Residency Training in Public Health and General Preventive Medicine

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IN a previous paper, we made a preliminary comparison of residencies in the clinical specialties with those in preventive medicine, that is, public health, general preventive medicine, aerospace medicine, and occupational medicine (*1*). The data indicated that the nation's need for trained clinical specialists is barely being met, especially since one-third of the residents are foreign citizens, many of whom return to their own countries.

In contrast, the number of physicians being trained for public health is woefully inadequate. Hill and associates estimated from a survey of residency programs in 1964–65 that the output of public health residents in the United States was one per 10 million population (*2*). From a similar survey in June 1969, we estimated that this figure had improved to one per 7 million. In fiscal year 1965, 78 field training positions were offered in public health; 35 were filled by U.S. civilians and six by members of the Armed Forces or the Public Health Service (*2*). In fiscal year 1969, according to our survey, 104 positions were offered; 60 were filled by U.S. civilians, three by members of the Armed Forces, and three by foreign citizens. We believe that there must be at least one trained public health administrator for each 250,000 persons. However, this figure cannot be met by extension of the present residency system.

The numbers of residencies offered in general preventive medicine have been growing more rapidly, and more physicians are being recruited and trained for this subspecialty than for public health. In this paper we describe the development of both general preventive medicine and public health programs, their current status, and some significant differences between them. Our data were derived from residency program essentials and listings, board requirements, statistics from the American Medical Association, a questionnaire survey which we carried out in May–June 1969, and personal observations and interviews.

According to two officers of the American Board of Preventive Medicine, Dr. John C. Hume and Dr. Harold V. Ellingson (personal communications, February 1970), the many obvious discrepancies between the statistical tables and the listings by name of sponsoring institutions and programs in the AMA publications are partly due to the issue of different figures from different offices. Also, these figures are based on separate reports which have different effective dates. Most of the discrepancies, however, result from the large degree of nonresponse, especially by the academic institutions, to queries by the AMA. The data obtained from our survey were quite different from the AMA data, particularly in that ours showed more residency positions filled and fewer filled by foreign trainees.

Public Health Residencies

Thirteen programs were initially approved by the AMA in fiscal 1951 (see table). The number increased slowly but steadily, with the largest increase (five) in fiscal year 1958–59 to an

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average of about 25 for fiscal years 1966–69. The number of positions offered increased regularly from 104 in 1961 to 158 in 1967 but dropped to 100 in fiscal 1969. The Public Health Service funded 25 of these positions in health departments in fiscal 1969 (*3*). The percentage of positions filled dropped steadily from a high of 60 percent in 1961 to 25 percent in 1968 but rose to 40 percent in 1969. The percentage of positions filled by foreign graduates was less than 5 percent during 1966–68 but rose sharply to 35 percent in fiscal 1969.

The 1969–70 AMA Directory of Approved Internships and Residencies, revised to June 30, 1969, lists 29 approved programs offering positions for 1970–71; 25 of these are sponsored by departments of health, one by a department with a university medical center, and three by the Army (*4a*). The Arizona and Kentucky State Departments of Health programs were approved in fiscal 1969.

In May 1969 we sent a questionnaire to the administrators of 26 programs besides ours (the joint program of the District of Columbia Health Services Administration and the Howard University College of Medicine) then listed in the 1968–69 AMA directory (*5*), and we received 26 replies in June. The respondents and our program had offered 104 public health residencies for fiscal year 1969, and 66 were filled. The distribution of the 66 positions filled in the 27 programs was as follows:

Number programs	*Number positions filled*	*Total positions filled*
4	0	0
12	1	12
3	2	6
2	3	6
1	4	4
2	5	10
1	6	6
1	10	10
1	12	12

Nineteen residents had previous public health experience, nine (including three Army officers) had been employed previously by the sponsor, and only three were foreign trainees.

