Factors Affecting the Use of Vaccines: Considerations for Immunization Program Planners

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A CONTINUAL CHALLENGE to those who plan and implement immunization programs is to improve the effectiveness of limited resources. One method of allocating resources wisely is targeting efforts to selected populations that can benefit most from vaccinations. It is seldom feasible and sometimes not desirable to vaccinate everyone in the general population. Benefits, risks, and cost effectiveness of vaccinations vary according to people's risk status for a given disease.

Another consideration in improving resource allocation is assessing the factors that influence the use of selected vaccines for targeted populations. Research concerning the public's acceptance of vaccine was initiated more than 20 years ago, following the advent of polio vaccine. Recent findings validate, and in some cases embellish, the early observations of consumers' vaccine-seeking behavior.

The factors described here can affect consumers' and physicians' use of vaccines. Immunization program planners might improve the effectiveness of their efforts by considering these factors before implementing their programs.

Consumers' Vaccine-Seeking Behavior

George Bernard Shaw, in his 1911 "The Doctor's Dilemma," stated that:

> The demands of this poor public are not reasonable, but they are quite simple. It dreads disease and desires to be protected against it. But it is poor and wants to be protected cheaply. . . . What the public wants, therefore, is a cheap magic charm to prevent, and a cheap pill or potion to cure, all disease. . . .
>
> Thus it was really the public and not the medical profession that took up vaccination with irresistible faith. . . .

The American public's enthusiasm for vaccines may have declined since Shaw's time. Demand for vaccines now depends on such factors as the public's general attitudes concerning the degree of specific diseases and benefits of vaccination, beliefs regarding the safety and efficacy of a particular vaccine, and the convenience of being vaccinated (*1–4*). Demographic variables that can be correlated with vaccine behavior also have been identified (*3,5,6*). Further, the cost of vaccination may influence public demand for vaccine (*7–9*).

Investigations to determine what affects the public's demand for vaccines began in the 1950s, when researchers attempted to identify factors that were influencing the demand for polio vaccine. In 1959, Rosenstock and associates used the findings of six studies to help explain why people were not seeking vaccination against poliomyelitis (*3*). They divided behavioral factors into two major categories: personal readiness factors and social and situational factors. The first category includes personal attitudes that may affect a person's willingness to seek vaccination: (*a*) perceived personal susceptibility to a particular disease (includes perceived likelihood of local occurrence of the disease), (*b*) perceived seriousness of the disease, and (*c*) perceived safety and efficacy of the vaccine. The second category, social and situational factors, included (*a*) social pressure and (*b*) convenience of vaccination. Rosenstock and associates concluded (*3*):

> Readiness and social factors may operate with a degree of independence of each other or they may interact. . . . The evidence to date suggests that among the currently unvaccinated, personal readiness to obtain poliomyelitis vaccination is so weak that rather strong social supports may be needed to modify their behavior in the short run. Education for increased personal readiness can probably be effective only in the long run.

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A more recent study was conducted for the Centers for Disease Control (CDC) by the Opinion Research Corporation (ORC). (The study and a questionnaire were designed and implemented by Dr. Walter Gunn of CDC's Bureau of Health Education (BHE) under DHEW contract 200-77-0723.) The purposes of the study were as follows:

1. To determine the relationships between individuals' past experiences with immunizations and their desire to receive, or have their children receive, other immunizations.

2. To establish baseline data regarding:

- consumers' desire to receive specific immunizations,
- consumers' belief in the likelihood of a disease occurring in their local area,
- consumers' belief in the seriousness of a disease,
- consumers' belief in their vulnerability to a disease,
- consumers' belief in the safety and efficacy of various vaccines, and
- the effect of local laws and regulations on consumers' acceptance of vaccine.

