BIBLIOGRAPHIC DATA SHEET

1. CONTROL NUMBER
PN-AAJ-692

2. SUBJECT CLASSIFICATION (695)
ND00-0000-0000

3. TITLE AND SUBTITLE (240)
The cost of primary health care

4. PERSONAL AUTHORS (100)
Gaspari, K. C.

5. CORPORATE AUTHORS (101)

6. DOCUMENT DATE (110)
1980

7. NUMBER OF PAGES (120)
34p.

8. ARC NUMBER (170)
657.832.G249

9. REFERENCE ORGANIZATION (130)
Gaspari

10. SUPPLEMENTARY NOTES (500)

11. ABSTRACT (950)

12. DESCRIPTORS (920)
Cost analysis
Health services
Accounting
Expenditures
Health
Primary health care

13. PROJECT NUMBER (150)

14. CONTRACT NO.(140)
AID/OTR-147-80-84

15. CONTRACT TYPE (140)

16. TYPE OF DOCUMENT (160)

AID 590-7 (10-79)

PN-AAJ-692

THE COST OF PRIMARY HEALTH CARE

December, 1980

The Cost of Primary Health Care

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December 1980
Order No:
AID/OTR-147-80-84

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The purpose of this work is to address the deceptively simple question: "What is the cost of primary health care?" As evidenced by the content of this paper, the answer to this question is neither simple in definition, in estimation, nor in evaluation. To establish a common starting point, primary health care is defined; here is stated not one, but three definitions of primary health care -- basic, comprehensive, and selective basic. Thus, the cost question is already a three-pronged question.

The provision of primary health care rests heavily on the development strategy and the level of development within a country. (In essence, comprehensive primary health care encompasses the development of all segments of the economy.) Whether or not the infrastructure that is necessary to deliver primary health care already exists in the country has vastly different cost implications for health care projects. Two primary health care projects, alike in all respects (objectives and philosophy) except for the countries in which each is implemented cannot cost the same. Why? First, what are the needs of the population, i.e., what level of health care services has this population previously received? If a population has previously received no care, then changes in mortality and morbidity may be effected at minimal cost and effort. For example, in such a case, one health hut may have a significant impact on the village's health. For populations that have received some minimal level of health care, additional resources are needed to see a like change in morbidity and mortality. In short, the cost of bringing about a decrease in morbidity and mortality rises as the population is exposed to increasing amounts of health care.

Secondly, what is the current structure of the health services sector? If no such structure exists, i.e., if the country is lacking this crucial infrastructure, then the development of such a structure is a cost of delivering primary health care and must be included in all calculations. Likewise, if the existing infrastructure must be expanded to meet the demands placed on it by the new (or expanded) primary health care program, then these costs too must be included in the cost of the primary health care program. The Ministry of Health is not the only limiting infrastructure; transportation, personnel, education, foreign trade, domestic manufacture are all elements of the infrastructure that is crucial to the delivery of primary health care. In short, there are many inputs into the production of primary health care. Should any of these inputs become nonexistant or grow scarce, an infrastructure bottleneck has developed that must be alleviated for the health care project to be successful. And, this alleviation of bottlenecks is a cost item for the primary health care project.

Thus, the production of primary health care produces not one, but many outputs. First is the distinction between the actual health services themselves and training, infrastructural development, public health education, and sanitary facilities. Even within the health services themselves many outputs are produced. First, there are diagnostic, curative, and preventive services. Even within the curative sector, a multi-product output is produced. The resources needed to cure vary dramatically depending upon the age, sex, general health of the person, and other disease-specific characteristics. Obviously, the actual cost of providing primary health care will vary directly with these multi-product outputs.

In estimating the cost of primary health care projects, care must be given to invisioning "the world" once the project has become a reality. Will either the demand for inputs into the project or the actual success of the project significantly alter "the world"? For example, will the increased need for building materials for Health Huts lead to a shortage and hence a rise in the price of such input materials? Obviously such increases in the price of materials would need to be budgeted into the project.

Lastly, what is the time horizon of the project? The cost of a one-shot primary health care project aimed at preventive care, e.g., an immunization program, will be vastly different from the establishment of a permanent primary health care project. And, is the permanent project to be self-sufficient or continue to be funded for its duration? These questions must be addressed before the concept of cost has any relevance.

The above provide the general framework guidelines for the planner. The last section of this paper applies these guidelines to the Sine-Saloum project to illustrate the deficiencies and common mistakes of the costing procedure. Most of these deficiencies are not inherent to the project of the planner, but arise from a misperception of what is a cost and how it should be valued. It is hoped that this paper provides a logical thought process that will aid the planner in estimating cost. By the end of this paper, it is anticipated that the reader is as convinced as is the author that the search for a single dollar estimate of the world-wide cost of primary health care is a misdirection of energy that could lead to a serious misallocation of world-wide resources.

Primary Health Care: Function, Scope and Input Mix

In its broadest definition, primary health care encompasses improvements in family planning, nutrition, sanitation, and water supply as well as personal health services.

Primary Health Care programs include, in general, the following elements:

- prenatal care and obstetrical assistance; care of mothers, new-born infants;
- family planning information and services, including convenient access to pills, condoms, and voluntary sterilization, and advice on the health benefits of birth spacing and delaying motherhood until women reach their twenties;
- childhood immunizations and certain other vaccines;
- basic medicines such as oral rehydration packets, eye ointment, certain oral and topical antibacterial agents, and antiparasitic medications, as appropriate;
- first aid for emergencies and minor trauma;
- health education

The primary care system may, however, be defined in terms of its functions which include: the assessment of total patient needs; the creation of a plan to meet those needs and a determination of the input mix to meet these needs; the provision of continuous care and evaluation of the effective coverage of such care; and lastly the provision of health maintenance and disease prevention.

