2. Principles of Community Health Intervention

Community health programs will be most effective and conserve more resources if they are built upon a foundation of solved puzzles. This chapter will discuss each of these puzzling questions in sequence, with the goal of providing local communities with a foundation upon which to build a dependable structure for local health interventions.

<table>
<thead>
<tr>
<th>PUZZLES TO SOLVE FOR BUILDING BETTER HEALTH</th>
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<tr>
<td>• What factors contribute to the excess number of specified diseases, disabilities, or deaths?</td>
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<tr>
<td>• How can these factors be changed?</td>
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<tr>
<td>• What additional protective or health giving elements can reduce these health problems?</td>
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<td>• With what subpopulations shall work be done, and in what sequence, to solve the problem?</td>
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<tr>
<td>• What overall intervention strategies will yield the greatest results?</td>
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<td>• Precisely what needs to be done—and what can be omitted—to reach the goals?</td>
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**STRATEGIES FOR IDENTIFYING CAUSES**

One of the early paradigms for explaining the spread of disease was the “epidemiological triangle”:

![Epidemiological Triangle Diagram]

This section will examine how the concepts of agent, host, and environment have expanded in meaning since they were first used early in the fight against infectious diseases.

**AGENT**

This term was first used to identify “the cause” of a disease, such as an infectious or parasitic agent. Today, agent also applies to excesses of heat, cold, dust, toxins, stressful events, instruments of injury, and even excessive amounts of calories or fats in the diet. Shortages or deficiencies of factors also may be considered...
as agents, as in hunger, thirst, iron or iodine deficiencies, lack of adequate mothering, lack of social contacts, lack of employment, poverty, and hopelessness.

In situations where no single element is a sufficient cause for disease, combinations of circumstances also can become agents. For example, among people without adequate protein, a serious lack of niacin will, in time, cause pellagra. This, however, occurs only among people who also lack tryptophan, such as those who eat maize, sorghum, or millet as the primary grain in their diet. Witness the fact that Southeast Asians, whose basic staple is rice, seldom get pellagra. Another example involves cancers that develop only after cells have been damaged in sequence by two separate chemical agents, then called co-carcinogens. Finally, patients taking certain psychiatric drugs can become severely sunburned and systemically sickened by only modest exposure to sunlight. What is the agent of this malady—the drug, the sunlight, both in combination?

**HOST**

The host also must be considered from several aspects. It can be the target of disease, as originally conceived, and it also can be the disease’s contributing cause and perpetuator, as it has come to be viewed later. Public health’s goal is to make the host a preventor much more of the time, as well as an active participant in the healing process.

The host should not be viewed merely as a biological “hunk,” however. Rather, the host is a complex set of systems, as is clearly seen when conducting a “review of systems” in making a diagnosis. The challenge of disease prevention and health promotion may require an evaluation and a change in the cognitive, emotional, behavioral, and social statuses of individuals, groups, and even communities. These efforts are in addition to such actions as raising host resistance by improving nutrition, providing immunizations, preventing immunodeficiency, and dealing with mood disorders, which can have many organic consequences.

Consider how the following conditions, all of which are parts of the host, might modify a disease prevention plan:

- Rural residents who fear or distrust doctors might not bring their children for immunizations or treatment.
- Families living in abject poverty will not be able to afford medicines nor follow the doctor’s prescriptions.
- Urban subpopulations that live where violence is out of control may feel helpless and hopeless.
- People may be so depressed that they cannot function socially, staying at home and barely maintaining themselves.
• Among sexually promiscuous youth, antibiotics may treat the current infection, but they won’t prevent the next one.

• Some factory managers may feel they will go broke if they have to add an effective chemical treatment system to the toxins they pour into the waterways.

• There may be proper citizens who see youth only as potential danger, and would just as soon see the homeless die of disease or violence rather than pay for kinder alternatives.

• There may be aged persons living alone with no one to help them in emergencies.

• People may know that cigarette smoking is damaging, but cannot get motivated to stop.

• Chronic alcoholics may be unable to stay in rehabilitation programs.

ENVIRONMENT

In considering this term, we usually think first about what environmental scientists, engineers, and health inspectors have been dealing with for centuries—such physical factors as air and water pollution, and solid waste disposal. Then we might consider such issues as highway construction and product design, which also have come to concern environmental specialists. The biophysical pathogens against which environmental specialists have made great advances include reservoirs of infection, insect and animal disease vectors, food-borne diseases, organic allergens, toxic chemicals, radiation, and person-to-person transmission of disease in its various forms. All these remain very important, and public health programs in many nations have much work to do before all the plagues we know how to conquer have, in fact, been brought under control.

At the same time, wise health professionals have for many years incorporated three more environmental levels into their work—the interpersonal, social/economic, and cultural/ideological levels of every person’s environment. Unfortunately, this knowledge and practice is not yet widespread.