Data from the ORC study appear to verify, at least

Table 1. Factors (discriminating variables) that influence consumers' vaccine-seeking behavior, Opinion Research Corporation survey

		Type of vaccine							
Factor (discriminating variable) [1]	*P value*	*Diphtheria*	*Tetanus*	*Polio*	*Smallpox*	*Asian flu*	*Influenza B*	*Swine flu*	*Total number of vaccines affected*
1. Race	.05	X	...	X	X	X	X	X	6
2. Perceived likelihood of local occurrence of disease	.05	X	X	X	X	X	...	X	5
3. Perceived personal susceptibility to the disease (includes prior case of, or immunization for, the disease)	.05	...	...	X	X	X	X	X	5
4. Perceived safety of the vaccine (includes prior adverse reaction experience)	.05	...	...	X	X	X	...	X	4
5. Perceived seriousness of the disease	.05	X	...	...	X	...	...	X	3
6. Household income	.05	X	...	X	X	...	...	...	3
7. Sex	.05	...	X	...	...	...	...	X	2
8. Age	.05	X	...	...	...	...	...	...	1
9. Education	.05	...	...	...	...	...	...	...	0
10. Belief in mass immunization programs	.05	...	...	...	...	...	...	...	0
Total number of factors	.05	5	2	5	6	3	2	6	...

[1] Listed in descending order according to the number of vaccines per factor.
SOURCE: Office of Technology Assessment, U.S. Congress, interpretation of data from reference 5.

Table 2. Percentage of Opinion Research Corporation interviewees responding to: "For the following diseases, please tell me how likely you think it would be that you might catch it if it occurred extensively in your local area"

Disease	February 1978 (N = 2,080)		August 1977 (N = 2,006)	
	Very likely	Some chance	Very likely	Some chance
Asian flu	10	51	10	44
Influenza B	10	47	9	44
Swine flu	10	43	8	37
Diphtheria	7	19	5	21
Mumps	5	23	5	19
Pertussis	5	20	4	18
Measles	5	21	5	17
Tetanus	4	23	4	24
Rubella	4	20	5	18
Typhoid	4	18	6	19
Smallpox	4	17	4	15
Rabies	3	24	5	23
Polio	2	15	4	16

SOURCE: reference 5.

partly, the findings of Rosenstock and associates with respect to the importance of selected factors that influence consumers' vaccine-seeking behavior. First, people must be convinced of a reasonable likelihood that a disease will occur in their area and that they are susceptible to it. Sometimes, people perceive themselves, at times falsely, to be protected against a given disease. Second, people must be convinced that a disease is serious. Third, they must be convinced of at least the safety, if not the efficacy, of a vaccine before they will accept it.

Using a multivariate statistical analysis, ORC attempted to predict the intent of respondents to seek vaccination for themselves and their children. Intent is difficult to predict and has not yet been statistically correlated with actual future behavior, but in its analysis, ORC did identify at least a few important discriminating variables (table 1). These variables are beliefs, demographic characteristics, or events that may influence a person's decision to seek or avoid vaccination. By themselves, these variables cannot be used to predict a person's behavior; however, they do indicate the basis on which consumers' decisions will likely be made. (The ORC researchers did not attempt to study interactions

Table 3. Percentage of Opinion Research Corporation interviewees responding to: "For each disease, please tell me how likely it will be that each will occur in your local area during the next 12 months"

Disease	February 1978 (N = 2,080)		August 1977 (N = 2,006)	
	Very likely	Some chance	Very likely	Some chance
Measles	26	49	29	47
Mumps	20	50	20	50
Influenza B	19	46	16	42
Rubella	19	45	21	40
Asian flu	15	52	14	43
Swine flu	14	40	10	33
Pertussis	8	28	8	31
Tetanus	7	31	11	32
Rabies	7	31	6	34
Smallpox	5	16	5	18
Diphtheria	5	12	3	14
Polio	4	19	5	21
Typhoid	4	14	3	13

SOURCE: reference 5.

among these discriminating variables or the potential influences of such interactions on people's behavior. However, they recommended inclusion of an analysis of interacting variables in future research.)

Personal readiness factors. Rosenstock and associates' categories of personal readiness factors are used to classify various researchers' findings in the following discussion.

Perceived susceptibility. Many people who did not seek polio vaccination during the 1950s believed that they were at low risk of contracting poliomyelitis (*1*). Many adults, for example, apparently perceived themselves to be at low risk because most vaccine campaigns were targeted at children. In general, the advertising of high-risk target populations tended to reinforce perceptions of safety from poliomyelitis among individuals not identified as being at high risk. As stated by Rosenstock and associates (*3*): "It is known that behavior is determined more by one's beliefs about reality than by reality itself, and that people vary markedly in their interpretation of reality."