Faced with the vast number of health care problems in developing countries one becomes aware of limitations. Since all health care problems cannot be attacked simultaneously, the specific mix of p h c services that is most feasible and necessary in a given country will vary. A country's particular health problems as well as its own limitations define the feasible functions of primary health care program. These functions may be single-purposed preventive or curative or be viewed simultaneously as an input and output of the development process. A.I.D.'s strategy for improving the health of the poor majority in low-income countries has stressed the following key components: broad community-oriented networks to provide low-cost primary health care, including maternal and child health, nutrition, and family planning services; improved water and sanitation; selected disease control; and health planning. Again, it should be stressed that any particular health care program may contain one or any combination of the above elements and it is the first task of the health care planner to determine a set of functions for the particular program that is feasible and desirable.

Provision of Services

In planning for the provision of primary health care, consideration must be given to the scope and range of services offered, as well as the input mix necessary to provide given services for the specified population. Various factors need be considered in this planning phase:

(1) What is the disease pattern in the project area?

(2) What is the current health services structure, i.e., what resources are currently utilized by the health care system?

(3) What additional resources exist that can be utilized by the health care system? (1)

Answering the first question causes one to implicitly choose between comprehensive or basic primary health care. Comprehensive health care, the goal declared at Alma Ata,

> "encompasses development of all segments of the economy, ready and universal access to curative care, prevention of endemic disease, proper sanitation and safe water supplies, immunization, nutrition, health education, maternal and child care and family planning." (2)

Obvious resource limitations preclude the achievement of this goal on a universal basis in the near future.

Basic primary health care, on the other hand, is targeted toward a specified goal/goals, which are to provide health workers and establish clinics for treating illnesses within a population. (3) Although, the majority of primary health care projects currently undertaken can be catergorized as basic primary health care, this category covers a wide spectrum. For example, Walsh and Warren advocate the use of selective primary health care which, based on high morbidity and mortality and the feasibility of control, selects a number of diseases for prevention in a clearly defined population. The philosophy here is simply that service should concentrate on a minimum number of severe problems that affect large numbers of people.

The distinctions among comprehensive, basic, and selective basic primary health care rest not only on service coverage but also upon the target population. These target populations vary not only with respect to health needs, disease, age, sex, but also in the rate of population change. The function of the project must, therefore, be defined in terms of changing numbers of persons involved rather than a constant population. Again, the costs of providing primary health care depend upon this age-disease-sex mix, combined with locale and the rate of change in the numbers of people to be served.

- What is the current health services structure?

- What additional resources exist that can be utilized?

Answers to these two questions cause a redirection of attention to the factors that produce health care. Specifically, what facilities and personnel exist, do additional resources exist, and can these resources be substituted for the more traditional (hence, typically scarce and oftentimes inefficient) inputs, focuses our attention on the actual production function for health care.

In an excellent survey of the historical underpinnings, Oscar Gish (4) alerts us to one of the lasting legacies of colonialization, i.e., the imposition of traditional health care delivery systems on developing economies/societies. The past independence period saw a continuation of the type of health care systems in operation during the days of colonial rule.

Most hospitals and some of the other health care facilities in developing countries have been built on patterns evolved in and adapted to developed countries. Since buildings, equipment, and facilities together with their maintenance constitute an essential (and expensive) element of the health care program, the development of such resources must be planned in light of "health sector objectives" with a view toward serving the objectives of the health care program.

> From the point of view of investment planning, physical facilities clearly represent a capital item. In planning physical facilities, however, it is important to take into account that the physical plant by itself is not a

> producing unit. The output of health care facilities is patient care or other health services, and this requires personnel and consumable supplies as well as capital. In a number of developing countries (although not only in such countries), construction of physical facilities independent of considerations of staffing and operation has meant that expensive capital resources were wasted because appropriate personnel to staff them were unavailable. In other cases, failure to make adequate budgetary provision for operating expenses resulted in similar waste, even when the facilities might have been put into full operation by recruiting available personnel and by purchasing available supplies." (5)

The function of primary health care alerts us to the need to replace traditional methods of delivery. In the context of developing countries, health care is seen as the means to development and as such, is a process that must encompass the entire population. Hence, "the new health care strategy which has emerged is based upon the provision of primary health care for all, although provision is perhaps not quite the right word, as the new approach calls for popular participation in the creation and implementation of health campaigns and health services or health "by the people" as opposed to health "for the people." (6)

Thus, the emergence of a new production function for health care services has arisen that includes as inputs village health workers, rural health care units, paramedics, public health educators, indigenous practitioners rather than urban hospitals and Western-trained physicians. A rethinking of other Western-based inputs, in particular a Western technology, must be undertaken in light of this new production function.

With respect to the health services inputs, alternatives exist for the developing countries: (1) produce these traditional health products indigenously and thus eliminate the outflow of foreign reserves and curtail the foreign exchange problem; or (2) reconsider the traditional production function for health care, and consider substitute inputs. The first option has been within the realm of the "input - substitution versus export-promotion" debate for 20 years and remains unanswered in general. The second option remains unanswered on empirical grounds. While one's intuition would favor the use of cheaper substitutes in terms of facilities, personnel, and technology, continual experimentation with alternative health care delivery systems is necessary to know how a given system may perform in a given environment. As more operations research is conducted in this area, the differential outcomes of such substitution schemes can be evaluated -- taking us from the realm of unsubstantiated normative statements to verified positive results.

The Output of Health Care

As stated above, many intermediate questions remain before addressing the main question "What is the cost of primary health care?" The most fundamental of these intermediate questions is "What is the output of primary

health care?" It is impossible to determine the cost of producing a good, until the good itself is defined.

Whether or not primary health care produces a single or multi-product must first be resolved. For example, Walsh and Warren measure output of health care programs as changes in mortality or deaths averted, a single-dimensional product. Later in their work, the authors agree that secondary outputs were produced by these intervention programs.

Berry (1970) in explaining variations in the cost of producing hospital services analyzes why hospitals might be operating on different cost curves. One of the answers Berry poses is that hospitals are an extreme case of multi-product firms.

