PERT and Planning for Health Programs

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AS THE NUMBER of community health service programs increase and their interrelationships become more complex, the public health administrator is becoming more aware of the urgency for effective health planning. PERT, an acronym for Program Evaluation and Review Technique, is suggested as a tool for mapping out interdependent program steps so that planning can follow a more rational and effective course. Prior to a discussion of PERT, a review of the planning process may be valuable.

A major assumption of all planning, including health planning, is that it is a process requiring both conscious effort and periodic surveillance (*1*, *2*). Planning involves these sequential steps.

1. Development of goals.
2. Assessment of resources: time, money, personnel, opinion, institutionalization of individuals and groups, and other social forces.
3. Consideration of alternative ways of using resources to achieve goals.
4. Selection of an alternative.
5. Development of specific objectives to implement the plan.
6. Implementation of objectives.
7. Evaluation, not only in terms of success in meeting goals, but evaluation of the total planning sequence.

Relationships among the steps in the process are dynamic. It is imperative that the health administrator recognize this characteristic and adjust goals, resource allocations, alternatives, and specific strategies to reflect the relationships appropriate at the time between health and other community programs and interests.

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What Is PERT?

PERT is an adaptation of a method long used for work flow management (*3*). It was developed cooperatively by government agencies and private industry to meet production difficulties arising from national defense contracts in which numerous and complex programs had to be coordinated to achieve the final objective (*4*). In some applications, PERT has acquired a high degree of sophistication (*5–8*).

Except for a few isolated instances, PERT has not been utilized by the practicing public health administrator (*9*, *10*). Because of its ability to provide the user with a graphic representation of the components of a program, PERT has the potential to become a valuable health planning mechanism (*11*). In addition to serving as the basis for planning objective-oriented work, it can provide information for scheduling, costing, redirecting, and evaluating health programs. Characteristics of the technique are:

1. A work breakdown structure, beginning with a final objective subdivided into a series of smaller subobjectives.
2. A network including all activities and events necessary to reach an objective. Activity is an effort required to move from one event to another. An activity may also indicate simply a connection or interrelationship between

two events which does not require any effort. In the latter instance, estimated time for the activity would be zero. Specific and definable program accomplishments that do not require time or resources are events.

3. Identification of time estimates for various activities as well as the total process, including a critical path. The longest path, in terms of time, through the network from the beginning to the ending event is the critical path.

4. A method of network analysis that provides continuous evaluation of program status and identification of problem areas so that preventive action can be taken. The network is a diagram of activities and events necessary to reach a program objective. It shows sequences of accomplishment, interrelationships, and dependencies. Analysis of the network by the administrator at any stage of the program permits him to determine if anticipated progress is being made, and if not, specifically where the bottleneck is occurring.

Limitations

PERT is a way to plan only objective-oriented programs. Objective-oriented programs are considered here as those efforts which are designed to meet organizational goals and have specific, measurable end results. Because of this restriction, PERT cannot assist with the total health planning process. Rather, its most effective use occurs after the selection of specific objectives and during the implementation and evaluation steps (5, 6, and 7 of the planning process outlined previously).

As with any management tool, PERT has little significance by itself. In order to be effective, PERT must be thoroughly understood and used by persons with authority over broad program activities (*12*). Obviously, one of these persons must be the chief administrator when a program of general interest is involved. Lower level supervisors must in turn understand and use the technique as it relates to their particular areas of responsibility (*13*). PERT is a tool; it cannot make decisions. It will, however, assist with arriving at rational decisions on allocation of resources, by determining which program aspects will require more effort to meet the program's planned completion date and, conversely, which aspects can receive less effort without jeopardizing the timing of the entire program effort.

Illustration of Application

PERT is most advantageous when applied to a program that requires simultaneous activities and has a time limitation. We have used a multiple screening program as an illustration of the application of PERT to a typical public health program. The final objective is to have the screening program ready for the segment of the public selected as a target group.