Results reported by the ORC regarding the importance of interviewees' "perceived susceptibility to disease" and "perceived likelihood of local occurrence of disease" are shown in tables 2 and 3. As shown in table 1, at the 95 percent level of confidence, perceived personal susceptibility to a disease and perceived likelihood of local occurrence of a disease appear to be important variables in determining consumers' use of vaccines.

Perceived seriousness of a disease. One important influence on an individual's willingness to seek protection from a disease is that person's belief about the seriousness of the disease. In 1959, in a study commissioned by the National Foundation for Infantile Paralysis it was found that adults (mostly men) who believed that poliomyelitis was milder in adults than in children tended not to be vaccinated (*3*).

In the ORC survey, perceived seriousness of disease ranked as the fifth most discriminating variable (table 1). Data from ORC's survey regarding the perceived seriousness of diseases for adults are shown in table 4. Five diseases—poliomyelitis, rabies, typhoid, smallpox, and tetanus—were perceived as very serious for adults by 50 percent or more of the respondents in at least one of the two surveys in the ORC study. No type of influenza was perceived as very serious by a majority of the respondents in either survey. Swine flu was perceived as very serious by an average of 32.4 percent, Asian flu by an average of 21.5 percent, and influenza B by 15 percent.

With few exceptions, the ORC survey respondents generally perceived the diseases that they believed to be the most serious as those least likely to occur in their local area and as those they would be least likely to contract. Poliomyelitis, rabies, typhoid, and smallpox, for example, were perceived as the four most serious diseases, but also as the four diseases that the respondents believed they were least likely to contract. In contrast, most respondents perceived "flu" not only to be among the least serious diseases, but also the disease most likely to occur in their area and most likely to contracted by them.

Perceived safety and effectiveness of the vaccine. An individual's belief about the safety and effectiveness of a vaccine can also strongly influence that person's decision to seek vaccination. Three studies have documented the significance of a person's doubt about the safety and effectiveness of polio vaccine as a major reason for his or her unwillingness to receive this vaccine (*1,2,4*).

In 1978, Pearman reported the results of a survey of 342 households. The survey was designed to assess the willingness of the public to participate in future influenza immunization projects, especially in light of the negative image—attributable largely to the occurrence of Guillain-Barré syndrome among vaccinees—of the swine flu program (*6*). In the aggregate, 52 percent of the respondents in this survey had participated in the swine flu program; 59 percent anticipated participating in a future immunization program if convinced that a flu outbreak was pending; and 53 percent thought people should take flu shots. Although approximately half of the respondents generally favored flu shots, 24 percent thought people should not take flu shots, and 25 percent said they would not participate in future programs.

In the ORC study, perceived vaccine safety ranked as the fourth most discriminating variable (table 1). ORC researchers reported the data displayed in tables 5 and 6 regarding the perceived safety of vaccines. Overall, the respondents perceived vaccines as relatively safe. About 90 percent perceived vaccines as either very or moderately safe (table 5). Respondents with lower incomes (less than $5,000 per year), those with less than a high school education, and nonwhites tended to doubt the safety of vaccines more than the higher income, better educated, and white respondents. Nearly 32 percent of the respondents thought that some specific vaccines were unsafe or a threat to one's health; about 57 percent said that there were no specific vaccinations that they considered unsafe (table 6).

Long-term effects of the highly publicized adverse

Table 4. Percentage of Opinion Research Corporation interviewees responding "very serious" to: "For each of the following diseases, please tell me how serious you think it would be if an adult caught it"

Disease	February 1978 (N = 2,080)	August 1977 (N = 2,006)
Polio	68	64
Rabies	63	61
Typhoid	51	49
Smallpox	51	47
Tetanus	47	49
Diphtheria	41	38
Rubella	36	36
Mumps	31	32
Swine flu	29	36
Measles	26	28
Pertussis	23	21
Asian flu	20	23
Influenza	15	15

SOURCE: reference 5.

Table 5. Percentage of Opinion Research Corporation interviewees responding to: "In general, how safe do you think vaccinations and immunizations are?"

