Further studies have to be done to obtain data on specific age groups reached, socioeconomic levels of patients, cultural or ethnic groups responding, and marital status of respondents.

## Cytology Activity Index

The cytology activity index represents the number of cervical cytology tests per 1,000 women age 21 years and over for any specified period of time. It is more meaningful than a number representing the total volume of cervical cytology tests, since it takes the population of an area into consideration. It is expressed as follows.

$$\text{C.A.I.} = \frac{\text{number of cervical cytology tests}}{\text{women age 21 years and over}} \times 1,000$$

Since the index can be calculated for a county as well as for a total State, it is useful not only in measuring progress from year to year in the entire State, but in comparing progress in individual counties as well. It can be used, therefore, to detect places where only a small segment of the female population is receiving the test locally.

Figure 1 indicates the cytology activity index for various years and gives some idea of the extent of cervical cytology testing in New York

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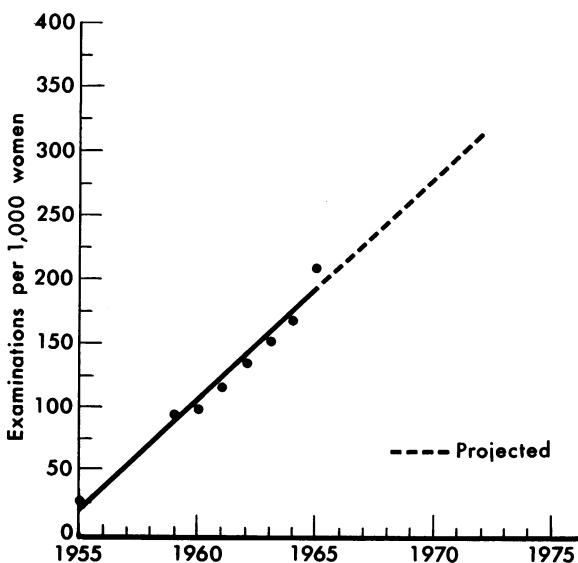
State excluding New York City. In 1955 there were 27 examinations per 1,000 women age 21 and over; in 1959, 94; in 1960, 102; in 1961, 120; in 1962, 143; in 1963, 154; in 1964, 170; and in 1965, 208. Projection of the trend line indicates progress toward the program goal even though projection entails an element of uncertainty.

If every woman had a yearly cervical cytology test, the cytology activity index would be 1,000. However, a goal which is attainable within the next few years has been selected for New York. The aim is that each woman will have a cervical cytology test every third year, which would mean that a third of all adult women would be tested each year. If this goal had been reached in 1966, 1,041,000 cytology tests would have been done, giving a cytology activity index of 333. Once this index is actually achieved, the goal can be redefined.

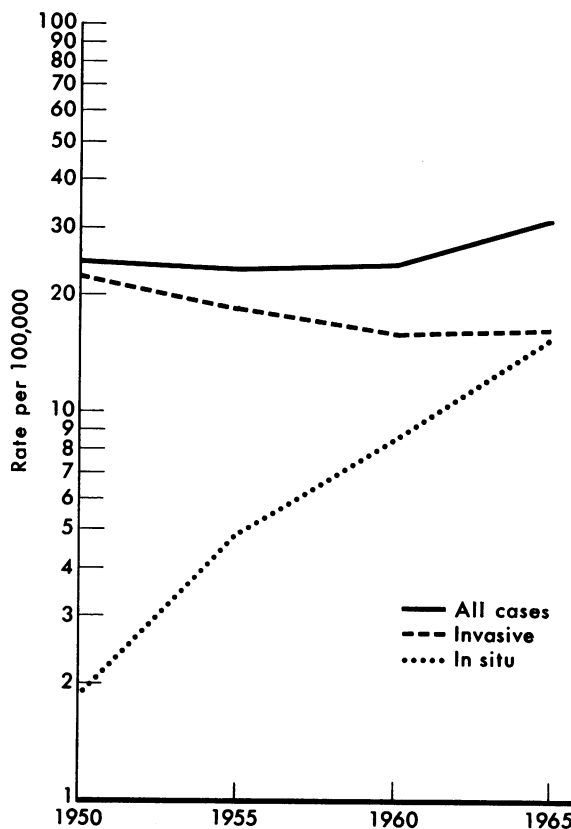
Actually, the total number of cytology tests reported included some on women under age 21 and some repeat smears on the same women. The projection of the trend line in figure 1 indicates that it will take until at least 1972 for the current goal to be achieved at the present rate of progress.