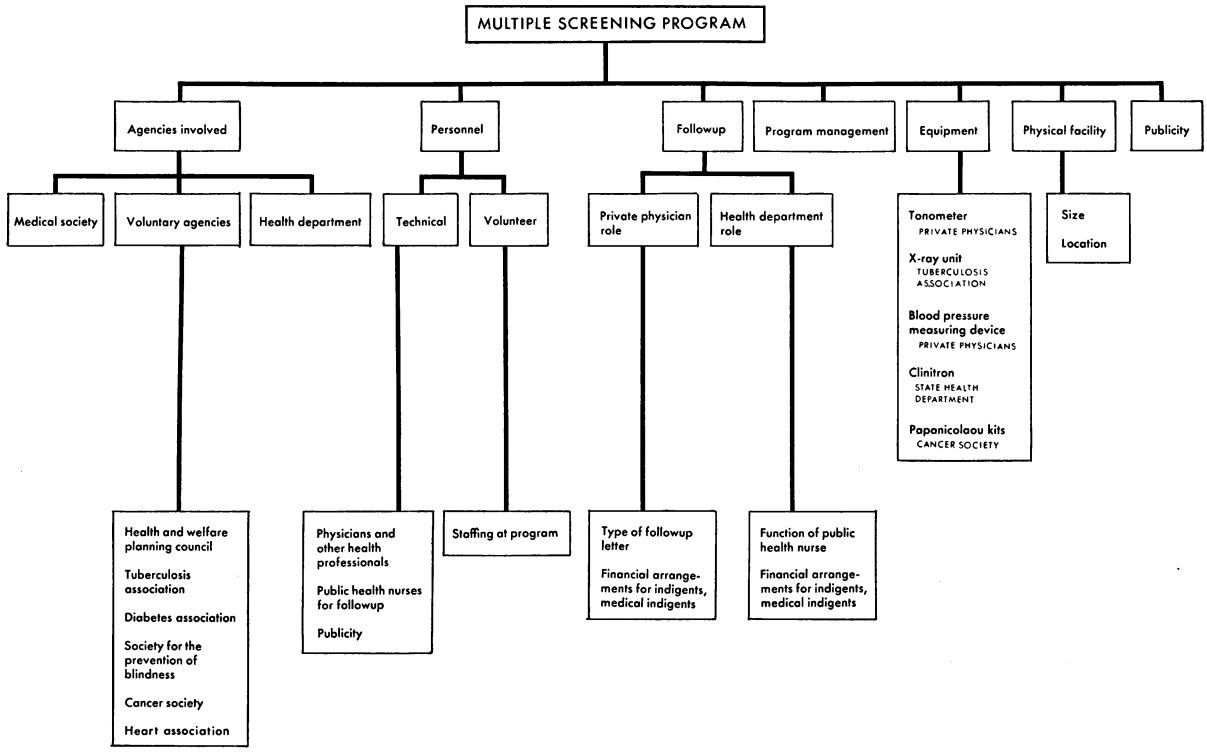
The major steps in the construction of a PERT system after agreement on the program objective are: (*a*) compiling a work breakdown structure, (*b*) developing a network, (*c*) estimating time for each activity, (*d*) determining a critical path and slack times, and (*e*) scheduling work processes.

Work breakdown structure. The work breakdown structure is a step-by-step detail of each major component of the program. The detailed program should include program aspects, such as decisions, equipment, groups, and facilities. The extent of detail is determined by the complexity of the components and the preference of the administrator. A work breakdown structure which might be used for the hypothetical multiple screening program is given in figure 1.

Network diagram. The work breakdown structure is the basis for the network diagram. A network for the multiple screening illustration is given in figure 2. Each event is represented by a rectangle. Activities are represented by the arrows joining events. The direction of the arrow indicates the sequence which must occur among events. The symbol t_e indicates the estimated time for an activity in weeks or fractions. Time estimates are obtained from persons most familiar with the activity. If desired, estimates can be made for the most likely, optimistic, and pessimistic times and then weighted to arrive at a single and, hopefully, more precise time estimate for the activity (*14*, *15*).