Fourteen programs had a formal affiliation with a school of medicine or public health, which enabled auditing of courses, but none were operated by the school. (No significant difference was seen in the percentage of positions filled in the programs which were academically affiliated and those which were not.) According to the respondents, 10 programs prepared the residents for public health only whereas 17 programs prepared them for both public health and general preventive medicine.

In seven programs the residents had an opportunity to teach, and in six the residents participated in clinical activities. The timing of the academic phase of training varied among the institutions. In eight programs the academic phase was in the first year, in seven it was in the second year, and in two it was in the third year. Ten programs allowed flexibility as to sequence. Fifteen agencies said they would pay the resident about the same if he were employed rather than being trained, and 12 said they would pay him more if he were an employee.

Compared with the other civilian residencies, the District of Columbia program with five residents had a much higher proportion of physicians with previous experience in public health, of previous employees, and of foreign trainees.

The three Army programs prepare selected candidates for assignment as military "preventive medicine officers." Formerly, residents were assigned to State or local health departments for field experience, but this is now obtained in military installations. Four military positions were offered in fiscal 1969 and three were filled, only one by an officer with more than 2 years of service. None of the three officers had public health experience. One Army program is affiliated with a medical school and one with a school of public health.

General Preventive Medicine Residencies

As shown in the table, the numbers of general preventive medicine programs increased rapidly from the first two accredited in fiscal year 1961, to eight in fiscal 1966, to 21 in fiscal 1969. Positions offered and filled showed a similar increase, to 206 offered and 104 filled, in fiscal 1969. The occupancy rate, however, has been declining steadily, from 70 percent in 1966 to 50 percent in 1969.

The AMA directory for 1969–70 lists 20 sponsoring institutions or agencies; 16 are schools of medicine or public health. The others are the Walter Reed Army Institute of Research, the

New York State Department of Health, and, new in fiscal 1969, the Air Force School of Aerospace Medicine and the Public Health Service Global Community Health Program. In fiscal 1969, the Public Health Service funded 27 residency positions through training grants to the institutions.

In May 1969 we also sent a questionnaire, similar to that on public health residencies, to 17 of the 19 "physicians in charge" then listed in the 1968–69 AMA directory (*5*) and interviewed the other two. Responses revealed that of 90 positions offered 73 were filled in 13 programs as follows:

Number programs	*Number positions filled*	*Total positions filled*
4	0	0
1	1	1
1	2	2
1	4	4
1	5	5
1	6	6
2	8	16
1	14	14
1	25	25

(Programs are listed in the AMA directory as epidemiology, community medicine, international health, and so forth. However, a program, or a number of programs, is counted separately only when a different "physician in charge" is designated; 22 such physicians are named on page 255 of the 1969–70 directory.)

Twenty-five residents had previous general preventive medicine experience; nine had been employed previously by the sponsor and eight of these were Army officers. Five trainees were foreign. Twelve programs were sponsored by or closely affiliated with schools of medicine or public health and one was not. Two programs were inactive. Of the 11 active programs, eight used their preventive medicine departments for training and four used their clinical departments. Only eight used operating health agencies for field training. According to the respondents for all 11 active programs, their trainees were prepared for both general preventive medicine and public health. Seven stated that the residents would be paid more if they were employed rather than being trained, and four would pay about the same. Two programs emphasized clinical epidemiology and the application of preventive medicine to clinical practice by assigning the resident to a clinical department (*6, 7*).

Differences Between GPM and PH Programs

From the responses received in our survey, the residency programs in general preventive medicine (GPM) were different from those in public health (PH) in that their programs were fewer but larger (offered more positions per program), they offered more positions in total, and they had a greater number and percentage of positions filled. Their civilian programs trained far fewer previous employees, and twice as many residents were foreign citizens (still only 7 percent of the residents). Nearly all the

Growth of residencies in public health (PH) and general preventive medicine (GPM)

Fiscal year	Number approved programs		Number positions offered		Number positions filled		Percent positions filled		Percent positions filled by foreign graduates	
	PH	GPM	PH	GPM	PH	GPM	PH	GPM	PH	GPM
1951	13									
1956	16									
1961	22	2	104		63		60			
1966	26	8	138	55	43	38	35	70	4	10
1967	25	14	158	106	60	66	38	62		11
1968	27	19	118	154	29	80	25	52	3	10
1969	24	21	100	206	40	104	40	50	35	9

NOTE: Leaders indicate data not available.