Degree of safety	February 1978 (N = 2,080)	August 1977 (N = 2,006)
Very safe	54	51
Moderately safe	36	37
Somewhat safe	5	6
Not safe at all	1	1
Don't know	4	4
No response	(1)	1

[1] Less than 5 percent.
SOURCE: reference 5.

Table 6. Percentage of Opinion Research Corporation interviewees responding to: "Are there any specific vaccinations or immunizations which you feel are unsafe or a threat to one's health? Which ones?"

Response	February 1978 (N = 2,080)	August 1977 (N = 2,006)
Yes (major mentions)	[1]32	[2]36
Swine flu	59	78
Flu (nonspecific)	30	11
Asian flu	3	3
Smallpox	3	(3)
No	57	54
Don't know	10	9
No response	1	1

[1] N = 733.
[2] N = 722.
[3] Less than 5 percent.
SOURCE: reference 5.

reactions to swine flu vaccine on the public's use of future vaccines are not yet known. A major influence on public behavior may be the amount and types of information about the safety and efficacy of vaccine that is presented to a person before vaccination. The Department of Health and Human Services (HHS) requires that recipients be informed of the vaccine's safety and efficacy by giving them information sheets or informed consent forms before they are vaccinated in any immunization program using federally purchased vaccines. The impact of the provision of vaccine safety and efficacy information on peoples' vaccine-seeking behavior is unknown. The Food and Drug Administration (FDA) plans to expand the use of patient package inserts (PPIs) for selected prescription drugs and to study the effects of PPIs on several factors, including patients' drug-consuming behavior and physicians' drug-prescribing behavior. Vaccines could be included in FDA's studies.

Social and situational factors. In addition to Rosenstock and associates' division of social and situational factors into social pressure and convenience (*3*), they and other researchers (*5,6*) also attempted to measure the influence of demographic characteristics on public demand for vaccines.

Social pressure. Analyses of some data indicate that a person's decision to seek vaccination may be influenced by the social pressures applied by others who are important to that person. Glasser demonstrated the potential influence of physicians on people's vaccine-seeking behavior (*1*). Belcher also reported that in one community the people who held presumably respectable positions (for example, school teachers, ministers, and physicians) effectively encouraged individuals to seek vaccination against poliomyelitis (*10*).

Convenience. As stated by Rosenstock (*3*): "For any individual with a degree of readiness to be vaccinated, the ultimate decision will be facilitated the more convenient, simple, and inexpensive the action is." In this context, convenience includes such factors as travel time and distance, hours of operation, and acceptability of the facilities in which vaccination is performed.

Validating Rosenstock's findings that both social pressure and convenience are important influences on people's vaccine-seeking behavior, Pearman's study (*6*) found that employed persons reported receiving swine flu shots because (*a*) shots were available at their workplace (convenience factor), (*b*) co-workers pressured them to take shots (social pressure), and (*c*) they perceived participation in immunization to be company policy (social pressure).

Demographic characteristics. Both Pearman and Rosenstock found a positive relationship between education and participation in vaccination programs (*3,6*). In general, they found that the more formal education a person completes, the more positive that person tends to be about immunization.

With the exception of race, ORC researchers found demographic factors to be much less discriminating than interviewees' perceptions of personal susceptibility to disease, seriousness of disease, and vaccine safety (*5*). At the 95 percent level of confidence, household income was more discriminating than sex, age, or level of education (table 1). Because many of these factors are interrelated, however, it is difficult to assess their individual effects on vaccine use.

Vaccine costs and health insurance. The effect of the cost of vaccination on the public's use of vaccines has not been assessed in any study published to date. In general, vaccination charges are low relative to the charges for many other types of medical procedures. The average fee for administering a vaccine (exclusive of the cost of the vaccine itself) in a private physician's office in 1978 was estimated by the Office of Technology Assessment (OTA) to be $6.47 (*11*). Product costs added another 50 cents to $5 per dose, depending on the type of vaccine. In a publicly financed immunization program, vaccinations can be performed without cost or at a reduced cost to the consumer. However, although the cost of a single vaccination may be low, for large families the price of a series of vaccinations, especially including the price of time, could be substantial.

