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## Mobile Units: A Solution to the Rural Health Problem?

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The fundamental problem of rural health is the extremely low density of health professionals per unit of surface area, resulting in large distances between patient and services. To deliver services in rural areas either stationary facilities or mobile units can be used. The underdeveloped world has had considerable experience with different varieties of mobile units. From this experience, certain principles can be derived which are useful in choosing between stationary and mobile facilities for specific situations. The first consideration is the geographic-demographic layout. Second is the type of health service desired, with mobile units most applicable to periodic health services employing simple facilities, but not desirable for comprehensive care. The third factor in deciding between stationary and mobile systems is the determination of which provides more benefits per cost. Whereas mobile units are an attractive method for rural health service delivery, stationary facilities are often preferable.

THE FIRST RECORDED MOBILE HEALTH UNIT may have been a 12th century Sultan of Baghdad's field hospital transported about the country on the backs of 40 camels.<sup>21</sup> A common form of mobile unit in the United States was the family physician making home visits with his black bag. A mobile health unit is any form of medical care in which the services are brought to the patient rather than having the patient travel to the services. It can be as simple as a medically-trained person bringing his talent to the patient's bedroom and as complex as a 50-foot trailer with thousands of dollars worth of machinery manned by an entire medical team.

Mobile units have played a significant role in the delivery of health services to rural populations. Rural health involves a

different type of intellectual exercise than urban health. In the poverty areas of large cities, money can buy sufficient quantities of appropriate systems of health services. In the countryside, money alone is no solution. Rural areas are characterized by low population density, which implies relatively great distances between people. This geographic truth itself multiplies the barriers to health services manyfold. Compounding the distance problem is the lack of health manpower in rural areas.<sup>22</sup> The combination of low population density and low health-professional density becomes striking when one calculates that in average rural counties in the United States there may be one doctor per 1,000 square miles, as contrasted with 30 doctors per square mile in the city. Even if it were possible to attract manpower into these areas, there is serious question whether it

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is worth the cost. If, in a depopulated area, there were a clinic for each 1,000 square miles, the clinic might serve only 500 people, averaging only eight patient visits per day—clearly not worth the cost in money and manpower. In short, though we recognize a great need for health care in rural areas, simply pouring money into these regions is not the whole answer. We must devise systems of medical care which can efficiently produce a positive effect with the available resources.

What are the possible schemes which might be used to bring medical care to sparsely settled areas? One could envision widely-removed stationary (fixed) health services staffed by doctors and provided with means for patient transportation, less-widely-separated fixed services manned by auxiliary personnel, or mobile units staffed with doctors or auxiliaries which either make periodic visits or can be called by radio or telephone. (Closely-spaced stationary facilities with doctors are not feasible, as the preceding paragraph noted.) This paper attempts to examine the role of mobile health units in the context of the problem of rural medical care delivery. After some preliminary distinctions are made, the issues involved in mobile health care will be brought out by a description of some of the ways in which mobile units have been used throughout the world. A more detailed description of a mobile health system in Central America will follow. Finally, the issues raised in the descriptive sections will be placed in a more analytic framework.

#### Types of Mobile Units

Mobile health units can be classified according to the presence or absence of mobile equipment. Traveling medical personnel carrying only small amounts of supplies are called mobile teams. Mobile services including equipment in addition to

personnel are known as mobile facilities. When speaking in general of mobile personnel, facilities, or both, the term *mobile unit* is used.

Simple mobile units can be jeeps or cars for the transport of personnel with basic equipment and drugs. Ambulances with oxygen, stretchers, splints and bandages are a form of mobile unit. A more complex mobile unit may contain a sink with running water, cabinets, a generator for electricity, refrigerator, examining table, simple laboratory facilities such as a microscope or centrifuge, x-ray equipment, dental equipment, and so forth. Of course, as the unit becomes larger, its mobility, especially on the muddy narrow roads of many underdeveloped countries, decreases. Units must be chosen, therefore, by balancing the need for facilities and the requirements for mobility. Different types of mobile units also have different purposes. Some are designed to provide primary comprehensive care to people who have no access to stationary facilities. Others are for more limited specialized care, such as immunization, x-ray diagnosis, dental checkups, or multiphasic screening.