SOURCES: Journal of the American Medical Association: Sept. 29, 1951, table 21, p. 442; Sept. 22, 1956, table 21, p. 364; Sept. 2, 1961, table 7, p. 625; Nov. 21, 1966, table 10, p. 881; Nov. 20, 1967, table 10, p. 770; Nov. 25, 1968, table 10, p. 2031; Nov. 24, 1969, table 10, p. 1498.

sponsoring institutions were academic, and they used service agencies for training less often than the public health programs. All the general preventive medicine respondents said that they prepared trainees for both public health and general preventive medicine, whereas half the public health respondents said they prepared trainees for public health only.

The following list points up some additional differences between general preventive medicine and public health residency programs, as disclosed by the AMA directory listings, program essentials, and board requirements, as well as from our personal knowledge and a few interviews.

Sponsor, as of June 30, 1969. School of medicine or public health: PH, 1; GPM, 16. State or local health agency: PH, 25; GPM, 1. Military or Federal: PH, 1; GPM, 3.

Emphasis. PH, service and administration; GPM, research and training.

Training faculty. PH, few; GPM, many.

Board certification requirements. (*a*) "academic phase": PH, 1 year—master of public health or equal; GPM, 1–3 years toward advanced degree (*b*) "practical training": PH, 2 years—at least 1 year general public health; GPM, 1–3 years—may be concurrent and elective. Usual location of *a* and *b:* PH, different institution and city; GPM, same institution.

Training sequence. Academic-field-field: PH, second choice; GPM preferred. Field-academic-field: PH, preferred; GPM, acceptable. Concurrent: PH, rare; GPM, often.

Stipend or salary. PH, $6,000–$18,000; GPM, $6,000–$10,000.

The main differences seem to be the location of general preventive medicine residencies in academic institutions, with program emphasis on research and teaching rather than administration, and the presence of full-time faculty members who can devote considerable time to instructing and supervising trainees. The requirements for board certification in general preventive medicine are more flexible than in public health (*4b*, *4c*). In some programs the resident may take from 1 to 3 years of academic study, with field training correspondingly decreased in effect or taken concurrently. There is much room for elective specialization, as in research methodology or epidemiology. (In our opinion, some of the programs are so specialized that they do not prepare the resident for the practice of public health—perhaps some not even for general preventive medicine.)

The resident in general preventive medicine may work toward many degrees, such as M.P.H., Dr.P.H., M.Sc., or Ph.D. Usually the residency is in one city, often in one institution, whereas the public health resident usually has to obtain field training in one city and his graduate education in another. This situation is partly due to the fact that the academic institutions are approved for 3 years of residency, whereas the public health departments are approved for only 2 years. Also, the general preventive medicine residency usually starts with the academic year rather than with field training as does the public health residency.

Summary and Conclusions

The need for trained clinical specialists is barely being met, especially since one-third of these residents are foreign citizens, many of whom return to their own countries. In comparison, the number of physicians in training for public health is woefully inadequate.

The numbers of residencies in general preventive medicine have been growing more rapidly, and more physicians are being recruited and trained for this subspecialty than for public health. Gross comparisons derived from residency program essentials and listings, board requirements, and statistical tables published by the American Medical Association suggest that the differences may be due to emphasis in general preventive medicine on research and training rather than on administration, to sponsorship by training institutions with full-time preceptors, to greater flexibility in curriculum, and to location of the school in the same city where the field training is given. The lower salary paid to residents in general preventive medicine does not seem to be a strong deterrent.