Some mechanism for recording the number of smears examined by each laboratory is neces-

**Figure 1. Cytology activity index, the number of cervical cytology tests per 1,000 women 21 years and over, New York State excluding New York City, 1955-65**



**Figure 2. Age-adjusted incidence rates for cancer of the cervix, New York State excluding New York City, 1950-65**



sary to obtain the cytology activity index. If one central laboratory examined all the cervical smears for an entire area, obtaining data would be simple. However, in New York the policy of the State department of health has always been to encourage cytology service as part of local laboratory operations. Laboratories are licensed by the State health department and are required to submit an annual report in which they list the number of cervical cytology tests examined for the year. A simple compilation of these reports from more than 200 laboratories yields totals for each county as well as for the entire State excluding New York City.

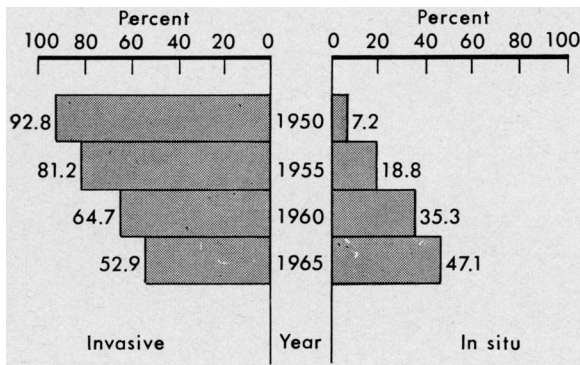
One shortcoming of the cytology activity index is the underreporting of cervical smears examined. Smears examined in a laboratory not licensed by the State department of health for such a procedure, or in a laboratory in an adjacent State or Canada, are not reflected in the total number of smears used to compute the in-

**Age-adjusted<sup>1</sup> incidence rates per 100,000 women for cancer of the cervix, New York State excluding New York City**

Year	Total cases	In situ	Invasive	In situ: invasive ratio
1945-----	23.3	0	23.3	-----
1950-----	24.4	1.8	22.6	1:12.56
1955-----	23.4	4.9	18.5	1: 3.78
1960-----	24.1	8.6	15.5	1: 1.80
1965-----	31.5	15.5	16.0	1:1.03

<sup>1</sup> Adjusted to the enumerated population of the United States, 1960.

**Figure 3. Distribution of cases of cancer of the cervix, New York State excluding New York City, 1950-65**



dex that year. This group is believed to be minimal, however, and there may be some balancing of this factor since the total number of smears includes some repeat smears on the same women. The index is a crude measure, similar to a crude rate, and is useful in comparing one year with another as well as use in different health jurisdictions in the State.

**Ratio of In Situ to Invasive Cancer**

In situ cancer is confined to the stratified epithelium and does not penetrate the basement membrane at any point. Invasive cancer has penetrated the basement membrane. The objective of cervical cytology is to detect early cancer, preferably in the in situ stage. As a program of cytology develops, more cases should be detected. However, there should be a shift in the ratio of in situ to invasive carcinoma because as more smears are taken, more in situ carcinoma should be discovered. It should be pos-

sible to have a community in which cervical cytology smears are taken on a routine basis from all women so that if carcinoma of the cervix does develop, it will be detected before invasion begins.

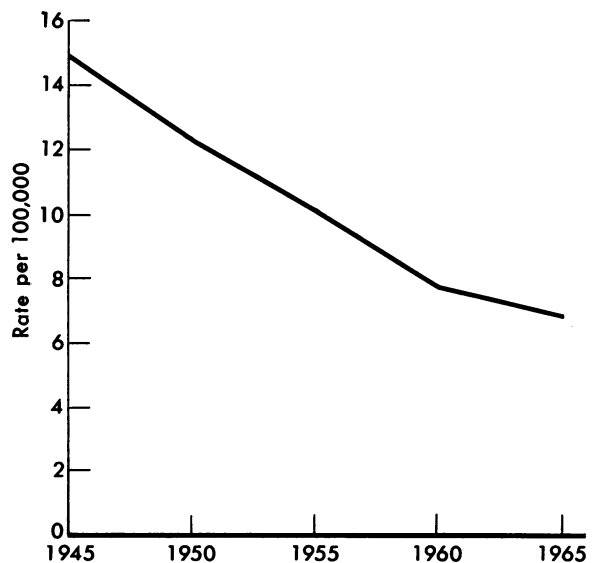
Naturally, at the start of any program many invasive carcinomas will be found. In the ideal community with a well-developed, broad cervical cytology program, invasive cervical cancer would be eliminated completely. Progress in a cervical cytology program is indicated by the increase in the ratio of in situ carcinomas detected to invasive lesions detected, with the ultimate goal being the absence of invasive cervical carcinomas.