A large part of the world's experience with mobile units has come from colonial nations and from military situations. The following discussion will be limited to mobile units as used for routine medical and preventive care for rural areas. Such exceptional circumstances as wartime medicine and disaster relief will be excluded.

#### Examples of Mobile Units

Mobile health units became highly developed in West Africa because of the epidemic of trypanosomiasis (sleeping sickness) which spread across that region between 1915 and 1940.<sup>40</sup> The West African approach to rural health is based on the ideas of Dr. Jamot, who believed that the

principal thrust in these areas should be the control of epidemics and the gathering of precise information on endemicity rates of diseases.<sup>35</sup> This information can be elicited not by setting up dispensaries, but only through a total census and mass survey of the entire population, a task requiring mobile units. Dr. Jamot adopted a monovalent approach, setting up teams against only one disease, trypanosomiasis, and his concepts spread from French Equatorial Africa to the neighboring countries.<sup>22, 23, 41</sup> Lacking the resources for a broader program, Jamot confined his attack to one disease; his successors, however, expanded the sleeping sickness program into polyvalent efforts against several diseases.<sup>35</sup> Thus, mobile units could make the rounds of a country doing monovalent, bivalent, or polyvalent surveys.

West Africa, then, had much experience using mobile health units with the specific tasks of survey and control of infectious disease. A different concept of rural health is exemplified by the work of Kenya and Uganda in East Africa.<sup>10, 15, 17</sup> In these countries the approach has been to establish comprehensive preventive and curative services rather than limited infectious disease thrusts. With the principal drive being toward comprehensive services, a fixed infrastructure, rather than mobile services, became the dominant feature. The fundamental unit of medical care in the rural areas of these East African countries is the health center, which provides complete services for an entire geographical region. Mobile teams do, however, play an important role within the fixed health infrastructure. Since it has been financially impossible to build and staff enough health centers to cover the entire population, the activities of the health center have necessarily extended beyond its walls through the medium of mobile teams. Mobile services in this type of system are different

from the Medical Field Units of West Africa, which constantly moved from village to village without a fixed schedule. The mobile services provided by an East African health center use simple facilities; auxiliary personnel are based at the health center, and visit regions which are too far from the health center to permit easy patient access. Ideally, these teams visit each village at regularly scheduled times, providing a wide range of services, including general ambulatory care, prenatal and well-baby clinics, vaccination programs and health education. Mobile services thus are simply an extension of a permanent facility and attempt to accomplish that which a greater number of permanent facilities ideally could do.

The World Health Organization, in proposing a rural health program, accepts the comprehensive approach based on the stationary health center.<sup>20</sup> However, it sees mobile units as useful in mass surveys and treatment of endemic infectious diseases, and for rapid mobilization against epidemics and disasters. Thus, some elements of both the East African and West African philosophies are incorporated into the WHO approach.

Another type of mobile unit, the traveling dispensary, has been used in many countries on various continents.<sup>7, 8, 21, 32</sup> Generally these dispensaries provide only curative outpatient services; the Trans-Jordanian units also engaged in such preventive activities as environmental sanitation, insect control, and immunization.<sup>14</sup> Traveling dispensaries, insofar as they lack a preventive orientation, are purely stopgap measures and do not truly advance the health status of an underdeveloped rural area. They often fail to gather useful information by which their work can be evaluated, and they do not succeed in developing paramedical manpower which might provide continuity of care in small villages.