> General hospitals by their very nature are engaged in the production of more or less complex scope of services. Medical and surgical services are sufficiently dissimilar to generate differences in costs per patient treated or per patient day in the hospital. Complicated surgical services and simple surgical services vary, usually in the cost of production. If hospitals produce different scopes of services or different proportions of the service of similar scope, then variation in complexity or product mix could be represented by (different average cost curves). (7)

In theory, the distinction is apparent. Yet how can the researcher resolve this problem of multi-product output? Berry provides an excellent review of methods used in the U.S. hospital cost studies. (8) If a hospital is, as Berry maintains, "an extreme case of a multi-product firm" (9) then its output cannot be represented by a single measure.

In Berry's terminology, hospital cost is determined by the output mix and the input mix, where output mix refers to mortality, morbidity decreases, cases successfully treated, births, outpatient visits, student nurses, interns trained, etc. Input product mix refers to the complexity of each case depending upon age, sex, disease -- specific (and disease interaction) characteristics.

If primary health care rather than U.S. hospital care is to be modeled, the output mix varies considerably from the above specification. A work by D. Dunlop (1973) transforms and expands the U.S. specific models to developing countries and the issue of the multi-product of primary health care.

Dunlop focuses on sectoral considerations. Within the entire health services industry itself, there exists a curative and preventive health sector, each with its own production process, resource requirements, and output. As regards primary health care, one can review the function of primary health care programs to establish how many sectors exist, e.g. preventive, curative, community-education, etc. The objectives of each sector coupled with the provision of services identifies the production function.

> In the case of preventive care, Dunlop (10) states that an output concept is readily derived from the rationale for providing the service, i.e., reduction in disease -- specific mortality and morbidity rates. A larger measure of output would also include multiple social and economic impacts resulting from the programs. Traditionally these have been measured in terms of the single variable per capita GNP (11).

Curative health care by comparison is a dual functional activity in that both diagnostic and treatment services are rendered. The definition and measurement of output now becomes a more complex issue. (12)

The output measure should be derived directly from the stated function of the project and provision of services. In general, answers to:

1. Who is the target population and why;
2. Will the entire population require the same set of inputs or is this set determined by other characteristics, including sex, age, geographic, and disease -- specific characteristics;
3. Could the population have a range of reactions to the same set of inputs

focus attention not only on the recipients of the input services, but also on interrelationships between inputs and recipient characteristics.

Given that the purpose of health services is "to restore the capacity of an individual to resume his major activity" (13) only persons who are able to resume their major activity can be considered as output. Thus, in defining output, we must subtract those who die or are unable to resume their major activities from the general population seeking treatment. (14)

The contribution of Dunlop's work is twofold. First, the multi-product aspect of output is analyzed by considering the difference in producing in-patient and outpatient care. Second, the non-homogeneous nature of the population to be serviced is incorporated to account for case-mix, and therefore to account for the cost differences of servicing various segments of the population.

The function of primary health care must be clearly stated so that intermediate outputs are not confused with primary inputs. If the function of a primary health care project is to train indigenous workers to man rural health care centers, then the trained workers are an intermediate product and both their product, function and the costs of producing them must be considered. If, however, the function of the primary health care project is to use rural health care centers [illegible] basic health care (with the

ultimate output being "the resumption of normal activities) then personnel is no longer an intermediate product but a primary input. As such, it is a constraint to be considered.

Evaluation of Costs

Scarcity of resources and the innumerable social needs of developing countries increase the need for developing an accurate measure of program costs. As stated above, however, cost itself is a meaningless term and must firstly be defined before it can be measured.

Be defining the cost of a health care project in terms of its function, relevant costs can be measured and identified. Costs vary among projects since costs depend upon the purpose of the project and the purpose for which the cost data is desired (15). One approach is to examine only those costs which occurred because of innovative or experimental health services; existing ancillary services are not considered to be a cost item. Another approach is to focus directly on operating as opposed to investment costs. Still other estimates include project costs as well as the costs of increased utilization of pre-existing health care facilities. The crucial step in cost measurement is to determine what are the specific health services whose costs should be identified; such identification is reduced to a simple task once the function of the project has been defined.

The method of functional analysis of health care costs as developed by the Johns Hopkins' Department of International Health entails an accounting procedure that highlights the distribution of health center costs by functions and activities. Cost figures are derived from each function "by cumulating the money value of all resources, including the workers' time, utilized in performing the various activities within each function." (16) A distribution of staff time was obtained from work sampling while expenditure information was collected directly from health center records. The cost information was then cross-classified by item and function. Items consisted of: capital expenditures, recurring expenditures on fixed items, recurring expenditures as variable costs, and salary and staff allowances. Functions included: medical relief, M.C.H., family planning, C.D.C. and Environment and Sanitation. The functional table was further disaggregated by separately considering work within the primary health care center itself versus work in the geographic area assigned to the primary health care.

The analysis can also be expanded to include the cost of project expansion or substitutability of inputs. For example, the authors consider the growing emphasis on providing family planning and MCH services at the PHC subcenters. Calculations indicated that Auxiliary Nurse Midwives (ANM) provide most of the family planning services at the subcenter level. By using a profile of the ANM's activity time, all expenditures related to subcenters except drugs and supplies were apportioned to the various functions carried out there. The capital and recurring expenditures were calculated using the same procedure as for the entire PHC; salaries were distributed on the basis of proportionate

time spent on PHC staff carrying out subcenter activities. (17) The results of this counterfactual exercise suggest that in some regions subcenter MCH services are as costly to provide as those in the PCH headquarters while in other regions subcenter services are relatively more expensive than PHC services. Then, by comparing the subcenters' activities and their proportions of total expenditure with the PHC headquarters activities and expenses it was determined that doubling the number of subcenters was less costly than adding another PHC headquarters.

Throughout their work the authors subdivide activities solely according to function and then compare the cost of providing the function by alternative means. If the function were constant, i.e. providing MCH in a number of different ways, or giving injections by using various personnel or center-subcenter combinations, then the functional analysis would be a powerful tool. Instead, the majority of comparisons are made between the cost of providing MCH versus PHC or family planning services. Although the authors themselves have defined functions in terms of homogenous activities, the question of non-homogeneous output, i.e. the multi-product output analyzed above, looms in the foreground. The value of functional analysis lies in comparison of these homogeneous activities where homogeneous is defined in terms of function.