**The challenge of disease prevention and health promotion may require an evaluation and a change in the cognitive, emotional, behavioral, and social statuses of individuals, groups, and even communities.**

Interpersonal Level

The elemental unit of the interpersonal environment is the dyad—the inter-relation between two persons. This begins with the bond between mother and child.
Even in lower mammals—from mice to dogs, to elephants, and up to primates—separation of the infant from its mother’s feeding, nurturing, and protection usually means disease, deranged behavior, or death. This is even more striking in the human offspring, as many pediatric and psychiatric studies have shown.

There is powerful preventive therapy in having a “significant other” or several caring persons who are close physically, mentally, and emotionally. This protective effect actually begins before birth. A later section on pregnancy will describe several interpersonal factors during pregnancy that raise the risk for the baby to have low birthweight or fetal anomalies.

Similarly, loving and guiding family and friends can steer older children through the dangers and threats of adolescence and build a happy, caring personal adjustment and healthy habits that will last a lifetime. The quality of the relationship, the emotional connection, and the mentoring appear more important than the amount of contact itself.

In later childhood and teen years, the peer group becomes more important in shaping values, habits (including health habits), attitudes toward risk-taking, and whether expectations for the future are rewarding or punishing—or neither! (“Neither” here refers to the numbing fatalism of some inner city youth, for example, who have seen peers die suddenly.) Families, teachers, and health professionals need to become more active in steering youth to those peer groups whose thinking and behaviors are constructive and healthy.

The powerful therapy of a nurturing interpersonal environment continues throughout the adult years. In almost all nations, at all age strata over 25 years, married persons have lower death rates than persons the same age who are divorced, widowed, or never married. Longitudinal population studies of loneliness versus social supports have consistently shown that those with an adequate social network have lower death rates, even when controlled for other elements such as health status and economic status at the beginning of the years of follow-up. Studies of the elderly show the same effect, and some organizations and areas in Europe (Sweden, for example) are now providing elders who live alone with opportunities for socializing, to see if this extends the number of their healthy, functional years of life.

Social/economic Level

Beyond direct, face-to-face interactions with family, neighbors, friends, coworkers, and members of one’s religious or social group, lie the social structures of the community and nation. These include work groups, commercial enterprises, local governments, medical services, unemployment or disability assistance agencies, religious groups, civic betterment groups, professional associations, and many others, as well as the ways they are organized and function.
These social structures comprise far more than the sum of the people in them, and exert more power than separate individuals. They may cooperate and facilitate, or debate, or remain passive when decisions are made about a variety of issues. Some of these include water and sewage systems; electric and telephone utilities; road building; schools; clinics and hospitals; how industry treats its workers and the environment; how prisons will be run; who is responsible for public health, disease prevention, and health promotion; who will provide medical care and at what level of modernity, and who will pay for it; and even what the laws of the land will be. It is obvious that these societal forces have a tremendous impact on everyone’s health—for better or for worse. From time to time, some of these social organizations will need to be targeted in order to enlist them in improving the health of their communities or region.

A population’s low economic level is the strongest predictor of poor health and high mortality everywhere in the world. The next strongest predictor is low educational level. This is true when comparing from country to country and also when comparing districts within a country—even those countries that provide health care for all. These socioeconomic indicators are associated with a plethora of diseases and causes of injury that share little in their etiologies. They have been said to predict every malady, but to explain none. People who live in poverty have poorer diets, poorer housing, more environmental pollution, more exposure to pathogens, more dangerous occupations, less job security, more damaging life crises, less effective police and fire protection, more tobacco and alcohol use, and tend to follow lifestyles that raise risk factors. The poor have fewer physical, psychological, and social protective resources, and they are usually powerless to improve their lot. (Also see Chapter 13).

The obvious solution is to eliminate poverty, but that has proven impossible to achieve and maintain in most eras and locations. The alternative is to identify the major “real” causes of death and disability in disadvantaged neighborhoods and enlist local government sectors and nongovernmental organizations to assist in reducing those environmental, individual, social, and cultural factors that perpetuate the real causes of death. (See the section “The Actual Causes of Death” in Chapter 1).

**Cultural/ideological Level**

Culture consists of a society’s framework of knowledge and beliefs, the content of its books and mass media, its technology, the determination of how social roles are to be fulfilled, which behaviors are normal and which unacceptable,
and which are its morals and value systems. It is culture that ranks the importance of families versus individuals, of industriousness versus leisure. It is culture that determines the relative value of competitiveness, equity among people, benevolence, valuation of health, and ultimate goals. A community's infrastructure—its roads, bridges, water, electricity, buildings, and medical technology—might be viewed as part of the physical environment, but it all has been created or borrowed by the culture.

Culture is the way of life of a people. Like health and disease, culture is transmitted from group to group, from generation to generation. Witness the power of television to transmit the culture of high-technology nations—both the useful and the destructive aspects—to every corner of the world. Raising the hopes for a healthier, happier life has been useful, but marketing materialism, consumerism, aggression, and violence has been harmful.