Mobile units are also a feature of health care systems of developed nations, particularly for the accomplishment of specific tasks. The mobile chest x-ray unit and the mobile dental unit have been employed throughout the United States. Mobile multiphasic units for chronic disease screening have traveled through Oklahoma.<sup>1</sup> This expansion of x-ray screening mobiles to multiphasic screening units is similar to the conversion of Jamot's monovalent sleeping sickness teams into polyvalent mobile attacks on several diseases in West Africa. In Alberta, Canada, mobile teams of specialists have brought their diagnostic abilities to remote rural areas.<sup>10</sup> It has even been proposed to put a cardiac catheterization laboratory on wheels for congenital heart disease screening of children.

Mobile services can be linked with emergency health services. An ambulance is actually a simple mobile unit insofar as its attendants, with simple first-aid training, and its rudimentary facilities, particularly oxygen, can offer preliminary care to accident victims and medical emergency cases before the patient reaches definitive care in a hospital. The ambulance, then, is a combination of mobile facility and transportation vehicle. The mobile coronary intensive-care unit, which originated in England,<sup>25</sup> is a further refinement of the medical care service which can be provided in an ambulance. The U.S. Department of Transportation is now attempting to upgrade emergency health services throughout the country by setting higher standards for ambulances and requiring training courses for attendants. The mobile unit aspect of the ambulance is thus receiving greater emphasis. Helicopters are replacing ground ambulances in some areas for emergency treatment and transport. In addition, Australia, Nigeria, and South Africa have instituted flying doctor services for medical or obstetrical emergen-

cies.<sup>9, 11, 26, 37</sup> These can also be thought of both as mobile teams and as a rapid transportation capability.

Mobile health units have occasionally been used for explicitly political purposes. A mobile trachoma service in North Vietnam was set up in part for its favorable propaganda impact.<sup>3</sup> A Central American mobile venture was originally established for political reasons.<sup>2, 12</sup> Because of the opportunity afforded by the Central American program to compare stationary and mobile health systems, this case will now be examined in some detail.

#### The Central American Experience

The countries of the Central American isthmus fall in the category of predominantly rural, with only partially-developed transportation and communication networks. It is not uncommon, in these countries, for populations to be totally unable to communicate with, or transport themselves to, health care facilities. The health ministries of Central America, with the advice of the Pan American Health Organization, committed themselves to a system of fixed health establishments. PAHO has generally been critical of mobile units,<sup>6</sup> and has favored a fixed health infrastructure with the most peripheral health posts staffed by auxiliary nurses.<sup>18, 24</sup> Four Central American nations and Panama, implementing their national health plans, have been building networks of health centers (run by physicians) in larger towns and health posts (manned by auxiliaries) in small villages.<sup>19, 26, 27, 29, 31</sup>

In 1962, however, the five Central American countries and Panama suddenly went into the business of mobile health units. This came about due to the promotional efforts of the U.S. Agency for International Development. Late in 1961 President Kennedy became concerned that the Alliance for Progress, with much of its money tied

up in long-term economic development projects, was not receiving immediate visibility. Dr. Edgar Berman, health consultant to AID, recommended rural mobile health units as an "immediate impact" project, and he passed on this idea to the six countries.<sup>2</sup> Thus PUMAR was born, the Programa Unidades Moviles Areas Rurales (Program of Mobile Units in Rural Areas). Though PUMAR's philosophy differed from the concepts embodied in the health plans of most of the countries, it was hoped that the mobile units could be fitted within the health infrastructure being created under these plans.

By 1964, PUMAR was operating 56 mobile units in the six countries, visiting 443 communities, and making health services available to over two million people.<sup>38</sup> Through the stimulation of PUMAR water systems are built, latrines are installed, bridges and roads are repaired, and community center buildings are constructed. Each mobile unit has its headquarters in a larger town (though it does not serve the inhabitants of that town), and goes each day to a nearby small village, returning to the larger town in the evening.