Critical path and slack. After time estimates have been allotted to each activity, it is possible to determine the critical path and slack. The

Figure 1. Work breakdown structure



critical path is the series of activities and events that require the most time (fig. 2). By periodically comparing actual progress of events on the critical path with their estimated completion dates, it is possible to determine if the end-event completion date can be met as planned.

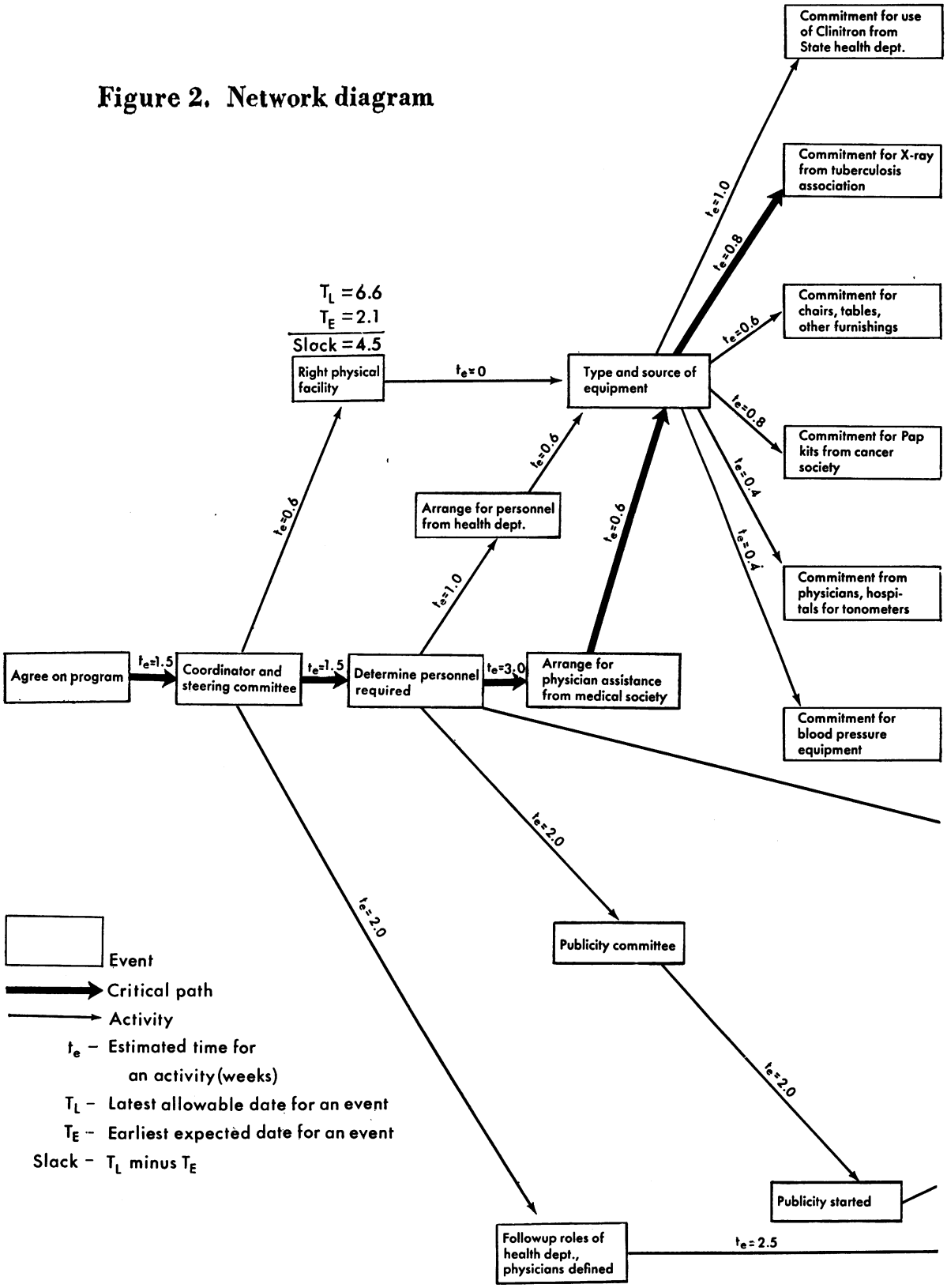
If progress is slower than estimated, the administrator can set the end-event completion date ahead, or channel more effort into activities along the critical path. When progress is ahead of schedule, he can proceed as originally planned and meet an earlier end-event completion date or increase the time estimates for uncompleted activities on the critical path. Slack is the difference between the latest allowable date (T_L) and the earliest expected date (T_E) for the occurrence of an event.