A community's ideology is part of its overall culture, and is often inferred, rather than seen. Ideology is the world of ideas, beliefs, and values in which the members of a society live. What people say is important to them is not always reflected in their behavior, however, and the written plan for many institutions is often not the “real” way they operate. In health planning, it is critical to understand this paradox.

Culture tells its possessor what is important. It may value fame, sports skills, or conforming to friends. Or, it may tell who is important and who can be left out—perhaps women, ethnic minorities, the poor, and the powerless, who are often neglected. The stream of illness generated in these subgroups by lack of resources, lack of knowledge and skills, and lack of “a way out,” is forced under the surface in many communities. But illness filters upwards to and through the roots of the upper and powerful classes, and the garden at the top soon ceases to flourish.

Culture also tells us what is possible and what is not. For example, villagers in Suriname’s interior had known malaria as far back as their spoken history could trace. And, they used the statistically powerful “persistency forecast”—the best predictor of the future is what has always happened in the past—to accept that malaria would always be a part of their lives. By developing trust in health workers, however, who themselves had seen malaria eradicated in their own communities, Surinamese villagers were able to change their perception of what “is possible,” and so release hope and energy to eradicate the malaria scourge in their own communities (Barnes and Jenkins, 1972).

Millions of people scattered in smaller groups throughout cities and countryside do not believe it is possible—or, perhaps, not sufficiently rewarding—to always drive vehicles legally, to get along without street drugs, to get almost all of their
children immunized, to prevent food poisoning, to stop family violence, to reduce heart attacks and strokes, and on and on and on. If they are to reach these people, health workers must enlist the help of behavioral scientists and communicators to use available channels to change culture and ideology; to help fill the environment with ideas, interactions, and communication about new beliefs about what is important; and to spread the idea that everyone is important and that far more is possible than current beliefs hold.

**USING THE EPIDEMIOLOGIC TRIANGLE IN PREVENTION PROGRAMS**

High rates of disease could be reduced sharply by appropriate changes in one or more of the three components—host, agent, environment—or in selected interactions among them.

The triangle was first used to deal with infectious and parasitic diseases. Its application could go something like this:

- The infectious agent can be neutralized by disinfectants, heat, or radiation.

- The host’s resistance can be raised passively or actively by immunization, exposure to a related but milder infectious agent, protective use of gamma globulin, and improved nutrition.

- The environment can be “treated,” such as by eliminating reservoirs of the agent, proper disposal of toxic waste, chlorinating and fluoridating water supplies, and enforcing sanitary standards for food processors and restaurants.

- A toxic, infectious agent can be separated from the susceptible host by using barriers, protective devices on machines, protective clothing, the quarantine of infectious persons, or even the use of condoms.

- The spread of transmission of the agent can be halted. Some of the examples above also serve to block transmission, but to these must be added early case finding and treatment (such as for tuberculosis, typhoid, or head lice); chemoprophylaxis (such as for malaria); vector control (for insects, snails, infected animals); sanitary disposal of human wastes; providing pure water supplies; and putting in place aseptic techniques in medical facilities, day-care centers, and nursing homes for the elderly.

The five strategies shown in Table 2.1 also can be applied to different sorts of health problems. The table illustrates how strategies can be used to reduce such wide ranging conditions and injuries as trauma from automobile accidents, ischemic heart disease, or cigarette smoking.
MULTIPLE CONTRIBUTING CAUSES

Scientists in the 20th century have demonstrated that the causal matrix of disease and injury was much more complex than Koch’s postulates could explain. Ischemic (coronary) heart disease, for example, has many possible contributing causes that can work cumulatively, interactively, or individually. And a single noxious agent (say, cigarettes) can cause or contribute to very different disorders (for example, emphysema, ischemic heart disease, or bladder cancer, to name just a few). So, the simple linear thinking of early germ theorists—the epidemiological triangle and, even, the five prevention strategies—must give way (for an increasing number of problems) to a conceptualization that includes both causation and remediation as a probabilistic, multidimensional matrix of

| TABLE 2.1. Applying the expanded epidemiologic triangle to preventive interventions.a |
|---------------------------------|-----------------|-----------------|-----------------|
| Intervention                      | Auto accident | Ischemic heart disease | Tobacco-related diseases |
| Change the agent                  |                |                  |                  |
|                                  | Pad car interiors. | Reduce risk factors. | All burning emits carbon monoxide. |
|                                  | Restrict speeds. |                  |                  |
| Raise host resistance            |                |                  |                  |
|                                  | Train drivers in safety. | Increase exercise. | Teach smokers to quit and youth to refuse to start. |
|                                  | Internalize belief that drivers do not drink alcohol. | Get commitment to “heart health.” |                  |
| Modify the environment           |                |                  |                  |
|                                  | Enforce traffic laws. | Provide facilities for exercise fun. | Make tobacco harder to get. |
|                                  | Make roads and intersections safer. | Have friends and family reinforce healthy habits. | Increase taxes on tobacco products. |
|                                  |                  | Make healthy foods more popular and accessible. | Develop social norms against cigarettes as dirty, harmful. |
| Separate agent from host         |                |                  |                  |
|                                  | Wear seat belts. | Keep fatty foods and cigarettes out of the home. | Make the home, workplace, health facility smoke-free. |
|                                  | Install air bags. |                  | Limit purchase places. |
| Interrupt transmission           |                |                  |                  |
|                                  | Move damage off-road. | Screen for risk factors. | Train school peers to teach classmates how to remain smoke-free. |
|                                  | Set up flares to prevent additional automobile accidents. | Teach youth about “heart health.” |                  |
|                                  | Issue penalties for recurring violations. |                  |                  |