Age, sex, and disease -- specific characteristics can be incorporated into this concept of function without overcomplicating the analysis. In fact the counterfactual example of expanding family planning services through MCH subcenters or PHC headquarters employed functional analysis while implicitly holding multi-product differences constant. Thus, this was one of the more powerful analyses of this work.

Costs Over Time

One aspect of function that must be considered is the time span of the project. Surely, the time function of a primary health care program varies between a one-shot immunization project and an engineering and sanitation project. The time dimension ushers in an expanded concept of cost that must differentiate between period costs and multi-period or continous costs. Joseph and Russell (1979) view the development of broadly distributed PHC systems as providing a piece of permanent infrastructure that can be used by other health care activities. The example cited is that of an immunization program that must not only reach the population on a one-time basis but also creates the demand for a sustained mode of access to the entire population at risk. The function of this program is now a continuous rather than discrete time period.

This expanded dimension of function directs attention to program maintenance and operational costs over time. Clearly not all of a program's costs will be recurrent, but those costs which will be recurrent must be costed on a continuous basis.

Why is this simple concept of recurrent cost absent from much of the health care cost literature and likewise from program budgets? Heller (1979) cites three fundamental reasons. First, the equating of development

expenditure with investment and recurrent expenditure with consumption has shifted priorities from continued support for current projects to initiation of new projects. Ironically, these 'new' projects will become next year's current projects and need recurrent fund support. Second, the amount of recurrent expenditure a project requires is a direct result of the function of the project.

> Thus a shift in the sectional composition of a public investment program may require an increase in recurrent expenditure in excess of the potential increase in public sector revenues. This does not reflect on the productivity of these projects, but simply means that the character and timing of their output flows may not lead to sufficient immediate growth in tax revenues to finance their recurrent costs. (18)

Third, in the choice of allocating scarce resources, governments are quick to cut recurrent expenditures without fully evaluating the consequences of cutting the flow of resources. In large part, Heller attributes exacerbation of the problem to external aid flows which enable a country to increase the level of its investment without directly encouraging the growth of recurrent revenues. The recipient country finds itself in one time period as the lucky recipient of targetted foreign aid and in the next time period in severe financial straits to continue or maintain the program.

Heller suggests various methods of educating public officials, planners, and donor agencies to see and acknowledge a program's recurrent expenses. One method he advocates is by calculating an "r" coefficient for a project which is merely a ratio of the project's net recurrent expenditure requirements to the total investment outlay. This "r" coefficient would vary both within and across sectors.

Why can't the average cost figure be disaggregated into recurrent vs. one-period costs? In this way functional analysis alerts the planner to next year's budgetary requirements as far as the recurrent items are concerned. This disaggregation of costs into one-period vs. recurrent categories will be further explained in the section on cost accounting. As Meed Over notes with respect to the Sine - Saloum Rural Health Care project in Senegal:

> In summary the recurrent expenditures....appear small from the aggregate perspective adopted by the project design team. However when we disaggregate those expenditures by budget category, we discover that their size is much larger relative to the categories to which they correspond. (19)

Over continues by stating that institutional rigidity and real need (i.e. recurrent financing) prevents the easy transfer of funds from one budget category to another. If funds are categorically earmarked then to maintain some balance costs must be categorically defined.

Barnum, et al (1979) mention another infrastructural aspect of each cost: costs vary according to mode of delivery, the organization of health institutions, the availability of related technology and the state of local

resource markets. International comparisons implicitly address this constraint when comparing costs. If a primary health care project alters this infrastructure, costs will be affected to varying degrees. The functional analysis of cost measurement described above assumes that a primary health care project can be instituted or expanded and it will have no impact on the overall infrastructural constraint that underlies the ability to provide inputs, or affects the costs of these inputs.

One remaining aspect of functional analysis remains to be addressed, that of complementary activities. So far, our analysis has been confined to a "per function" level. But, inputs can complement each other; and create a positive synergism. This synergism (leading to economies of scale) has been ruled out of the functional analysis framework. Theoretically it could readily be incorporated by redefining functions and considering interaction between functions. What must be firstly determined are these various interactions and their final output.

The Measurement of Costs

In actual dollars and cents terms, what is to be included in our cost measurement? To date, there is no adequate internationally acceptable definition of what constitutes health care expenditures and an even less acceptable definition exists for primary health care expenditures. The money costs of care comprise the expenditures for prevention, detection, treatment, rehabilitation, research, training, and capital investment in facilities. In many systems, money cost represents a part of the true cost as other costs must be borne by the individual. The health care consumer must meet time costs (and possibly loss of income), inconvenience costs, transportation costs. In many cases a tradeoff exists between program money costs and costs imposed on the consumer.

Once again, the function of the project must be reviewed in light of the project impact on the general environment. Are there externalities or spillover costs created by the project that have not been included? Does the project impose costs on other sectors of the economy and thus disrupt the general equilibrium? Here the planner is required to exercise foresight and anticipate project outcomes and impacts. Such indirect costs must be included in the projects' money costs.

While many inputs appear to be 'free' because they have been donated, an opportunity cost in terms the best alternative use of the resource is implicit in their use. If such inputs are 'tied' to specific projects, then their opportunity cost is zero for they have no other best alternative. Volunteer labour and donated facilities carry this implicit opportunity cost with them.

Another hidden project cost is that incurred in infrastructure creation, expansion, or utilization. As stated in the previous section, an infrastructure is a constraint on the project. If the project seeks to extend this constraint, the cost of expansion must be borne by the program. For example, if project supervision taxes the Ministry of Health staff and more workers must be hired or the Ministry expanded, the project should bear those costs. Likewise with other aspects of the infrastructure.