A questionnaire survey additionally revealed that as of June 1969 general preventive medicine directors believed that they were training residents for public health also, whereas many public health directors felt they were training only for public health. The respondents also indicated that the general preventive medicine programs used service agencies far less than did

the public health programs, thus they had less contact with the health "establishment."

Studies of the apparent differences between the two programs should be made in depth to determine how public health residencies can be strengthened and made more attractive. Possibilities such as providing academic sponsorship and incorporating the lures of research and teaching, clinical involvement, and greater program flexibility should be explored as a means toward these ends.

The American Board of Preventive Medicine, the American College of Preventive Medicine, and the Residency Review Committee for Preventive Medicine are acutely aware of the differences. The board and the college have established an organizing committee to initiate discussions on the desirable content of public health residency training and the best ways to organize such programs. We believe these organizations will support or conduct the studies needed.

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(*4*) American Medical Association: Directory of approved internships and residencies, 1969–70: (*a*) approved residencies in preventive medicine, pp. 257–258; (*b*) special requirements for residency training in preventive medicine, pp. 328–332; (*c*) requirements for certification, pp. 379–381. Chicago, December 1969.

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Tearsheet Requests

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ph synopses

JANUS, ZELDA L. (District of Columbia Health Services Administration), and FUENTES, ROBERTO: ***Participation of low-income urban women in a public health birth control program. Public Health Reports, Vol. 85, October 1970, pp. 859–867.***

A population of 564 low-income nonwhite mothers from the District of Columbia, 45 percent of whom were married at the time their study baby was born, was evaluated by the District of Columbia Health Services Administration to determine, among other things, the extent of their continuing participation in a birth control program, the reduction in births because of the program, and why some women became dropouts from birth control.

The study population included mothers delivering a live baby at the District of Columbia General Hospital between November 1964 and December 1965. Nearly one-third of all resident newborns are delivered at this hospital, almost entirely to women from low-income Negro families.

The time interval covered by the study included almost 13,000 woman-months, during 70 percent of which the women practiced birth control. At the time of interviewing them, which usually averaged 2 years from registration at the birth control clinic, 376 or 67 percent of the 564 mothers were using contraceptives, 158 or 28 percent had at some time used contraceptives but were not then using anything, and 30 or 5 percent had never used a contraceptive method.

The Pearl pregnancy rate for the 564 participants was 19.3 per 100 woman-years. An estimated reduction of 55 percent in the number of expected births occurred in the study population for the period covered by the study.

The 158 women who no longer were using birth control methods had stopped for such reasons as being pregnant or because they were separated from their husbands, had surgery, became sick, gained weight, were nervous, or thought it too much trouble. Only one woman admitted losing track of the cycle for using contraceptive pills.

phr synopses

SCHNEIDER, P. J. (DePersia-DuPree Medical Associates, Woodbury, N.J.), COOPER, J. K., BIRCH, A. A., Jr., and DWYER, E. M.: *Computer analysis of electrocardiograms with six and twelve leads, Public Health Reports, Vol. 85, October 1970, pp. 853–858.*

An investigation of the value of several methods of screening with electrocardiograms (ECG's) was undertaken by the Bureau of Medicine and Surgery, U.S. Navy, and the Heart Disease and Stroke Control Program, Public Health Service. Since rapid computer analysis of electrocardiograms had become available, it seemed feasible to compare the accuracy of interpretation with limited numbers of ECG leads. A system of rapid application of the six frontal plane electrodes was used. The patient was seated; both his feet were placed on electrodes moistened with saline or alcohol, and his index fingers were inserted into tension clips. Application of the electrodes took approximately 1 minute. The six leads were then recorded. Conventional 12-lead ECG's were obtained with ordinary ECG electrodes and paste while the subject was recumbent. This procedure usually took 4 to 5 minutes. Both six-lead and 12-lead ECG's were fed into a data acquisition console.