a For further discussion of these strategies, see Last JM. Public Health and Human Ecology. East Norwalk, CT: Appleton/Prentice Hall; 1987.
interactions: a web of etiology and a web of interventions, if you will. This discussion is included here in the hope of stimulating the reader to study both the web of causation and the web of prevention imaginatively, and to find the most cost-effective ways to break the cycle of illness and injury in different cultures and communities.

The struggle to control diseases that have multiple contributing causes, such as ischemic heart disease and most cancers, gave birth to the concept of risk factors—those elements in host, agent, or environment that increase the incidence of specific health problems. The concept of protective factors soon followed, based on findings that physical exercise reduces atherosclerosis; that dietary folic acid reduces fetal anomalies; and that having a close, supportive, and encouraging family enhances child development.

Preventive programs for many diseases and sources of injury follow the risk factor strategy—reducing risks and increasing protective factors. This approach has dramatically reduced many endemic diseases, ranging from heart disease and stroke to automobile fatalities and oral cancer. The field of mental illness prevention has now also adopted the “risk factor-protective factor” strategy to intervene against the complex neurological, psychiatric, and social behavioral disorders in that field (Mrazek and Haggerty, 1994). (Also see Chapter 7.)

A review of the prevention strategies reveals that each involves changing behaviors. Some changes must come from community and government leaders, others must involve health professionals; many involve intersectoral cooperation and all require changing community priorities and personal and collective behavior of the public.

**SELECTING WHICH CONDITIONS TO PREVENT**

Prevention is a contest that must be won. To mount a program and then to have it fail not only wastes money, it disillusions both the public and senior officials regarding the value of future public health proposals. So how can the playing field be set up so that prevention programs are sure to win?

The entire plan should be worked out in advance, starting from how to present the plan’s advantages to officials and the public, to what baseline measures will be needed, what interventions will be done, how and with whom, how the outcome will be evaluated, and what budget and human resources will be needed.
Early on, it is critical to establish which condition is both of high priority to prevent and also has a high feasibility to be changed. The condition must be one that is costly to the community or nation—costly in terms of human suffering and economic impact. Ideally, the condition to be prevented should have a high prevalence; cause suffering, prolonged disability, or death; lead to loss of time from work or normal childhood activities; and be expensive in terms of medical care.

Respiratory infections, for example, have a high prevalence, but their severity is too low and they are self-remitting. They would not be an appropriate prevention target. And certain rare cancers, although severe and fatal, do not affect enough people to generate community support. A widespread preventive effort targeting these cancers would not be cost-effective. Back injuries in industrial workers, on the other hand, are very common in some jobs—such as those involving twisting the body or doing heavy lifting—are very costly to employers, create chronic pain in affected workers, and often force workers to leave their line of work. All of these costs are high. Furthermore, the population to be targeted for intervention is relatively small, which limits costs. Preventive measures targeting industrial back injuries have proven to be successful.

Mortality statistics are the most comprehensively gathered health data worldwide. Where ministries of health cannot obtain reliable data from their whole nation, they often focus on a reasonable sample of areas for death registration, so national estimates can be made to guide health policy. Information on non-fatal disease and disability is much more difficult to collect reliably. The World Health Organization (WHO), Harvard University, the World Bank, and others have set up a cooperative system of data collection, evaluation, and statistical adjustment of disability data. This project, called the Global Burden of Disease (GBD) Study, began publishing results in 1994, and has continued to do so at a rapid rate since (e.g., Murray and Lopez, 1996).

The concept of an overall statistic that combines deaths and disability in a single estimate of burden of disease has been under development and refinement since about 1980. WHO has approved the general concepts of Disability Adjusted Life Years (DALYs), Years Lived with Disability (YLDs), Years of Life Lost (YLLs), and related indicators. WHO has recommended more work on the equations and weightings of variables.

Future work with changed weights for specific diagnoses and more accurate assessment of numbers of cases, particularly from places where many conditions are incompletely recorded, may change rank order and final estimates of the leading causes of lost life and health. The GBD estimates, however, are widely
accepted as the best available to date, and are dependable enough to serve as policy guidelines (Murray and Lopez, 1996). These indicators, especially DALYs, will be incorporated into this handbook to help identify priorities.