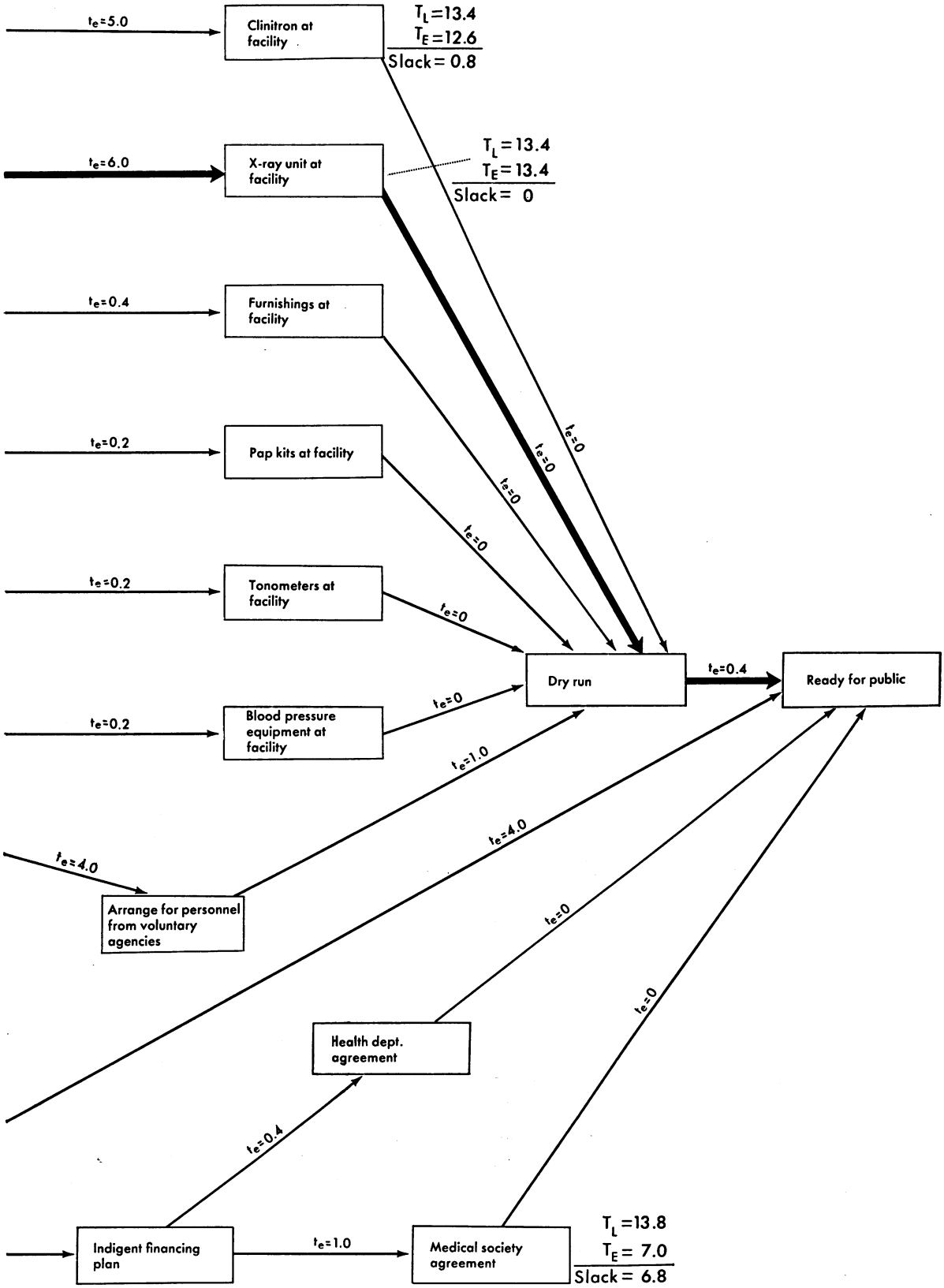
Slack indicates the time cushion available at each event, which can be used, as necessary, without affecting the timing of the total program. The latest allowable date for each event is determined by working back through the longest path of the network from the end event to the event for which the T_L is desired. For example, in the illustration the critical path is 13.8 weeks, and the Clinitron must be at the multiple screening site 0.4 week before the completion date. Therefore, the latest allowable date is 13.8 minus 0.4, or 13.4 weeks. The earliest expected date when the Clinitron will be at the screening site is obtained by totaling estimated activity times back from the event through the longest path of the network to the beginning event. In the case of the Clinitron, the earliest expected time is 12.6 weeks. Slack at this event is, therefore, 13.4 minus 12.6 or 0.8 weeks. Slack can be determined for each event in this manner.