In the public sector, Medicare, for example, specifically excludes payment for immunizations to prevent disease (*12*):

> Immunizations.—Vaccinations or inoculations are excluded as "immunizations" unless they are directly related to the treatment of an injury or direct exposure to a disease or condition, such as antirabies treatment, tetanus antitoxin or booster vaccine, botulin antitoxin, antivenin sera, or immune globulin. In the absence of injury or direct exposure, preventive immunization (vaccination or inoculation) against such diseases as smallpox, polio, diphtheria, etc., is not covered. (Flu injections are administered as a preventive measure and are excluded from coverage without regard to a patient's particular susceptibility to influenza.) In cases where a vaccination or inoculation is excluded from coverage, the entire charge should be denied.

An exception to this exclusion was created on December 28, 1980, when President Jimmy Carter signed Public Law 96–611, which provides for full Medicare reimbursement for pneumococcal vaccinations.

Medicaid may or may not pay for immunizations, depending on the discretion of a particular State. Immunizations are not a service mandated by the Federal Government as a condition for State participation in the Medicaid program. The Federal Government jointly finances immunizations with those States that include vaccinations in their Medicaid benefit packages. The Early and Periodic Screening Diagnosis and Treatment (EPSDT) program, designed to pay for preventive health services for Medicaid beneficiaries under 21 years old, pays only for immunizations provided as part of a child's initial screening examination. A program designed to replace EPSDT, the Child Health Assessment Program (CHAP), if enacted by Congress, would pay for immunizations.

The extent of coverage for immunization in the private sector by either commercial health insurance companies or Blue Cross and Blue Shield is not known. According to a Health Insurance Survey in 1977, 20 of the 28 companies responding offered coverage for some types of preventive services (personal communication, D. Jones and T. Lutins, Health Insurance Institute of America, New York, July 1978). No data are available on the percentage of policies or insurers with preventive coverage. Most companies do not cover immunizations (Jones and Lutins). Likewise, individual Blue Cross and Blue Shield plans may cover preventive services in some of their contracts, but the number of people covered is unknown (personal communication, B. Buckley and E. Mitchner, Blue Cross/ Blue Shield, Chicago, July 1978). The Safeco health insurance plan in California and Washington State and the Blue Shield-Blue Cross Plan for New Jersey include immunizations as services to be covered by primary care providers, who are reimbursed through a prospective capitation payment mechanism (personal communication, R. Fairity, Blue Cross/ Blue Shield, Newark, July 1978).

The extent to which vaccinations are provided by health maintenance organizations (HMOs) is also unknown. Theoretically, HMOs have financial incentives to immunize their members, because the cost of vaccination is usually much less than the cost of treating a preventable infectious disease. Factors such as turnover of members (due to mobility and choice of plans), however, may reduce the benefits to HMOs of providing immunizations. The Health Maintenance Act specifically mandates immunizations as one of the basic services to be included in the benefit package of HMOs (42 USC 300e–1). An HMO may offer supplemental health services, including vaccinations, at its discretion.

In a study conducted at Group Health Cooperative, a hospital-based prepaid plan in Seattle, members had higher rates of immunization than persons in control groups who were receiving medical care through a

Blue Shield plan (*7,8*). In another study, however, Medicaid recipients in health insurance plans were more likely to have received immunizations than members of either group or foundation HMOs (*9*).

Physicians' Provision of Vaccines

Just as the behavioral research literature is replete with attempts to describe the behavior of health care consumers, so it is filled with descriptions of physicians' behavior. Explanations of physicians' behavior have been based on such items as reimbursement policies, professional motives, and malpractice concerns.

Unfortunately, few studies have included an analysis of the factors that determine physicians' prescribing of vaccines (*13*). The following factors may influence such behavior:

- attitudes and knowledge about targeted diseases,
- attitudes and knowledge about the safety and efficacy of certain vaccines,
- perceptions about a patient's need for vaccination,
- consideration of revenue generated by administering vaccines, and
- consideration of the potential liability for vaccine-related injury.

These items reflect concern for a patient's health and economic status, as well as concern for the physician's own economic and liability status.

In assessing a patient's need for a particular vaccine, physicians may consider (*a*) the likelihood of the patient's being exposed to a given disease-producing organism, (*b*) the patient's vulnerability to the disease after being exposed to the organism, and (*c*) the extent to which contracting the disease will disrupt the patient's life.