Another element that often enters into institutional or governmental decisions regarding which health problems receive high priority. For example, a medical university in a developing country gave its first priority to preventing ischemic heart disease. Although the condition was relatively rare in the area served by their medical facilities, two senior faculty members had had myocardial infarctions. And in the United States, the occurrence of an illness in the country’s president is a good predictor of future appropriations for research on that topic. In contrast, diseases and injuries common in people living in poverty, among the homeless, or in groups who are criticized on moral grounds (such as illegal drug users or homosexuals) often are given a much lower priority than their prevalence, severity, and cost would warrant. Health professionals should be alert to these biases and work to correct them, but, for the sake of effectiveness, should always work in cooperation with formal and informal community leaders.

SELECTING THE TARGET SUBPOPULATIONS TO RECEIVE HELP

Many readers probably already are saying, “Of course you help those who are sick.” Or, “No, we’re talking prevention here. You intervene with those who are at risk of becoming sick or injured.” Well, the answers are getting closer, but no prizes need be awarded yet.

A community’s health, as well as its continuing streams of ill health, is spread and sustained by a delicate, complex web of interactions among elements of the physical, biological, interpersonal, socioeconomic, and cultural environments. The persons whose health is of concern rest in the center where all the strands come together. Those persons are in constant interactive exchanges with different levels of their own functioning (biological, psychological, social, values, and lifestyle), as well as with the changing environments of their private worlds. Sometimes the easiest way to repair tears in the web, tears that bring illness and injury, is to deal with other persons or circumstances, rather than with the high-risk person or group.

The mechanisms of illness and injury are also interwoven, involving agents of disease, environmental circumstances, culture, socioeconomic, people and their behaviors. The task to be accomplished is simple to state, but difficult to achieve. Vaccination coverage rates need only be between 70% and 90% (depending on the pathogen) for “herd immunity” to be adequate to prevent epidemics, but that will not eliminate scattered individual cases. And cigarette smoking needs only to continue declining steadily. Once a society starts to perceive smoking as
“out of style,” dirty, and harmful to the smoker and to others, then the momentum of social change will make the ashtray as obsolete as the cuspidor.

**Once a society starts to perceive smoking as “out of style,” dirty, and harmful to the smoker and to others, then the momentum of social change will make the ashtray as obsolete as the cuspidor.**

The task, then, is to study the strong and weak spots in the web of health and in the web of pathology to identify the very few linkages that must be broken—or those that must be strengthened—to reduce morbidity and promote health most efficiently, with the fewest side effects, and at the lowest possible cost.

Typically, such programs rely heavily on human interaction, and very little on advanced technology. In many cases, only limited groups need be targeted for interventions to help many people. The following are successful examples that may spark the imagination of those considering starting programs.

- To deal with an endemic level of neonatal tetanus in Haiti, Drs. W. and G. Berggen first studied the local mode of tetanus transmission. They then decided to work with traditional birth attendants to improve hygiene during delivery and to keep the newborn’s navel free of infection after severing the umbilical cord. Neonatal tetanus dropped nearly to zero.

- To reduce the high level of infant and small child deaths in automobiles, many states in the United States have: (1) passed laws requiring that safety seats be used by all children riding in cars and trucks; (2) solved the distribution problem by enlisting hospitals and well-baby clinics to loan safety seats free of charge for several years, until the child is large enough to use regular safety belts; (3) solved the financial problem by having civic organizations, commercial enterprises, and others buy the seats and donate them for use; and (4) solved the compliance problem by requiring police to keep an eye out for violations in automobiles they observe, and to fine those in violation. The rates of child deaths in vehicles, as well as the extraordinarily larger rates of trauma, have declined dramatically. Yes, the public was educated about the problem and its solution, but the most critical interventions were with legislators, health professionals, government agencies, and non-governmental and commercial resources.

- To reduce the rate of malaria transmission, anti-malarial medications are often distributed to populations. This is difficult where the population at risk is difficult to reach and compliance is poor. In PAHO’s campaign against malaria in Suriname in the 1960s, the targets for intervention were storekeepers. They were given pink medicated salt to distribute free, in place of regular white salt, which was always sold. The pink color told the public that the product was “the real thing” and for free. Everyone needs salt, and free salt is, clearly, best. Acceptance was rapid and enthusiastic (Barnes and Jenkins, 1972).
To cut the carnage wrought by motor vehicles, highway safety experts have successfully changed behaviors in four target groups: (1) highway engineers to get them to design safer roadways with better visibility, barriers where needed, and adequate signs; (2) vehicle designers and automobile company executives to construct safer cars equipped with seat belts, better cushioning, collapsible steering columns, anti-lock brakes, and many other safety provisions; (3) individual drivers (especially youth) to drive more safely through courses, driver licensing, and systems that take away driving privileges for repeated offenses; and (4) law enforcement personnel to enforce driving safety laws by providing clear legislation with non-trivial penalties and by enlarging the force to permit full enforcement of the laws.