A current goal of the program in New York is to have the rate of in situ cervical carcinoma consistently higher than that of invasive cervical carcinoma, that is, a ratio of in situ to invasive of greater than one.

Figure 2 and the table show incidence data for cancer of the cervix. The rates for in situ carcinoma are increasing and those for invasive carcinoma decreasing, but as yet the ratio has not reached the goal of more in situ than invasive carcinomas.

This measurement is also valuable in reviewing programs in individual counties. As one would expect, in those counties where very few

**Figure 4. Age-adjusted mortality rates for cancer of the cervix, New York State excluding New York City, 1945-65**



cervical cytology tests are performed, few in situ cases are discovered.

A similar type of ratio is obtained by comparing the percentage distribution of cases of in situ with invasive cancer reported each year (fig. 3). Use of this index, whether by comparing incidence rates for in situ to invasive cancers or percentages of in situ to invasive cancers, requires disease reporting that indicates the stage of cancer in the report.

One shortcoming in using a central registry for such data is that some cases of cervical cancer are reported in which the stage of disease is not indicated. Data for New York State are obtained from a central registry maintained by the bureau of cancer control of the State department of health. However, no case is counted as in situ unless it is indicated on the cancer report that the diagnosis was substantiated by a pathology laboratory; therefore, our statistics for in situ carcinoma are minimal. However, by being consistent in what is counted as in situ, comparisons from year to year are possible.

#### Mortality Rate

The ultimate objective in detecting cancer of the cervix is to reduce the mortality rate from cancer of this site to zero. Unfortunately, it is difficult to show a direct relationship between an increase in cervical cytology tests and a decrease in the cervical cancer death rate since many other factors, such as method of treatment, place of treatment, and time interval be-

tween diagnosis and death, must be considered. Nevertheless, it is reasonable to assume that as more in situ carcinomas are discovered and treated, fewer cases of advanced cervical cancer which end in death will develop. The mortality trend from cancer of the cervix in New York is continuing to decrease (fig. 4).

#### Summary

Three indices which have been useful in measuring progress in cervical cytology programs are the cytology activity index, which is the number of cervical cytology tests per 1,000 women age 21 and over, the ratio of in situ to invasive carcinomas detected, and the mortality rate from cancer of the cervix. Application of these indices allows the study of trends over periods of time, permits comparisons among different areas, and gives the health officer a means of indicating his progress toward his immediate and long-range program goals. The immediate goal in New York State is that each woman receive a cervical cytology test every third year, giving a cytology activity index of 333.

In New York State, excluding New York City, these indices have enabled assessment of the use of cervical cytology tests year by year for the entire area as well as by individual county, permitted the measuring of progress in detecting the disease in its earliest, most curable stage, and indicated how close the health department might be to eliminating all deaths from this disease.

#### ERRATUM

In the paper, "Childhood Tuberculosis with Reference to the American Indian," by Helen M. Wallace, published in the January 1967 issue of *Public Health Reports*, the statement on page 30 that "During 1961-63, it was 11 times that for the total population in 1962 (table 3)" is in error. During 1961-63 the tuberculosis death rate among Indians was five times that for the total population in 1962.

Totals in the table on page 31 were also incorrect. The corrected table appears at right.

**Table 3. Age-specific death rates from tuberculosis**

Age group (years)	Indian		All races
	1961-63	1953-55	1962
Under 5.....	6.5	63.4	0.8
5-14.....	2.8	10.5	.5
15-19.....	5.1	30.0	.2
20-24.....	9.0	19.8	.5
All ages.....	25.3	56.6	5.1

SOURCE: Reference 3, p. 20.