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Md. P. H. A. DRAFT

Maynard P. H. A. C. H. A. S. T. E. R.

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With the recent licensing of the last of three types of oral polio vaccine, ~~we have been provided~~ ^{we have been provided} ~~you can find with officials in the medical profession generally have been denied~~ a second preventive tool for the control, perhaps the eradication of clinical poliomyelitis. Before and since this licensure the storm of controversy as to which is the better agent has raged in almost every significant medical journal from Time magazine to Science. The spokesmen have sometimes been articulate, usually extreme in their statements, rarely objective and prone to participate in, or call a press conference at the least opportunity. It has seemed in this argument that anyone even discussing the subject has almost had to identify himself with a label - either he was a Sabin man or a Salk man - just as in making a major political speech, one has to be identified as Republican or Democrat. With this background of florid political campaigning, I should like to discuss the subject of polio vaccines from the standpoint of the Independent voter and to present you with what appear to be evident advantages and disadvantages to each of the two vaccines. Neither I am afraid is the great golden ideal ~~preventive~~ ~~tool~~.

The so-called Salk vaccine was released commercially seven years ago. Intensive field trials prior to this demonstrated both its safety and effectiveness. Major, large scale commercial production was begun and problems evolved not previously encountered in small scale production. Shortly after its release, the well-known Cutter incident occurred. Production and testing procedures were necessarily revamped. These

changes resulted in a vaccine which initially was sharply reduced in potency. The aftermath of this came 3 years later with a polio epidemic in Boston among supposedly adequately vaccinated individuals.

Prior to release of the Salk vaccine in 1955, we were at work to evolve a surveillance program to evaluate continually on a national basis both the safety and efficacy of the vaccine ~~in~~ⁱⁿ day to day use in the country. This program was launched at the time of the Cutter incident. Since that date, in cooperation with State and local health officials throughout the country, we have sought to obtain for each case of poliomyelitis certain items of basic epidemiological data to permit, on a national basis, a continuing appraisal of these two key factors: (1) vaccine safety and (2) vaccine efficacy. Since cases of inoculation polio followed within 30 days the date of immunization and ~~was~~^{did}, in a large percentage, result~~ed~~ in first paralysis of the inoculated extremity, this information has been watched particularly and correlated with vaccine manufacturer and lot number of the vaccine where available. Since 1955, we feel confident in saying that the vaccine is safe - if risk is present we feel it occurs less often than once in a million injections.

We also have information regarding efficacy of the vaccine on a national basis and have been able to test this repeatedly. The results are consistent. We know from the surveillance data the number of cases of paralytic poliomyelitis and the number of injections of vaccine received

by each case. Through the Bureau of Census, we can obtain estimates from ~~1957~~ nationwide sample survey as to the numbers of individuals in each age group ^{have} who ^{received} the ~~appropriate~~ numbers of injections. We thus have a numerator and a denominator. Effectiveness estimates based on these data indicate 3 doses of the vaccine to be 90% effective in preventing paralytic poliomyelitis. The results have been consistent from year to year since this was initiated. It is to be noted, however, that cases of poliomyelitis have largely occurred in the lower socio-economic groups - these groups are disproportionately poorly immunized. The bias in this 90% figure is such ^{that} ~~to suggest~~ ^{appears} the vaccine to be more effective than in fact it is. Through intensive epidemic studies in Des Moines, Kansas City, Providence and San Juan, Puerto Rico, we have been able to correct for these biases. The results in each area are ^{again} remarkably consistent. For three doses of vaccine, the effectiveness closely approximates 80%. Further on the basis of these studies, it would appear that the severity of paralysis among those vaccinated three or more times is less severe at 60 day evaluation than among the less well immunized.

A further phenomenon more recently described is the apparent ability of the killed vaccine to inhibit spread of the polio virus. As this has not been widely discussed, it is well to spend a moment with it. We have noted since the 1956 epidemic in Chicago a change in the epidemiologic pattern of poliomyelitis. ⁶ Epidemics have demonstrated a marked selectivity for preschool age Negro and white children from lower socio-economic areas of the city. This might be explained on the basis that those from

higher socio-economic classes and school children are simply better immunized. However, if vaccine in no way inhibits spread, poliomyelitis rates for the unimmunized in the higher socio-economic groups should be comparable to that among lower socio-economic classes. Intensive studies in the Des Moines epidemic published last summer and corroborating data from a study in Providence yet to be published show disproportionately low attack rates for unimmunized children in these upper socio-economic groups. Further, sewage samples taken at scattered areas throughout both cities show little polio virus in the so called better neighborhoods but repeated positives in the less well immunized areas. The virus appears to spread poorly in the well immunized areas.

The mechanism of inhibition is ^{at least} partially clear. Studies by Wehrle, Bodian and others have shown reduced to absent pharyngeal virus excretion in ~~un~~immunized persons. Fecal excretion of virus is somewhat reduced in duration, sometimes in titer.

A herd immunity effect with the killed vaccine is, to a degree we believe, present. *In brief, we have a killed vaccine requiring 4 in 1000 for what is believed adequate immunization. It is safe, effective within the limits described and able to confer* *Some degree of herd immunity*
I should like ~~to~~ to turn to the oral vaccine and to discuss several salient features regarding its mode of action, its safety and its effectiveness.

Work with attenuated strains of polio virus for immunization purposes began over 10 years ago. Limited studies were progressively ^{broadened} extended to ever more extensive field trials. Three sets of strains with certain overlaps were developed and tested, respectively by Drs. Koprowski, Cox, and Sabin. Customarily fed by placing two or three drops of tissue culture

Epidemiologic data and animal challenge has indicated the Sabin strain to be the safest.

fluid containing the virus on sugar or in simple syrup, the vaccine may be rapidly and easily administered. An active infection is produced in the gastrointestinal tract and antibodies are generated. A limited spread of the virus to immediate contacts has been demonstrated to occur. Its spread, however, is quite clearly less effective than occurs with the more virulent polio strains. The vaccine has been fed quite literally to millions.