When the network has been developed to this point, including slack times for key events, its value as a management tool becomes more obvious. The administrator should view the network critically to determine obvious duplications of effort, how the critical path might be reduced by rearranging activities, how much slack is available for events not on the critical path, and how resources could be scheduled most effectively.

After the network is modified to include any changes suggested through this panoramic view

Figure 2. Network diagram




t_e=5.0
Clinitron at facility
T_L=13.4
T_E=12.6
Slack= 0.8
t_e=6.0
X-ray unit at facility
T_L=13.4
T_E=13.4
Slack= 0
t_e=0.4
Furnishings at facility
t_e=0.2
Pap kits at facility
t_e=0.2
Tonometers at facility
t_e=0.2
Blood pressure equipment at facility
t_e=0
Dry run
t_e=0.4
Ready for public
t_e=1.0
t_e=4.0
Arrange for personnel from voluntary agencies
t_e=4.0
Health dept. agreement
t_e=0.4
Indigent financing plan
t_e=1.0
Medical society agreement
T_L=13.8
T_E= 7.0
Slack= 6.8

of the program, each activity should be scheduled to conform to total network timing. Network times can be translated to calendar dates at this time. Supervisors should be apprised of the projected beginning and ending dates for the activity under their responsibility. The importance of completing the activity within the time estimates must be thoroughly understood by all persons having major program responsibilities. The chief administrator has the responsibility for interpreting the importance of respecting time estimates, in addition to periodically checking actual progress against times planned for events. The ability to compare planned and actual completion dates for all events enables the administrator to anticipate problems long before the time of the program objective is near. Consequently, preventive action can be taken in the appropriate place at the proper time before a major and unreconcilable problem exists.

Summary

PERT can assist the public health administrator in precisely estimating program progress, coordination, rational phasing of activities, delineation of responsibility for various program components, and preliminary and final evaluation. In addition to multiple screening, PERT could be applied to other public health programs as well as budget and personnel utilization processes. Various types of large meetings, immunization programs, processing and obtaining data for vital records, and the promotion of legislation are program areas to which the technique might be profitably applied. Further experimentation could lead to an almost limitless number of complementary PERT-public health relationships.

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