Due to the variability in project function, accompanying infrastructure, and sectoral imperfections, it is impossible to completely list all cost categories to be considered. What can be considered, however, are the conceptual elements of cost change. Four main factors contribute to cost increases: increases in the number of people covered; more units of care for existing recipients, i.e., increased coverage per person; more resource intensive units of care; and more expensive resources. The dilemma most projects face is that more than one of the above factors is present at any given time.

In an article on the variance analysis of cost accounting, Bashan, et al, (1973), provide a simple tool for isolating cost increases from specific factors. The total variance for a product can be decomposed into its components: price variance, quantity variance, and joint variance. For example, the total cost of a project can increase because of an increase in the number of persons covered, an increase in the per person cost of coverage, and some increase due to both of these increases (20).

Economics or Diseconomies of Scale?

In a previous section mention was made of economies and diseconomies of scale. While most planners and economists "intuitively feel" that such economies and diseconomies exist, few empirical works have undertaken the testing of this intuition. Yeon (1979) by employing the techniques of regression analysis, presents one of the few cases of slight economies of scale in maintenance costs. Berry in two separate works systemmatically tackles this question with respect to the U.S. hospitals.

> The statistical analysis does provide insight to the factors affecting hospital cost: hospital services are produced subject to economies of scale but the absolute magnitudes are rather insignificant. (21)

The value of Berry's works liesin raising the possibility of economies/diseconomies of scale and points to an area that requires further investigation and research. While many planners 'intuitively feel' that economies/diseconomies of scale exist with respect to their particular projects, there is no conclusive empirical evidence on this topic.

Problems in the Measurement of Costs

The previous section ended where this section begins -- by noting some of the problems in measuring the costs of primary health care. If one were less than selective, this entire paper could be devoted to stating the problems encountered in cost measurement. The focus of this paper is on both the non-obvious and yet fundamental problems.

Variance analysis was introduced above as a means to identify changes in cost. One shortcoming of this analysis is its inability to answer the question of why the factors in the initial cost model have changed. Thus, the analysis serves a descriptive role in explaining the how, but cannot explain why. One advantage of variance analysis is that it can be used to forecast changes. A problem encountered in cost measurement is that an estimate of predicted cost

is often needed in expanding a pilot project. Here, variance analysis can be a forecast tool (22).

Klarman (1974) tells us that the estimate of costs poses no special difficulties; one merely prepares a budget in terms of the market prices of inputs which may be adjusted by shadow prices if warranted. (23) When it is warranted, how to estimate shadow prices, and what "social good" lies behind the shadow price concept are questions that open a Pandora's box of problems in estimation. If the market price of inputs is not in keeping with their true value, the opportunity cost of the inputs can be used as a proxy for shadow price. In the case of imported goods that are either donated or subsidized, the program cost should include all costs borne by the recipient. If the subsidiary is borne by a foreign nation or agency, then the recipient should not consider these costs in the project calculation (24).

The input-output analysis estimation of costs rests on the assumption of constant returns to scale, i.e., proportional costs, and certainty. The first issue was already addressed in terms of economies and diseconomies. The issue of certainty poses new problems. For example, as the size of a project increases, and it requires greater quantities of inputs, pressure on these input markets may cause factor costs to increase. Conversely, in the early phases of a program, unit cost is likely to be higher than later on, as people become more proficient in their jobs. In this way, people's learning curve (25) causes costs to fall over time. Whether either of these cases exists can be established on a project-by-project basis. The first case, the impact on factor markets, requires large increases in demand for inputs relative to the available supply; the planning phase of the project should incorporate this question. Likewise the second case of decreasing costs can be anticipated given the level of expertise of the personnel.

Time, however, adds a new dimension to the question of certainty for time ushers in new technology, factor price changes not traceable to any one project, changes in patient mix, changes in treatment, and overall changes in the infrastructure. To answer the problems posed above would be to forecast with perfect certainty or accuracy. Instead the planner can focus attention on intertemporal comparison of costs.

A final aspect of uncertainty is the concept of readiness and capacity. Not only are costs the result of activity and the passage of time, but they are also related to volume of activity and the idea of readiness. Attempts to measure such readiness and capacity costs on a per patient basis, Macdonald (1973) are limited to the various procedures of a single health care category that can be finely described. It is not anticipated that this procedure could be adapted to account for the wide range of activities of a primary health care unit. The problem of planned excess capacity does, however, exist on this level also and should be addressed by the planner and future researchers.

The most pervasive problem of cost measurement is described by Berry (1967): "Cost analysis is often complicated by variations in product quality and by inability to segregate costs by product for multi-product firms." (26)

Although this problem of the determination of costs when product-mix and multi-product output is widely documented, the literature is barren with respect to any resolution.

U.S. hospital cost studies provide us with various approaches taken to control for rather than specifically identify multi-product costs. Results indicate that yes, indeed hospital costs do increase with the complexity of services, but there is no clear identification of the way in which costs increase or what factors are responsible. (27)

The approach of most works clearly suits the needs of identifying the sources of cost difference, but requires data sets that are impossible to obtain for primary health care projects. Another technique was adopted by Walker and Gish (1977) in their cost-effectiveness evaluation of mobile and primary health care units in Botswana. Details of all patients were recorded by questionnaire and the details of diagnosis, treatment, and disposal were completed by the patient's doctor. (The purpose of the Walker and Gish study, i.e., a cost-effectiveness analysis, varies strongly from the present task of identifying cost items). Conditions were classified according to the effectiveness of diagnosis and treatment and the outcomes if contact had not occurred were considered. Total costs of providing either mobile or primary health care contact were obtained from the Ministry of Health.

The patients seen by the mobile units were similar with regard to age, sex, diagnostic grouping, and distance traveled for care. Thus, the services delivered were similar by case-mix. Next, the patient outcomes were viewed by the effectiveness of drug and treatment and compared with the effectiveness of the fixed clinics. Comparisons were made along the following lines: average cost per patient contact; average cost per effective patient contact; and average cost per referred patient.