As a standard for comparison, 309 full 12-lead ECG's were obtained and interpreted by two cardiologists independently. Differences of interpretation were then discussed, and an assumed correct interpretation was obtained. This reading was compared with the readings by digital computer of the 12-lead ECG and of a special six-lead (no chest leads) ECG, as well as with a physician's analysis of the six-lead tracing. The interpretations of the 12-lead ECG's by computer were found to be 91 percent sensitive and 72 percent specific; the interpretations of the six-lead ECG's by computer were found to be 77 percent sensitive and 85 percent specific. The interpretations by the physician of the six-lead ECG's were found to be 88 percent sensitive and 65 percent specific.

The ability to detect abnormality was less with the six-lead screening method (23 percent) than with the 12-lead. Overdiagnosis occurred more frequently in the interpretation of the 12-lead ECG by computer (28 percent). For large computer studies, the rapid frontal plane electrode application system is feasible in detecting normality, but it conceivably could miss a considerable number of abnormal electrocardiograms. Further investigation of this rapid application system in conjunction with selected precordial-lead ECG's seems indicated.

COE, RODNEY M. (St. Louis University School of Medicine): *Attitudes toward Medicare among older people. A followup. Public Health Reports, Vol. 85, October 1970, pp. 868–872.*

Comparison of the attitudes of older residents of five Midwestern communities in 1968 with those manifested in 1966 showed that approval of Medicare had increased. The sample in both surveys was drawn from the same population, and the distributions in the second sample differed less than 1 percent on the characteristics of age, sex, and race.

Sixty-nine percent of all respondents approved of Medicare in 1966, and 87 percent approved in 1968; 8 percent disapproved in 1966, but only 3 percent disapproved in 1968. The increased approval was greater among women than men, among persons eligible for Medicare than those who were younger, and among persons with an adequate income than those who were comfortably situated.

Of the respondents who approved in 1966, 41 percent did so because Medicare "provides care for those who need it," and 30 percent approved because it "provides money to pay medical bills." In 1968 the same responses were given in reverse order by 52 percent and 44 percent, respectively. Sixteen percent of the respondents said they could not afford the deductions in 1966; 26 percent made the same statement in 1968.

All except one or two of the more than 2,000 respondents said Medicare had not altered their relations with members of their families, and 99 percent perceived no change with respect to their physicians. Half of the respondents said they had perceived a change, and 98 percent of these persons said they felt more secure since Medicare began.

Less than 10 percent of the respondents had used Medicare in 1966, but in 1968 nearly 25 percent had benefited. Data in both surveys showed that persons in the poorest health and those with least adequate financial status benefited most.

In 1966, 65 percent of the respondents reported "no problems" getting their bills paid, but this response rose to 83 percent in 1968. Delay in reimbursement was mentioned by 14 percent of the users of Medicare in 1966, but by only 11 percent in 1968. Those who did not understand the program dropped from 12 percent in 1966 to 2 percent in 1968. The increase in approval of Medicare is the result of the realization that medical bills are paid by Medicare even though not in the full amount.

phs synopses

BROWN, R. CHRIS (in private practice, Clearwater, Fla.), GURUNANJAPPA, BALE S., HAWK, RODNEY J., and BITSUIE, DELPHINE: ***The epidemiology of accidents among the Navajo Indians. Public Health Reports, Vol. 85, October 1970 pp. 881–888.***

All accident cases occurring between November 1, 1966, and October 31, 1967, to Navajos living on the Navajo Indian Reservation and recorded in emergency room records, outpatient records, and hospital charts of the medical facilities serving the reservation were investigated for type of accident, nature of injury, time and place of occurrence, and age and sex of the persons involved.

The data were tabulated and analyzed to give a descriptive epidemiologic picture of accidents in this population. A total of 4,863 accidental injuries to 4,803 patients was reported, with an annual incidence rate of 43.9 per 1,000 population; 114 (2.4 percent) of the patients died. The mortality rate of 104.2 per 100,000 population was nearly double that of the general population of the United States for the year 1966.