To improve dental health, an effective caries prevention involves providing a healthy level of fluoride in public water supplies (about 0.7 parts per million). The persons that receive the most intervention in this effort have been community leaders overseeing the water supply. In many communities in the past, this narrow approach created problems among some of the public, who felt they had lost control of their city and its services. To overcome those problems it may have been better to start with a public education program led by respected professionals such as dentists, physicians, teachers, and the clergy, thereby laying to rest fears and issues about loss of control. Currently, most organized public opposition to fluoridation has ended, based on the splendid results in so many communities. So, perhaps at this point a narrow intervention would be enough. It depends on the local culture.

Working with both formal and informal community leaders can help health workers decide which community group should receive the most information, motivation, and help for the plan of action. For a pleasantly and effectively implemented intervention for changing health, always work within and with as much of the community as possible. Never work on the community, to the community, or for the community. Although most health promotion programs are directed at the general public, sometimes health promotion specialists enlist a target group to help them work with other target groups. The three following examples show some of these cases.

• When trained to identify the signs, schoolteachers can be the best case-finders for depressed, troubled, or neglected children.

• Health professionals may have the most influence in getting new mothers to breastfeed. However, they also may need to change the father’s attitude to enlist his support, and they may need the young mother’s mother to give encouragement.
• Health professionals may need to educate community and regional officials about the importance of establishing a district public health clinic, but the voting public and business leaders also may need to “motivate” officials to get the job done. In Chapter 12 you will find a discussion about which community segments are likely to accept new programs first and which last.

WORKING WITH THE WHOLE COMMUNITY OR ONLY WITH THE HIGH-RISK GROUP

There are several convincing arguments for targeting a community risk-reduction intervention only at high-risk individuals. For example:

• It keeps the programs smaller.

• The target group is likely to be highly motivated. Its members have learned that doctors can fix what is, or may come to be, wrong with them.

• Persons in the high-risk group have, as individuals, the most to gain by reducing their higher probability of disease.

• Health professionals see this as what they have been trained to do, and so are well motivated.

• The general public remains unbothered.

There is, however, a convincing argument to the contrary for most widespread maladies. By targeting the intervention program at the whole community and getting the most community members to lower their risk factor by a small percentage, a much greater reduction in new cases and mortality will be achieved. This is the “population strategy” put forth by the late Professor Geoffrey Rose, Emeritus, from the London School of Hygiene (Rose, 1992) and others.

In his book, Professor Rose used epidemiologic data to put forward the following points:

• Most biologic, psychological, and social parameters associated with rates of disease are distributed in a roughly normal, or bell shaped, curve in the population. Blood pressure, IQ, and social participation are examples of such a distribution. It then follows that there are many more people that have moderate elevations of risk, compared to a few with extremely high risk.

• For many risk parameters, the chance of disease emergence is directly related (in some linear or nonlinear function) to the amount of deviancy (in either direction) from the levels of the healthiest subgroup. For example, the higher
the blood pressure, the greater the risk of pathology; or, the lower the intake of protein in infants, the greater the risk of growth stunting.

- The percentage of people over any “high-risk cutoff point” (e.g., 160 mmHg/95 mmHg for blood pressure) is highly correlated with the population mean for that variable.

- The largest number of “cases” do not occur at the extreme “tail” of the risk factor distribution curve, but rather in the much larger group above the median, roughly from the 55th to the 90th percentile.

- By moving the entire population toward lower risk will lower the population mean modestly and lower the number of high-risk persons considerably.

Table 2.2 is taken from the screening phase of the United States Multiple Risk Factor Intervention Trial (MRFIT). The data are tabulated from Professor Rose's discussion of the original publication in *Lancet.*

Row No. 1 in Table 2.2 shows the distribution of total serum cholesterol values observed in 361,000 United States men aged 35–57 years old who volunteered to participate in a study of men at higher risk of ischemic heart disease. This was not a representative sample. Based on earlier population studies (including the one conducted in Framingham, U.S.A., and others), the risk of ischemic heart disease attributable to total cholesterol was apportioned among the nine levels in percentages, as shown in row No. 2. The power of the total cholesterol risk factor (row No. 3) is shown by dividing the percentage of deaths attributable to total cholesterol by the percentage of the group that generated them. The potency keeps rising with level of total cholesterol, as past research has taught us to expect.

The message to take home from Table 2.2 is that intervening with the entire population enough to shift the whole population's distribution of total cholesterol lower by only 0.5 mmol—one category—would reduce ischemic heart disease mortality attributable to total cholesterol by about 34%. In contrast, a much larger reduction—three categories, or 1.5 mmol—applied to every high-risk person (≥6.0 mmol total cholesterol), but to no lower risk person, would achieve only an 18% reduction in ischemic heart disease mortality.

Table 2.2 illustrates more of Rose’s arguments.

- When the common conditions are met—the risk factor has a bell-shaped distribution and the rates of disease keep increasing for each increment in the

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risk factor—then the population approach saves more lives and prevents more illness than the high-risk approach. This does not necessarily mean it is more cost-effective. The costs of each approach and the size of the targeted groups also must be considered.