A typical day for a Costa Rican mobile unit starts with the meeting of its team at headquarters in the central town, and the loading of medicines onto the jeep-station wagon. After an hour's drive the unit reaches the target village where 20 to 50 people may be waiting outside a schoolroom. The nurse takes weights and blood pressures, organizes the records, and gives injections. The doctor attends only to the patients' chief complaints, and usually gives symptomatic treatment; no laboratory facilities are present. The most frequent diagnoses are intestinal parasites, anemia, malnutrition, gastroenteritis and bronchitis.<sup>36</sup> The jeep driver gives out the medicines as prescribed by the doctor. The sanitary inspector, the preventive medicine

member of the team, can spend his time giving health educational talks, inspecting wells and latrines, or examining such problems as insect control. At the end of the day there may be a short conference with community leaders concerning the proposed construction of a small building for the unit to work in, and then the team departs. The village will have its next visit in three or four weeks.

The doctor is supposedly the drawing card, attracting people for health education and preventive efforts. But the preventive and educative aspects are seldom carried out with much vigor, and the visit is generally confined to curative services. The typical patient has symptoms of parasitosis, is given antiparasitic medication, and then returns to the same unsanitary environment which gave him the disease.

In El Salvador the system is somewhat different. A mobile unit visits ten villages, each for half a day; thus, villages receive weekly visits. El Salvador is gradually constructing health posts, staffed by permanent auxiliaries, in the towns visited by the mobile units. All the villages store their own supplies of medicines, in contrast to the Costa Rican situation, in which the drugs are carried by the mobile units. El Salvador is thus moving away from mobile facilities toward a system of mobile teams visiting fixed health units.

Eventually, as all five Central American countries and Panama put into operation more and more fixed health centers and posts, the mobile program will probably fade out of existence. The preventive services, such as vaccinations, latrine construction, installation of potable water systems, and well-baby care, could be handled by periodic visits to a town. But these preventive aspects are largely ignored due to PUMAR's heavy emphasis on curative medicine. The periodic visits of the mobile units simply cannot provide the continuous

accessibility of services which is fundamental to a system of comprehensive care, and thus the mobile units do not truly provide health coverage for the two million people inhabiting the regions visited.

The "coverage" of a health care system relates to the number of people for whom health services are accessible. Barriers to accessibility which might limit the coverage are generally listed as physical (distance or lack of transportation), economic, and sociocultural. However, the barrier of time is particularly pertinent to the subject of mobile units: the health services are not present at the time when the patient is sick. The time barrier does not limit the number of people covered by health services, but limits the accessibility of services to each person.

One way to judge the strength or weakness of the PUMAR program in providing services is to quantify the coverage of the program. This could be done by defining coverage as the percentage of time during which a health professional is available. The mobile unit, visiting each town for eight hours every two weeks, would supply about 2.5 per cent coverage. A more accurate method for estimating the amount of coverage provided by mobile units takes into account that some people can wait a certain number of days before consulting a health practitioner. The percentage of coverage for the mobile unit making visits fortnightly might then be calculated by dividing the number of patients who were seen in one visit of the mobile unit by the total number who desired to see a health worker in the preceding two-week period. Unfortunately, this percentage is not known.

A third method of calculating the coverage provided by a mobile unit system is simple and direct. It consists simply in determining to what extent the population utilizes the services. This method assumes

that the chief barrier to the utilization of mobile units is the time barrier; and when comparing mobile units with fixed health centers for a similar population, this assumption is probably valid. Crude figures from the Central American countries give some impressions about utilization rates. In El Salvador patients tend to utilize all ambulatory services at the rate of about .5 visits per person per year.<sup>34</sup> Stationary health centers in Costa Rica are utilized at the rate of one or two visits per person per year.<sup>13</sup> Data from all six PUMAR countries show that the utilization rate for mobile units is about .25 visits per person per year.<sup>30, 38, 39</sup> This means that if a mobile unit reaches 10,000 people, it will have 2,500 patient visits per year, whereas a fixed health center might have 10,000 visits. On the basis of these estimates, the coverage provided by fixed health establishments is four times as great as the coverage of mobile units.