Thus, comparisons can be made with respect to the costs of different programs answering the same needs. In calculating these various per patient costs, Walker and Gish merely divide total cost by the appropriate population number. For projects that address the same function, the Walker and Gish method appears to provide a basis for comparison of cost-effective methods of delivery. It does not, however, clearly address the issue of allocating costs on the case-mix and multi-product basis.

The problem of allocating costs in the health field is really one of allocating costs in the multi-product firm. Economic theory offers a starting point for our thinking (28) if not for application.

The formulation of this costing of the multi-product firm can also be translated into linear programming analysis or input-output analysis. In a previous section, the multi-product concept of health developed by Dunlop (1973) was reviewed. By completing our description of this analysis we see that his linear programming analysis can estimate the total cost for any given activity in any of the health functions. This merely involves allocating the total cost among the several activities (29).

The importance of this specification lies in the fact that the total cost of activity includes the costs of the persons who are not treated successfully and that the model can change between time periods. Here, the general equilibrium effects of intervention can be incorporated into the model by respecifying the technology matrix (30), the set of input and factor prices, and the set of inputs for the new time period.

Since factor prices and input constraints can be obtained without much difficulty, attention focuses on the technology matrix. How is this crucial piece of information obtained? As evidenced by Dunlop's estimation of the technology matrix for Uganda, this can be accomplished with a minimal amount of data (31); the true cost of these estimations lies in the expertise to develop such a model.

Division of Costs

The accounting application of cost principles is a handy and practical tool, as well as a logical thought process for the health administrator. Costs are primarily divided into three categories: (1) full costs; (2) differential costs; and (3) responsibility costs, and relate to three types of cost accounting. Full cost accounting measures the direct and indirect cost of not only producing goods and services, but also for any other activity that is of interest to management. Differential accounting estimates how costs, revenues, and/or assets would be different if one course of action were adopted as compared with an alternative course of action. Lastly, responsibility accounting traces costs to individual organization units, each of which is headed by a manager. For example, responsibility accounting would allocate the costs of a health care project to each of the sub-centers involved in the project. Since each type of costing can be applied to the health care field each is examined in detail. Table 1 is provided as a reference aid to the reader.

Full Cost Accounting

Full cost accounting addresses all the resources used for a given objective and includes, therefore, both direct costs that are specifically traceable to or caused by that objective, and indirect costs, or costs that are associated with or caused by two or more objectives jointly, but that are not directly traceable to each of them individually. (32)

At this point, a distinction should be made between direct and variable costs. If the cost objective is a product, many costs that are direct to that product vary with the volume of output. Anthony and Reese (1979) alert us to the distinction:

> the direct/indirect dichotomy relates to the traceability of costs to cost objectives, whereas the variable/fixed dichotomy relates to the behavior of cost as volume fluctuates. (33)

The calculation of indirect costs involves an allocation of costs incurred for several objectives. Just what the fair share of costs allocated to any one objective may be is related to a causal occurrence, e.g., a health

Table 1: Accounting Methods

	Full Cost		Differential Cost(DC)	Responsibility Cost			
Cost Concept	Direct	Indirect	Fixed(F)- invariant w.r.t. volume	Controllable,	Discretionary,	Engineered,	Committed
	relates to output	not traceable to output	Semivariable(S)-vary less than proportionately with volume	mgt. discretion by varying inputs/outputs	mgt. control by objective	given physical production	fixed in the short-run
		Includes joint cost overhead	Variable(V)-vary with volume				
			Includes $(F+S+V)_2-(F+S+V)_1=DC$ where: Period 1 vs. 2 is based on: input/output volume changes money/real price changes				
Measurement of Costs	Actual	Imputed	Actual or Estimated with respect to volume changes	Actual and Estimated Costs Designated by Responsibility Center Rather than Volume or Output			
Uses:	Financial Reporting Profitability Analysis		Facilitate Comparisons Narrow Realm in which decisions will be made	Designated for Management Control Process			

care project that requires close supervision and heavy time inputs on the part of the Ministry of Health should bear a larger burden of the administrative costs than a less supervisory-intensive program. In practice, payroll, personnel, material, space, and activity are often bases used to determine this fair share allocation. (34)

A further distinction should be drawn between the actual costs to produce a given product and costs that should have been incurred. In accounting terminology, this later procedure is called standard cost accounting. It merely assigns to each product a fixed amount of input that should be required to produce a unit of output, where the factor price of the input is priced at what it should be with respect to prices. (55) Obviously, such standard costs convert budgeting and forecasting into simple multiplication processes.

In allocating indirect costs, some fair share of the costs must be assigned to each product. While neither of these methods is applicable in the health care field, allocation on the basis of time spent on a given activity or some valuation of the end product, e.g., the benefits from averting various illnesses, could be used.

Full cost accounting is most useful: (1) in financial reporting; (2) in an analysis of profitability; and (3) in answering the question "What did it cost". (36) It should be noted, however, if some of the costs of production are indirect, the full cost of an objective cannot be measured with complete precision. In other words, there can be as many cost estimates as there are accountants. Discretion arises with respect to the following: (1) capital versus product costs; (2) the measurement of direct costs, i.e., are records kept in the same fashion in various projects; (3) the distinction between direct and indirect costs; (4) alternative allocation methods; and (5) assorted overhead measurement allocations.

Differential Accounting

Differential accounting brings in the concept of function that was developed earlier. Differential costs are costs that are different under one set of conditions than they would be under another set of conditions. These conditions are indicated in Table 1 by the subscripts 1 and 2. Full cost is the sum of direct and indirect costs; differential cost includes only those elements of cost that are different under a certain set of conditions. While full costs are calculated directly from accounting records, there is no comparable or systematic way of collecting differential costs. Also, full cost takes on the historical perspective of what the costs were. Differential costs always relate to the future, i.e., what would costs be under different scenarios.

To estimate differential costs, one must calculate total costs under varying assumptions, usually varying the volume of activity. Should: (1) the measure be based on inputs or outputs; and (2) the measure be expressed in money amounts or physical quantities? The choice of input versus output criteria rests on how one expects costs to vary. For example, input costs should be considered when comparing programs that produce the same amounts of health care, but do so by using different sets of inputs. Output measures would be more appropriate when considering the expansion of services. The choice of physical

or monetary volume measures rests on whether a physical change will leave monetary values constant. For example, will hiring 20 additional workers cause the wages of all workers to increase due to pressure on the labour market or will it leave wages at their previous level?