- The population approach is more likely to be preferable in the following scenarios: (1) when the risk factors are widely diffused throughout the community; (2) when the gradient of disease risk continuously rises as the risk factor becomes more extreme; (3) when it is impossible or too expensive to separate

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**TABLE 2.2.** Estimated association of total serum cholesterol to six year mortality with population data from the screened population of the United States Multiple Risk Factor Intervention Trial (MRFIT)*, 1972–1973 (n = 361,622 men).

<table>
<thead>
<tr>
<th>Total serum cholesterol (mmol/l)</th>
<th>Total cases (%)</th>
</tr>
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<tbody>
<tr>
<td>&lt; 4</td>
<td>9</td>
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1. Population distribution by cholesterol level (%)*

2. Deaths attributable to high cholesterol effect

3. Potency of effect (L2)/(L1)†

4. Deaths after successful high-risk approach (%)*

5. Deaths after successful population approach (%)*

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*S. M. Multiple Risk Factor Intervention Trial (MRFIT), as cited in Rose, 1992.

† MRFIT mortality data are the six year total for all causes, because total cholesterol affects several cardiovascular endpoints.

‡ Data from MRFIT screening.

§ Ratio of percentage of deaths to percentage of persons at each total cholesterol level. This yields a relative risk ratio signifying the relative lethal potency of each level of total cholesterol. Ratios less than 1.0 indicate a protective effect.

∥ Percentage of the original (100%) deaths that would occur if the high-risk approach were applied to all persons having baseline total cholesterol of 6.5 mmol/l or greater and assumes that this intervention was successful in reducing all “high” cholesterol by 1.5 mmol/l—or three categories lower. The percent of deaths is then recalculated with every high-risk person experiencing the potency effect three categories below his original level. There is now only 82.2% of the original burden of disease—about an 18% decline.

* Percentage of the original (100%) deaths that would occur if the population approach were applied to the whole community, using mass media, group meetings, and all the other “total” approaches, and assumes that this intervention lowered the community’s total cholesterol mean by only 0.5 mmol/l—just one category lower. The shape of the distribution curve remains the same, as is also assumed for row No. 4. This results in the community experiencing only 65.7% of its earlier mortality—over a 34% decline.
the susceptible from the non-susceptible groups or persons; and (4) when the intervention is better achieved at a group or population level rather than at an individual level (for example, changing eating patterns of families or school groups; fluoridating the water supply, rather than hiring hundreds of dental aids to find and treat every child and adolescent).

- The high-risk approach will be more effective: (1) when the risk conditions are highly restricted (for example, exposure to fumes and solvents among furniture workers); (2) when susceptibility is limited and obvious (for example, persons with white, rather than tan or brown, skin for strict teaching about sun exposure and skin cancers); (3) when there is a “risk threshold” below which a risk factor confers no added danger and the low risk subpopulation can be easily identified; or (4) when the intervention causes enough inconvenience so that only high-risk, motivated persons will adhere to the hygienic program (for example, diabetics and pre-diabetics following needed strict dietary programs).

The population approach also reduces the size of the high-risk portion of the population. Rose (1992) estimates the reductions as follows:

- If high risk for systolic blood pressure begins at 140 mmHg, reducing a population’s mean systolic blood pressure by 3% will decrease the number in the high-risk group by 25%.

- If excess body weight is judged to be more than 92 kg, reducing the population’s mean weight by 1 kg (about 1%) will cut the number of excess weight persons by 25%.

- If heavy drinkers of alcohol are defined as persons drinking 300 ml of ethanol or more each week, reducing the drinking population’s average ethanol intake by 10% will cut the number of heavy drinkers by 25%.

Comparisons of distributions of values of risk factors, such as those above in numerous populations, reveal that populations differ in means but not in the shape of the distribution. The above calculations are based on that assumption.

THE PREVENTION PARADOX

The paradox goes something like this: preventive interventions often must involve many, many people in order to help just a few. This is an issue that dates back at least to the first immunization campaigns in the 1890s. And even in the early part of the 20th century, when diphtheria was epidemic, preventive programs had to immunize about 600 children to prevent one death. Of course, numerous non-fatal cases also were prevented. Similarly, today thousands of
persons are wearing their automobile seatbelts for thousands of days each, for just one life to be saved.

These are examples of preventive measures—risk factor reductions—that bring large benefits to the population as a whole, but little or no benefit to most participating persons. Such high ratios of participants to persons benefiting must always be the case in situations where we know there will be many destructive events in a population but do not know who might become the victim.

The message for health promotion is to make preventive actions automatic and habitual, emphasizing their ease and simplicity, and also stressing that failure to do the preventive act may generate only a tiny risk but represents a huge penalty to anyone who becomes a victim. As Table 2.2 demonstrates, having many persons exposed to a modest risk of disease or injury costs a community far more damage than having a small number of persons exposed to a high risk.