Sometimes, physicians are required to vaccinate. Most States, for example, have mandated the administration of certain vaccines to children entering public schools (*11*). Similarly, the Federal Government recommends the use of selected vaccines for travelers to and from certain countries having endemic diseases.

Evans has theorized that physicians consider the ability of their patients to pay for a medical procedure or for use of a technology before prescribing it (*14*). The effect of this factor on the use of vaccines is not known, but it may be minor because of the low cost of vaccines.

Physicians derive their knowledge and attitudes about a given disease or a certain vaccine from the following sources:

- formal medical school and postgraduate training,
- contemporary professional literature and texts,
- peers,
- government publications,
- vaccine manufacturers,
- formal continuing education programs, and
- personal experiences of their patients.

The risks and benefits of vaccination against certain diseases—measles, rubella, diphtheria, mumps, typhoid, poliomyelitis, and tetanus—have been known for many years. Physicians learn about vaccination against these diseases in their formal training. In addition, since the epidemiology and potential harm of these diseases have been studied for many years, physicians generally have access to large data bases when deciding whether or not to vaccinate their patients. For other diseases, such as pneumococcal pneumonia, data bases are limited, and physicians must often speculate about a given patient's risk of contracting the disease and need for vaccination.

For data regarding new vaccines, as well as new data regarding old vaccines, physicians rely largely on contemporary sources of information, such as professional literature, the recommendations of the Advisory Committee for Immunization Practices, American Academy of Pediatrics' "Red Book," government publications, peers, and vaccine manufacturers. In spite of widespread communications and product advertising, physicians' acceptance of vaccines—particularly new ones—can be quite slow (*15*).

Heightened awareness of vaccine-related injuries (for example, Guillain-Barré caused by swine flu vaccine and poliomyelitis caused by poliovirus vaccine) may have influenced physicians' use of vaccines for two reasons. First, adverse reactions obviously influence the welfare of the vaccinee, and potential injuries may alter the benefit-risk ratio of certain vaccinations for some people. New concern about the potential dangers of pertussis vaccine, for example, has led to a sharp decline in its use in England. Second, in this era of mounting malpractice liability problems, some physicians may hesitate to administer vaccines that are known to be more dangerous than others, especially when vaccination is perceived to be of marginal benefit to a particular patient. Physicians' liability for vaccine-related injury rests on at least two responsibilities: (*a*) to warn the vaccinee about potential adverse reactions and (*b*) to administer the vaccine without negligence (*11*). Increased public awareness of vaccine-related injury could increase physicians' vulnerability to legal action, and this could impede physicians' use of vaccines in general.

Conclusion

Although contemporary research has validated some 20-year-old observations concerning consumers' use of

vaccines, two general challenges remain to those who research, design, and implement immunization efforts. First, existing data and methods need to be applied more extensively in actual immunization practices to determine readily which factors are major determinants of vaccine use within selected target populations (*16–18*). The interplay among personal readiness factors, social and situational factors, and vaccine costs needs to be assessed within each targeted population. Launching a television campaign to educate people about the evils of disease and the virtues of vaccines, for example, probably would have little effect if a community's biggest obstacle to obtaining an immunization program is a lack of public transportation. Likewise, funding a worksite immunization program might be futile if the intended vaccine recipients do not perceive the vaccine as beneficial for themselves.

Second, new research needs to be generated to answer new questions. The relationship between vaccine use and cost (to the consumer), for example, is not fully understood. In addition, factors that influence the public's acceptance of new vaccines will need to be studied. Some testing of new techniques to enhance vaccine acceptance has been reported (*19–21*). Some claim that better relationships need to be established between the press and vaccine promoters (*22*).

To promote childhood immunizations, most States and many local governments mandate selected vaccinations for school-age children. Enforcement of such laws appears to raise vaccination rates in some areas. For some vaccinations, however, such as influenza and pneumococcal pneumonia, there are no such laws; these vaccinations are strictly voluntary—and are likely to remain so. To promote voluntary types of vaccinations, immunization planners and administrators must appeal directly to members of targeted populations. Pluralistic motivating efforts must be developed. The findings reported here can help vaccine promoters assess the types of education and motivation needed for targeted persons to become immunized.

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