The study identified Navajo males as having an incidence rate twice that of the Navajo females. School-age and preschool children accounted for 46 percent of the total accident cases. Highest incidence rates for the total series were noted in the age groups 0–4, 5–14, and 65 and older. The mortality rate was highest in the age group 65 and older (228.7 per 100,000 population).

Falls and pedestrian-motor vehicle accidents occurred most frequently; pedestrian-motor vehicle accidents accounted for nearly 50 percent of the accident fatalities. Lacerations, contusions, fractures, and dislocations accounted for 75 percent of the injuries sustained by this population. The incidence of accident cases was highest in the summer months and lowest during the winter; most accidents (29.3 percent) occurred on the home premises. Health education techniques that are properly used are probably the best means of reducing the mortality and morbidity from accidents in the Navajo population.

TIZES, REUBEN (Department of Health, Nassau County, N.Y.), and TIZES, CAROL W.: ***Decline in statewide mobile X-ray programs to detect tuberculosis. Public Health Reports, Vol. 85, October 1970, pp. 901–904.***

Statewide mobile X-ray programs for screening large populations to detect tuberculosis are based on the rationale of discovering enough new cases to make the effort worthwhile. It is known that the yields are low and continue to decline. A review of the X-ray program in Nassau County during 1968 revealed an overall yield of only 0.24 case per 1,000 films taken. The exception was at the Salvation Army center which shelters vagrant, alcoholic, single men whose yield was 16.9 cases per 1,000 films taken. A program of tuberculin testing and chest radiography at nearby health department clinics was introduced for the center's residents.

A nationwide investigation of mass screenings was conducted by sending a letter of inquiry to all 50 State health departments. From the 45 replies, we learned that 20 States had discontinued their statewide mobile X-ray programs, four States limited their programs to selective surveys of high-risk populations, and 21 States were continuing their programs.

The reasons given for discontinuing the statewide mobile X-ray programs were the very low yields of active cases per 1,000 films taken. The yields were as low as 0.05 and no higher than 0.7 per 1,000 films.

A comparison of the yields from mobile programs with those of stationary programs shows that it pays to place X-ray screening units in areas with a high incidence of tuberculosis. The emerging trend is to discontinue mobile X-ray programs at the State level and leave the responsibility of whether to sponsor such programs to local health authorities.

HAY, SYLVIA (Public Health Service), LUNDE, ANDERS S., and MACKEPRANG, MURIEL: ***Background and methodology of a study of congenital malformations. Public Health Reports, Vol. 85, October 1970, pp. 913–917.***

An evaluation of the completeness and accuracy of congenital malformations and other items reported on birth certificates was undertaken jointly by the Epidemiology Branch of the Division of Dental Health, Bureau of Health Professions Education and Manpower Training, and the Division of Vital Statistics, National Center for Health Statistics.

All congenital malformations noted on hospital records of infants born in Iowa in 1963 were compared with birth certificates of those infants. Medical records of newborn infants of 144 hospitals were abstracted by staff of the statistical laboratory of Iowa State University. Records were found and reviewed for 57,909 infants, 98.8 percent of the 58,583 births registered in Iowa in 1963.

Hospital records were matched with birth certificates. Unmatched certificates represented misfiled records or births not occurring in participating hospitals.

Records of all 5,092 fetal deaths occurring in hospitals and 733 fetal death certificates were also included in the study for better assessment of total outcome of pregnancies.