#### General Issues Concerning Mobile Units

There are essentially two ways to deliver health services to rural areas with low population densities: widely-removed stationary facilities staffed by doctors or auxiliaries with transportation for patients, or mobile services which either make periodic visits or can be called by radio or telephone. The combination of stationary facilities and mobile teams is also a possibility. The theoretically-ideal situation of closely-spaced facilities run by doctors is unfeasible in practice due to the low population density, shortage of money, and unavailability of manpower.

There are three factors to consider in deciding whether to use mobile or stationary facilities to meet the medical needs of rural areas. These considerations, which apply to both developed and underdeveloped countries, are: 1. the geographic-

demographic situation; 2. the type of health service desired (comprehensive, specialized, emergency, etc.); and 3. cost-benefit data. These three considerations will help decide not only whether mobile units are desirable, but also which type of mobile services would be suitable, *e.g.*, land or air, large or small, teams or facilities.

#### Geographic-Demographic Factors

Population density is of overriding importance in determining the need for mobile health services. In urban areas with dense populations, it would be senseless to bring medical services from house to house; stationary facilities are more efficient and effective. In the extreme opposite case, that of ultrarural areas in underdeveloped countries where people will not travel more than three miles to seek medical care, mobile units may become a necessity if health services are to be accessible to these people. Population density is not best expressed in the usual form of people per square mile; a more meaningful expression is the number of people living a certain travel time from a facility. In a middle-class rural area of the United States, many people will drive 30 miles, or 45 minutes, for an outpatient visit. In rural Uganda, however, five miles, or walking through the mud for three hours, presents a great obstacle to people seeking medical care. Utilization rates of medical care facilities have been directly related to distance in Uganda,<sup>17</sup> and might have a relation to travel time throughout the world.

Isochrone maps could be drawn, depicting areas in which the population lives a given travel time from a health facility, taking into account the roads available, and the means of transportation used. People living outside a certain travel time from a health facility could be served by

another fixed facility or by a mobile unit. The acceptable maximum travel time depends on such factors as money and manpower, and also on the type of service to be provided. For instance, one might decide that no person should live more than two hours from a primary comprehensive care facility. However, the maximum acceptable time from an ambulance might be one hour, whereas specialty consultation may be satisfactory at four to six hours' distance.

The geographic-demographic situation could be used as follows in planning health services: if isochrone maps drawn for existing facilities reveal that significant populations live outside the maximum acceptable time from certain types of health services, then these populations would require coverage by new facilities. Mobile units might be chosen to provide this coverage if the roads, pattern of population concentration, and the considerations to be discussed below would so indicate.

#### Type of Health Service Desired

The second consideration in deciding between stationary and mobile health services is the type of service desired. Health services can be listed as: primary comprehensive care, specialty consultation, general hospitalization, specialty hospitalization, chronic extended care, basic preventive services, and emergency services. Different types of services require alternative qualities: availability *vs.* periodicity, greater *vs.* less importance of speed, simple facilities *vs.* complex facilities, and highly-trained personnel *vs.* simply-trained personnel. Stationary facilities best provide some of these qualities, whereas mobile units can supply others. A discussion of each type of health service will illustrate the importance of matching the service desired with the delivery system in terms of these qualities.

The prime quality required by primary comprehensive services is availability. Primary care—the general practitioner, internist, or pediatrician, whether in solo or group practice or at a comprehensive health center—is the first line of defense for the sick person and must be accessible at all times. For this reason, mobile units which are characterized by periodic visits rather than constant availability are inappropriate to primary comprehensive care. The present shift in Central America from mobile to fixed primary facilities is an expression of this truth. The East African health center network for comprehensive care employs mobile units only as an alternative to no care at all for remote populations.