There are many reasons other than those connected with changes in volume for interperiod variations in cost:

(1) Input prices may change;
(2) Economies or diseconomies of scale will cause costs to change in other than a proportional fashion;
(3) The duration of a change in volume affects costs differently (temporary changes affect costs less than do permanent changes);
(4) Overall impacts of technology may cause changes in productivity.

Thus, the use of differential costs may be undermined by the presence of any of these other factors.

As indicated in Table 1, differential costs are broken-down into three categories: fixed costs which are invariant with respect to the volume or quantity of output; semivariable costs which do vary but <u>less</u> than proportionately with the quantity of output; and variable costs which vary proportionately with the quantity of output.

Although differential costs rarely provide the answer to any business problem (for one thing constraints are not taken into account), they facilitate comparisons and narrow the area within which judgemental decisions arise. With respect to the health care field, comparison of differential costs could facilitate decisions concerning project expansion, substitutability of inputs, or changes in coverage. Differential analysis allows one to look at aggregate cost changes given that a uni-dimensional variable, volume (however defined), has changed.

<u>Responsibility Accounting</u>

Responsibility accounting is specifically designed for the management control process. The essential characteristic of this accounting scheme is its focus on responsibility centers, or in our case, health care sub-centers. Hence, concern is with costs within a sphere of responsibility rather than per project or per output.

As Table 1 indicates, responsibility accounting cost concepts include the notions of controllable, engineered, discretionary, and committed costs. Controllable costs are those items whose amount can be significantly influenced by actions of the manager of a sub-center or in accounting terminology, the responsibility center. Engineered costs are items for which the right amount of cost that should be incurred can be estimated. Given the specification of a product, engineers can reasonably and accurately estimate costs. Discretionary costs, on the other hand, are cost items whose amount can be varied at the

discretion of the manager of a responsibility center; these are often called programmed or managed costs. Committed costs are the inevitable consequence of previous committments. These costs are noncontrollable in the short-run or until the committment can be changed.

The use of responsibility accounting is in comparing sub-center costs, not on the basis of volume, or output, but on the basis of their sphere of responsibility. Various health sub-centers could be compared on the basis of controllable or discretionary costs and management evaluations made on this basis. For our purposes, responsibility accounting plays a small role in the costing of health care and has, therefore, received little attention in the literature or in this work.

Function of the Cost Estimates

Gaspari, "The Costing of Primary Health Care", addresses the question of the function of the cost estimates, i.e., why are the cost numbers desired. Cost estimates are used to both budget for projects and to allocate funds among competing uses. The former purpose has been addressed up to this point. Gaspari, pp. 37-45, explicitly addresses the allocative role by comparing various project evaluation methodologies. Each methodology is explained in terms of its use, its advantages, its disadvantages, and its data requirements. While mastery of this section is essential before any allocative decisions can be made, that section is not duplicated in this work; the interested reader should reference the previous work.

An Example of the Cost of Primary Health Care: Sine-Saloum

How do the principles discussed in this paper relate to actual cost estimates? This section directly addresses this question by examining the estimate of the costs of providing primary health care in Sine-Saloum as a working example of the aforementioned concepts and principles. Here, no attention will be given to the "why's" or to the development of methodology. Instead, framework guidelines will be applied to the Sine-Saloum Project (37).

I: What is the function of this project in terms of:

- goals and objectives of the project
- scope, in terms of geography, population, and development
- inputs and utilization of existing infrastructure
- outputs
- duration

The stated objectives of the Sine-Saloum project are: (a) to establish a network of village health posts staffed and supported by community level personnel throughout the region; and (b) to improve and strengthen the support infrastructure of the Government of Senegal for services to health centers (38). The project is focused specifically on the Sine-Saloum region of Senegal and is to service the 880,000 rural persons in that area. The project has a four year

stated duration although the real objective of the project is to "establish self-supporting Health Huts in 600 villages" (39). Thus, project funding spans four years by which time it is anticipated that all Health Huts will be established and self-sufficient. (Those of you familiar with the Sine-Saloum project know the punch line: these Huts never became self-sufficient).

From the stated objectives there is an implied multi-product output of this project. First, health care is to be provided to 880,000 rural inhabitants of Sine-Saloum. From the report, the nature and extent of health care to be provided is unclear. This is a serious flaw in project design. Second, a health care delivery infrastructure must be developed and this was to occur through the establishment of Health Huts. Third, not only was an infrastructure to be developed, it was to be self-supporting. In fact, each Hut individually was to be self-supporting. These outputs must be considered as one unit because taken separately there is no rationale for the use of Health Huts as the most cost-effective way of delivering health care to 880,000 persons nor was it established ahead of time that the effective demand of the population for health care was sufficiently great to enable these Huts to become self-sufficient.

II. Will the project function as a pilot project or as an expansion project?

The Sine-Saloum project is an "all-or-nothing" project in that it is neither a pilot project nor was it preceeded by a pilot project. (This later point was mentioned in the evaluation report and one wonders how a project of this size and financial worth could be approved without a 'test run'!) Because the Sine-Saloum project will not be expanded, the appropriate choice of accounting method is full-cost rather than differential accounting. Full cost involves accounting for all the resources used for a cost objective. With respect to labour costs, both the quantity of labour time expended and the price per unit of labour time must be measured; the same holds for material costs.

III. Which costs should be included

At this point, a distinction should be made between direct and variable costs. If the cost objective is a product, many costs that are direct to that product vary with the volume of output. Costs are labeled indirect if it is impossible or infeasible to trace them to a product or if management chooses not to trace them to a product.Since the calculation of indirect costs involves an allocation of costs incurred for several objectives, just what the fair share of costs allocated to any one objective may be is related to a causal occurrence. For example, a health care project that requires close supervision and heavy time inputs on the part of the Ministry of Health should bear a larger burden of the administrative costs than a less supervisory-intensive program.