Whether to choose the high-risk approach or the population approach hinges on several additional factors, including the inconvenience or possible side effects of the intervention program on persons at minimal risk and the shape of the gradient of potency of the risk factor. For example, a U-shaped effect—when both being too high and being too low are harmful—calls for the kind of program that encourages both extremes toward safe moderation. These decisions need to be worked out with the input of expert consultants. The purpose of this discussion is to alert all health workers to the issues and the options.

SPECIFYING THE CHANGES IN BEHAVIORS AND ENVIRONMENTS REQUIRED TO REACH THE HEALTH GOALS

Once the type of health problem against which to intervene has been selected, as well as the population subsets whose changes in behavior will reduce the problem, those planning the program are ready to specify precisely what changes need to be made. A vague goal will doom public health leaders and workers to an enterprise akin to trying to catch a cloud in a butterfly net. A precise, operationally defined goal, on the other hand, will provide focus (thus eliminating unnecessary activities) and enable quantitative evaluation (both before the program begins and after it ends), both for the behavioral and environmental changes that the program aims to achieve and for the improved health outcomes the program is intended to produce.

Goals should be stated in terms of specific, measurable results. They should not be stated in terms of resources spent or activities conducted. For example, it is not recommended that a goal be set such as, “Use 25 nurses to do home visits to educate people about risk factors for cancer.” Rather, state an outcome ori-
ented goal, such as, “Raise public awareness of cancer risk factors so that 80% of adults know risk factors for cancer of the lung, head, neck, liver, and bowel.” The following three examples of a third approach are more behaviorally oriented: “Decrease the proportion of adults (X%) who smoke cigarettes by 20%;” or “Decrease the X% who drink more than 7 alcoholic drinks per week by 20%;” or “Increase the X% who consume both three fruits or vegetables and two fiber-rich foods each day by 20%.” Evaluation should be made in terms of measured changes. Since the cancers above may take 20 to 30 years to develop, early evaluation must be conducted in terms of risk factor changes. Don’t look for changes in health statistics until the “incubation period” of the disease in question has elapsed. Simply to make people “more health conscious and knowledgeable” is not helpful, unless it spills over into measurable actions that really prevent disease.

Goals set for health interventions also should be attainable. Reducing the incidence of diarrhea in day care centers by 90% is not an attainable goal for the first intervention in most places. If a 20% reduction seems easy, set your goal at 30%, not at 50%. With some extra effort, you have a good chance of reaching 30% the first year, and then set another 30% reduction as the second year’s goal. The prevention specialist should weigh the attitude of both health workers and the target population: Will they work harder the second year if they achieve their goal, if they fall somewhat short of it, or if they fail badly? Most behavior change specialists believe that a sequence of small or moderate successes is the best way to build morale, self-efficacy, and commitment for future goals—both among health workers and among the participating public.

Careful analysis of the etiology of a disease or class of trauma will usually reveal several risk factors in the people who later become victims. Certain places and times also confer greater risk. There are usually potential interventions to change the environment, to separate the agent from the host, or to activate any other of the five strategies for prevention (see Table 2.1).

Most behavior change specialists believe that a sequence of small or moderate successes is the best way to build morale, self-efficacy, and commitment for future goals—both among health workers and among the participating public.

In general, combating a problem by launching two or more interventions simultaneously is often more effective than carrying out a single intervention, but it also can be more costly. The goal is to select cost-effective ways of intervening, and to combine them if indicated.

For example, some malaria control programs follow a probability model both to attack the vector (mosquitoes) and to raise human resistance with antimalarial medications. If the number of mosquitoes can be cut by half and the number of
susceptible hosts can be cut by half (assuming equal and independent effects from each intervention and no changes in other factors), one would expect malaria transmission to fall to one-quarter of its previous rate. A similar multi-pronged approach also works well for highway safety and many other conditions.

In general, a program designed to change behavior and attitude will always be needed to gain public acceptance of environmental and health service programs. A highly successful polio immunization program conducted in the 1960s, when live-virus polio vaccine was new, was organized to include health professionals; elementary schools; churches; supermarkets; county offices; factories; recreational facilities; newspapers, radio, television, and billboards in two languages; community volunteers; and civic clubs. This enthusiastic, multi-faceted and many-channeled approach set records for community participation. The facilities, work hours, and media coverage were mostly free gifts to the health campaign. This “community saturation approach” is still being used with encouraging success.

The channels to be used to reach people, the nature of the message, and the times and places for providing services will differ greatly depending on the nature of the target disease and that of the target population. As an exercise, think how you would plan a program targeting measles in children, breast cancer in middle-aged women, AIDS among intravenous drug users, sexually transmitted diseases in teenagers, or reactive depression in recently widowed persons.

Before continuing, think about and write the nature and content of the program to be designed for each of these diseases and population subgroups, as well as where, how, and by what sorts of workers the services are to be rendered. Save the notes. You may want to review them after reading Chapter 12.

Chapter 12, on changing behavior, will provide further guidelines to use in planning for such programs. Before that, however, Chapters 3 through 6 in Part II will review the major health problems at each stage of life and will examine how they can be reduced.