The hallmark of specialty services is highly-trained personnel. Such personnel can be used in mobile circumstances, as has occurred in Canada,<sup>16</sup> since there is no inconsistency between many types of specialty consultation and the periodic visits characteristic of mobile health. However, most specialists are wedded to complex diagnostic equipment. Though such equipment as x-ray units, intensive-coronary-care hardware,<sup>25</sup> or even catheterization laboratories, can be mobilized, the expense of such ventures must be calculated carefully.

Preventive services, including prenatal and well-baby care, immunizations, infectious disease control, chronic disease screening and health education, are generally periodic in nature and thus are well adapted to mobility. Actually, maternal-child health, including immunizations is often integrated with primary comprehensive care, and health education may take place in schools. However, mobility is not inconsistent with the delivery of these services. Mobile monovalent and polyvalent infectious disease control became basic to West Africa's rural health approach,<sup>35</sup> and

mobile monovalent and, more recently, polyvalent chronic disease screening has been a feature of American preventive medicine.

Hospital services, due to the complex facilities involved, are not adaptable to mobility (perhaps with the exception of certain military situations). Extended-care facilities for the chronically ill must also be stationary, though patients not requiring constant availability of care can remain at home, visited by mobile personnel. Emergency services are mobile in proportion to the amount of care which is provided before the patient is brought to definitive care at a fixed facility. The tendency toward such interim treatment is increasing in this country, and appropriately so, because the requirement for speed in emergency care is met by mobile services.

Mobile health units are characterized by the qualities of periodicity, simple facilities and, usually, simply-trained personnel. Health services fitting these qualities are deliverable by mobile units if the geographic-demographic situation is appropriate. However, a final decision on whether mobile units are preferable to stationary services in a given situation should be made on the basis of a cost-benefit analysis.

#### Cost-Benefit Factors

Health care systems have as their objective the delivery of more and better health services. Delivery systems should be evaluated by their effects on mortality, morbidity, and disability, but, if such measurements cannot be made, change in utilization becomes a useful yardstick. The measure of patient utilization of health services is appropriate to rural health systems, in which the chief purpose is the extension of medical care to populations which have poor access to such care. Therefore, in deciding between alternative rural health systems, determination of the utilization per

cost becomes a valuable tool. Utilization might be measured by the number of physician consultations, or the number of people screened for a particular disease, etc. Cost must include not only money, but also the manpower time consumed; in fact unavailability of certain types of manpower may be the deciding issue in some cases.

How do such factors relate to mobile units? If the geographic-demographic situation and the type of service required are appropriate to mobile units, a cost-benefit study might indicate which system—stationary or mobile—has the lower cost (money plus manpower time) for the benefits it yields (the utilization of the system). Multiphasic screening would be an ideal candidate for such a study, since it is a service adaptable to both a stationary and a mobile medium, and has easily measurable benefits, *i.e.*, the number of people screened. The decision between mobile and stationary specialty consultation is amenable to such analysis, also, though the determination of cost would include the problematic factor of specialist travel time.

The analysis is relatively easy if the mobile and stationary systems yield equal benefits, with the difference being in the costs. Difficulty arises when the more costly system yields greater benefits, and one must decide whether the additional benefits are worth the extra money spent.<sup>9</sup> For example, coronary-care mobile units, or any service-providing ambulance system, may save a certain number of lives at a greater money and manpower cost when compared with a simple emergency transportation network. And, as the Central American example will illustrate, a system of fixed comprehensive health centers can be more costly, but also more beneficial, than a traveling dispensary arrangement.

The manpower cost of one PUMAR mobile unit visiting ten Central American vil-

lages is the cost of one doctor, one auxiliary nurse, and one sanitary inspector. The manpower cost of fixed health posts serving the same ten towns would be ten auxiliary nurses. It is difficult to compare the cost of one doctor plus two aides with the cost of ten auxiliaries. It might only be said that a physician's training lasts seven years, whereas auxiliaries are trained in a few months, and that the supply of potential auxiliaries is greater than the pool of potential rural physicians.