Although we have no reason to question the safety of the available oral vaccines, it is difficult to ~~assess~~^{assess} the level of safety of this

product in the same manner as we have been able to do with the Salk

Many of the millions fed have been in the underdeveloped countries where immunity is high almost from birth. In this country, the largest proportion fed have had natural or induced immunity
~~will actually provide an answer. To illustrate, the Cox strains,~~

originally tested in very limited fashion in the U.S. originally received most of their large scale field testing in certain countries of South America. The studies were careful and thorough. The results appeared excellent; there was no question of the safety of the product. Without question, however, the bulk of the population fed the vaccine was immune. A trial was next conducted in the Miami - Dade County area. The population fed enjoyed a moderate natural immunity plus a substantial increment of immunity ~~which~~ conferred by the killed vaccine. Five cases of poliomyelitis occurred among 410,000 vaccinees during the course of the campaign. Since this was in the range of the "normal" experience in Miami, the meaning was obscure. The basic point to be made, however,

is the fact that by simple calculation it can be shown that even had the most virulent lots of the Cutter vaccine been employed in this relatively immune population, no more cases would have resulted. In 1960, 290,000 or about 55% of the population in West Berlin were fed the vaccine in the face of an epidemic. Four cases occurred before the feeding; 21 occurred during the following 30 days; 16 of these had been fed by the vaccine, the other five were contacts. The epidemiological data left little room for an hypothesis other than that the cases were vaccine induced.

The Cox strains by test can be shown to be more virulent by monkey tests; they are not in the present vaccine.

~~Although~~ The ~~so-called~~ Sabin strains, ^{have been} tested extensively in Russia, ~~in~~ ^{we do not really know} fact well over 80 million ^{have} been fed the vaccine, ^{whether confirmed} polio cases have or have not occurred since the feeding, ~~we really do not~~ ^{know}. Dr. Sabin insists that where community wide programs have been carried out as in Hungary and Czechoslovakia, it has resulted in the complete elimination of confirmed cases. Dr. Chumakov states that no complications or reactions have followed the administration of the vaccine. With all due respect to Dr. Chumakov, it is impossible to give anything to this many people without there occurring a variety of illnesses temporally related which however long one spends in evaluation, one can never be sure whether it was or was not related to vaccine administration unless one has a control population for comparison.

Community wide programs using Sabin strains have been carried out in the U.S. in a number of cities including Atlanta, Cincinnati, Syracuse

and others. Careful surveillance has been a part of these programs. In Atlanta and Syracuse, both epidemic situations, cases have occurred after vaccine administration, they do not, however, group themselves in time as did the Cutter cases or the West Berlin cases. We believe the vaccine to be quite safe although the number of actual susceptibles receiving the vaccine in this country is ~~still quite small~~ ^{not large.} The problem of measuring an actual limit of safety is still with us *and demands continued active surveillance.*

The efficacy of the vaccine is a variable thing. Other enteroviruses, such as the Coxsackie and ECHO groups, may serve to block implantation and ~~RNA~~ multiplication of the virus. In depressed communities at the height of the enterovirus season, the rate of "takes" may be as low as 40%. For this reason, feeding of the virus is advised to be carried out during the winter or non-enterovirus season. *During winter and in higher socio-economic groups - protection should approach 100%.*

Spread of the attenuated strains occurs but here again, the degree of spread rests heavily with circumstance. In crowded, poorly sanitized areas, inter family spread of a degree is possible. In well sanitized, upper socio-economic areas, it would appear that the virus ~~rarely~~ spreads *poorly* ^{over with} ~~between~~ the household, ~~if it spreads at all.~~

Quite clearly, ^{however,} there is a herd immunity factor operative with the oral vaccine. An immunity of the intestinal tract is induced; implantation and multiplication of a homotypic wild virus may sometimes ^{occur} ~~be achieved~~ ^{at best} ~~but it~~ ^{will be} ~~transitory~~ and only low titers will be ~~found~~ ^{found.}

With this as background, let me review negative and positive factors inherent in the two vaccines:

	<u>Salk</u>	<u>Sabin</u>
1) Safety	+++	> ++
2) Effectiveness	80% 3 doses	? 1, 2, 3 + tri. 5 - Cincinnati > 80%
3) Herd Immunity	+	+++ discuss when
4) Duration of immunity	?	+++
5) Ease of Administration	+	+++
6) Storage and Preservation	++	+ The problem area.
7) Reactions	minimal	minimal

Circumstances

1) Epidemic Use	0	+++
2) Mass Campaign	+	++
3) Individual Practice ? E DPT.	++	?

? Combination of two vaccines - fine - two roofs on a house may be better than one.

Vaccine failures ^{with both} - 4 Salk; 3 Sabin - severe par. dis.

Pos for surveillance

^{In part of prob.} The problem at hand, ^{actually} is less that of which vaccine to use; the heart of the problem is that over 65% of preschool children and 70% of young adults have yet to receive the recommended 4 doses of vaccine. It is particularly among these persons, especially in the immunization-resistant lower socio-economic groups that the epidemic conflagrations occur. Baltimore and certain other communities in Maryland have experienced this.

^{prop at CDC} Available for epidemic use is oral vaccine. These cases with two confirmations as to type within some reasonable period of time and geographic proximity is all that is required to obtain this supply. A campaign can be organized as was never possible before when needles were a necessary element - 300,000 in 3 days is readily achievable. This is fire fighting, however; it is less effective than good fire protection.