Malformations were classified by three-digit codes and by severity and ease of recognition. A total of 6,516 malformations were discovered among records of 5,471 live births and 201 malformations among records of 128 fetal deaths.

ph synopses

HEINZELMANN, FRED (Department of Justice), and BAGLEY, RICHARD W.: *Response to physical activity programs and their effects on health behavior. Public Health Reports, Vol. 85, October 1970, pp. 905–911.*

The overall effectiveness of health programs is linked to an understanding of the factors that influence response to such programs and of the kinds of changes in health attitudes and behavior that participation generates. These issues were examined as part of a collaborative research effort that included three pilot studies of programs of supervised physical activity. The programs were made available to sedentary men 45–59 years of age who were considered to be at risk of coronary heart disease. The study sites included a metropolitan community and two university settings; the university settings included both faculty members and service employees. The study groups consisted of 239 men randomly assigned to an exercise program and 142 men randomly assigned to a control group. Program participants were asked to exercise for 1 hour three times a week for 18 months. Research data (medical, physiological, and social-psychological) were obtained from program participants and from members of the control group at regular 3–4 month intervals while the program was in operation.

A number of variables influencing the men's response to the physical activity programs were identified and defined; these included a variety of motivational factors as well as the social aspects of physical activity and the attitude of the participant's spouse. Differences were noted between the factors influencing the men's decisions to participate and those affecting their continued adherence to the program.

Physical activity was found to influence the participant's attitudes and beliefs, his habits and behavior, and his general self-image. Significant effects were reported on the man's work performance and his attitude toward work, along with such general health effects as feeling in better health, having increased stamina, experiencing a weight reduction, and possessing a greater ability to cope with stress and tension. In addition, the effects of participation were reportedly reflected in behavioral changes relating to the amount of food eaten, the kind of sleep and rest obtained, and the participant's pattern of recreation. These changes were linked to a more positive self-image which served to support the person's thoughts, feelings, and actions.

LANE, J. MICHAEL (University of California School of Public Health, Berkeley), MACK, THOMAS M., and MILLAR, J. D.: *Take rates by double versus single insertions of smallpox vaccine in revaccinees. Public Health Reports, Vol. 85, October 1970, pp. 928–932.*

Testing the hypothesis that a double insertion would increase the probability of a successful smallpox revaccination by doubling the viral inoculum used, we vaccinated 334 men 18 to 51 years old at the Georgia State Prison. All volunteers who had been vaccinated previously, the men were matched for race and time since previous vaccination. Single vaccinations were given to 85 white and 76 Negro inmates; simultaneous double vaccinations to 90 white and 83 Negro inmates. All vaccinations were done by a single vaccinator using the multiple-pressure technique with 30 needle pressures per insertion.

Readings of the skin responses on the 4th, 7th, and 14th postvaccinal days showed no superiority of double insertions. Six single vaccinees had equivocal reactions, and 155 had major reactions. Seven double vaccinees had two equivocal reactions, 20 had one equivocal reaction, and 146 had two major reactions.

Of the white single vaccinees, 84 had a major reaction and one had an equivocal reaction. Of the Negro single vaccinees, 71 had a major reaction and five had an equivocal reaction. Eighty-eight white and 78 Negro double vaccinees had a major reaction.

Among the single vaccinees who had been vaccinated less than 10 years previously were 62 with major reactions and two with equivocal reactions. Seventy-four single vaccinees with major reactions had been vaccinated more than 10 years previously as had two with equivocal reactions.

Fifty-eight double vaccinees who manifested major reactions had been vaccinated within 10 years, and four others with equivocal reactions had been vaccinated within the same period. Among double vaccinees who had been vaccinated more than 10 years previously were three men with equivocal reactions and 85 with major reactions.

Serologic examination of a subsample confirmed the results of the skin examinations. Prevaccination titers of serums from 30 men selected for single insertion and 35 selected for double insertions showed five prospective single vaccinees and seven prospective double vaccinees with titers of at least 1:256. Four candidates for a single insertion and five for double insertions had titers of 1:024 or more.

Eighteen single vaccinees and 21 double vaccinees had a fourfold rise in titer after vaccination. Five men had no significant change in titer. Of these, three were single vaccinees and two were double vaccinees.

Good technique and full potency of vaccine are the most important factors affecting revaccination takes. These factors are also the most readily amendable to improvement.

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