The money costs of the two health care systems vary among the Central American countries, but average figures can be used. One mobile unit costs about \$25,000 per year, including salaries, medicines, gas and vehicle maintenance.<sup>39</sup> The initial cost of the vehicle is \$4,500. A health post costs about \$10,000 to build and \$6,000 per year to maintain.<sup>41</sup> For ten rural towns, then, a mobile system would cost initially \$4,500 and \$25,000 per year, where as a stationary system would cost \$100,000 to construct and \$60,000 per year. The fixed infrastructure, then, has a far higher initial cost, and more than double the maintenance cost, as compared with the mobile system.

It was noted earlier that Central American fixed health establishments are four times as beneficial as mobile units in terms of utilization rates. Over a five-year period, ten health posts would cost \$400,000, whereas a mobile unit covering ten villages would cost \$130,000. Thus, a system of fixed establishments is three times more costly, but provides four times the benefits of a mobile system. This crude example demonstrates how cost-benefit analysis can be used to help in deciding between two health delivery systems. However, the estimation of benefits cannot be a completely quantitative process; qualitative and even subjective elements must also appear in the cost-benefit equation. Taking into account these nonquantitative aspects for the

Central American case, the benefits of the stationary health infrastructure in delivering reliably accessible curative and preventive services clearly outweigh the disadvantage of the greater cost. The quality of constant accessibility is fundamental to primary comprehensive care, and that is precisely the need which mobile units cannot fulfill.

### Conclusion

We have tried to illustrate various types of rural mobile health units and to examine some factors to be considered in deciding whether to bring health services to the patient rather than requiring the patient to travel to the services. First, the geographic-demographic facts must be sought, and these may lead one to the conclusion that mobile units are necessary for any utilization of health services to take place, or that mobile units are at least one feasible way of providing services. Second, one must determine whether the type of health service desired is compatible with the inherent qualities of mobile units, *i.e.*, periodicity, simple facilities, and, usually, simply-trained personnel. Finally, if on the basis of the above considerations mobile units are a reasonable answer to the health delivery problem, a cost-benefit study should be done to determine whether a mobile system has a higher benefit-to-cost ratio than a system of fixed services.

Though mobile units have great potentialities in rural areas, especially in certain aspects of preventive medicine and emergency care, the mobile concept must not be embraced without a thoughtful analysis. Often stationary medical services with good transportation systems can accomplish far more—albeit in a less dramatic fashion—than mobile units.

### References

1. Adler, J. J., Bloss, C. M., and Mosley, K. T.: The Oklahoma State Health Department mobile

multiphasic screening program for chronic disease: Part I. *Amer. J. Public Health* 56:918, 1966.

2. Berman, E.: Personal communication.
3. Braff, E., and Winklestein, W.: Field treatment of trachoma in North Vietnam. *Public Health Rep.* 67:1233, 1952.
4. Canton, J. A. Director of PUMAR in Nicaragua: Personal communication.
5. Discusiones Tecnicas: Servicios de salud en areas rurales. *Boletin Oficina Sanitaria Panamericana* 44:6, 1968.
6. Duncan, J.: The flying doctor service of Africa. *World Med. J.* 13:102, 122, 1966.
7. Falk, I. S.: Health in Panama: A Survey and a Program. Prepared for the Government of Panama, 1957.
8. Federation of Malaya: Report of the Medical Department for the Year 1957. Kuala Lumpur, Government Press, 1959.
9. Fein, R.: Problems of Assessing the Effectiveness of Child Health Services: Economic Aspects. U.S. Department of Health, Education, and Welfare, Office of Program Coordination, 1967.
10. Fendall, N. R. E.: Planning health services in developing countries. *Public Health Rep.* 78: 977, 1963.
11. Hagberg, C. J.: The Cape Town obstetric flying squad. *S. Afr. Med. J.* 30:1140, 1956.
12. Health and Sanitation Projects Supported by the Agency for International Development in Fiscal Year 1965. U.S. Agency for International Development, July, 1964.
13. Informe de labores del Ministerio de Salubridad Publica. Costa Rica, Ministerio de Salubridad Publica, 1962.
14. Jones, S. A.: The mobile medical unit in colonial work. *J. Trop. Med. Hyg.* 53:23; 58, 1950.
15. Kershaw, J. D.: Experiment in Africa: The rural health services of Kenya. *Medical Care* 1:52, 1963.
16. Kilsdonk, R.: Travelling clinics bring care to Cardston. *Canad. Hosp.* 43:39, 1966.
17. King, M.(ed.): Medical Care in Developing Countries. Nairobi, Oxford University Press, 1966.
18. Lopez-Vidal, E.: Health care for the dispersed rural population. *Boletin Oficina Sanitaria Panamericana*, English edition, Selections from 1967, 1-7.
19. Memoria Anual, 1966-67. El Salvador, Ministerio de Salud Publica y Asistencia Social, 1967.
20. Methodology of planning an integrated health programme for rural areas. Geneva, World Health Organization Technical Report Series, No. 83, 1954.
21. Mobile industrial medical clinics. *Industrial Med. and Surg.* 23:545, 1954.
22. Mouchet, R.: The Foreami. *Trans. Roy. Soc. Trop. Med. Hyg.* 44:483, 1951.

23. McLetchie, J. L.: Medical field units in Nigeria. *Trans. Roy. Soc. Trop. Med. Hyg.* 48:156, 1954.
24. Pan American Health Organization staff members: Personal communications.
25. Pantridge, J. F., and Geddes, J. S.: A mobile intensive care unit in the management of myocardial infarction. *Lancet* 1:271, 1967.
26. Plan Nacional de Salud Publica, 1958-1963. Honduras, Ministerio de Salud Publica y Asistencia Social, 1958.
27. Plan Nacional de Salud Publica, 1962-1970 (Preliminary). Panama, Departamento de Salud Publica, 1963.
28. Prince, J. H.: Flying doctors of the Australian outback. *New Eng. J. Med.* 252:706, 1955.
29. Programa de Salud para la Republica de Guatemala, 1965-69, Guatemala, Consejo Nacional de Planificacion Economica, 1965.
30. El Programa Movil de Salud para Poblaciones Rurales. Costa Rica, Ministerio de Salubridad Publica, 1967.
31. Programas de Salud y Progresos Registrados, 1964-66, Nicaragua, Ministerio de Salubridad, 1966.
32. Roemer, M. L.: Rural health programs in different nations. *Milbank Mem. Fund Quart.* 26:58, 1948.
33. Roemer, M. L., and Anzel, D. M.: Health needs and services of the rural poor. *Med. Care Review* 25:371, 1968.
34. Salud en El Salvador, 1962-1965. El Salvador, Ministerio de Salud Publica y Asistencia Social, 1965.
35. Sanner and Massequin: Le service d'hygiene mobile et son oeuvre. *Bulletin Medical de l'Afrique Occidentale Francaise*, special issue: 11-16, Jan. 1954.
36. U.S. Department of State circular from the U.S.A.I.D. Regional Office for Central America and Panama, July 14, 1966.
37. Vickers, A.: The Royal Flying Doctor Service of Australia. *World Med. J.* 10:171, 1963.
38. Vintinner, F. J.: A mobile rural health services program in Central America and Panama. *Am. J. Public Health* 58:907, 1968.
39. Vintinner, F. J., U.S.A.I.D. Public Health Advisor for Central America and Panama: Personal communication.
40. Waddy, B. B.: Rural health services in the tropics, and the training of medical auxiliaries for them. *Trans. Roy. Soc. Trop. Med. Hyg.* 57:384, 1963.
41. Waddy, B. B.: Organization and work of the Gold Coast Medical Field Units. *Trans. Roy. Soc. Trop. Med. Hyg.* 50:313, 1956.