One of the main complications in the costing of health care lies in the joint or multiple-product nature of the output and the need to allocate to each of the joint products the costs that were incurred up to the split-off point in production. Inpatient costs might be allocated on the basis of hospital days per illness; outpatient costs could be allocated on the basis of diagnostic time

required for the "clinical case" of the illness. In this way, some formula could distribute indirect costs in a standardized fashion.

With respect to the Sine-Saloum project the costing of a multi-product output is further complicated by the fact that the products are so diverse: health care (itself a multi-product), a health infrastructure, and self-supporting business operations.

While full cost accounting is most useful in answering the question "what did it cost" it should be noted that if some of the production costs are indirect, the full cost of an objective cannot be measured with complete precision. Discretion arises with respect to the following: (1) capital versus product costs; (2) the measurement of direct costs, i.e., are records kept in the same fashion in various projects. (Here the Sine-Saloum project made a concerted effort to hire individuals who would comply with an accounting uniformity; this led to a poor choice of personnel when viewed under leadership criteria.); (3) the distinction between direct and indirect costs; (4) alternative allocation methods; and (5) assorted overhead measurement allocations.

IV: The Breakdown of Direct and Indirect Costs

The first breakdown of cost, therefore, occurs between direct and indirect costs. Grosse et al (1979) introduce a further division. This consists of:

(1) variable investment: one-time costs related to type and volume of activity

(2) fixed investment: one-time costs independent of the volume of activities ultimately to be achieved

(3) fixed operating: operating costs related to the time/duration of activities, but not to their volume

(4) variable operating: operating costs related to the duration and the volume of activities.

The following illustrates the breakdown:

	COSTS	
	DIRECT	INDIRECT
One-Time		
1. Variable Investment		
2. Fixed Investment		
Recurrent		
1. Operating		
2. Variable		

V: Recurrent Costs

The time dimension ushers in an expanded concept of cost that must differentiate between period costs and multi-period or continuous costs. This expanded dimension of function alerts us to program maintenance and operational costs over time, i.e. such items must be costed on a continuous basis.

This opens the door to numerous problems. First, how should the program account for these recurrent costs? Various alternatives exist: (1) The recurrent costs can be earmarked and projected over the life of the project and then, through the use of an acceptable social discount rate, the present value of this cost stream can be calculated. (Obviously, this procedure requires much computational time and many 'educated guesses'.) (2) Heller (1979) suggests calculating an "r" coefficient for projects where "r" is merely a ratio of the project's net recurrent requirements to the total investment outlay. This would quickly alert administrators to the nature of the project and the span of the financial committment; or (3) Expenses for one year can be calculated and recurrent expenses merely flagged in some respect. While this alerts administrators and evaluators to recurrent costs, it eliminates the discounting of the continuous stream of future recurrent costs.

The absence of identification of and inclusion of recurrent costs in the Sine-Saloum project was one of the main reasons for project failure. As already mentioned, one function of the project was to establish self-sufficient Huts; to do this, calculations concerning Total Cost and Total Revenue were essential. Examination of the above Table alerts the reader to the seriousness of ignoring recurrent costs when estimating the total costs of the project.

failure

A further disaggregation of the above Table could facilitate accountants, administrators, and evaluators.

TABLE 2

	ONE-TIME		RECURRENT	
	DIRECT	INDIRECT	DIRECT	INDIRECT
1. Personnel				
. personnel directly related to the provision of services				
physicians				
nurses	Salary	Initial	Salary*	Replacement
midwives	Recruitment	Preparations	Allowances*	Training
health workers				
others				

	ONE-TIME		RECURRENT	
	DIRECT	INDIRECT	DIRECT	INDIRECT
1. . Administrative/ Government personnel (by definition, these personnel are indirect to the project itself)		Salaries Bldg, or capital expansion to facilitate increased workload	on-site visitations direct interaction with Sine-Saloum*	% of time located to Sir Saloum projec vs. other projects
2. Facilities				
. Health Huts	existing facilities new purchases	expansion of materials mkts to facilitate inputs	Rent Maintenance	Acquisition o maintenance equipment use for more than one project
. living quarters for personnel				
3. Land	existing ownership new purchases	convincing neighbors of desirability of location to Huts	Rent	Upkeep/ Maintenance
4. Vehicles				
. Horse and buggy	new purchase*	special order	food, vet care	
. cars	new purchase*		gasoline* maintenance*	
5. Medicines				
. vaccines . drugs . food supplements . laboratory equipment and supplies	initial stocks*	transportation to Hut	recurrent purchases	. transporation to Hut, maintenance o: supplier and delivery system . cotton, gauze, etc.
6. Communication and Evaluation				
. personnel	salary training data visits		salary visits*	
. vehicles	new purchase	search time competent drivers	maintenance	road infrastructure must be maintained
. fuel			purchases*	

The above is a simplified outline of the breakdown of a project's costs into one-time, recurrent, direct and indirect categories on the basis of function. Asterisks denote information contained in the Sine-Saloum report. It is obvious from the small numbers of asterisks that little costing of this project was undertaken. The most serious and constant omission occurs on the far right hand side of the Table, i.e., the recurrent cost category. What asterisks do occur in that column are supplied by Mead Over in Appendix F of the Sine-Saloum Report. It is in this Appendix where M. Over disaggregates the regional budget into functional categories and discovers that such a disaggregation leads to a pessimistic view toward budgetary capabilities of project maintenance. Since many expenses are either already committed or are of a recurrent nature one cannot "rob Peter to pay Paul" as was first expected.

Conclusion

Neither this paper nor the "parent paper", "The Costing of Primary Health Care", could provide any actual numbers. Both papers sought to provide the health planner and project evaluator with a conceptual framework that would lead to a logical ordering of priorities, considerations, and aspects of the cost estimates that should be considered, included, or questioned. I anticipate that many readers will be disappointed by the lack of numerical benchmarks in these two works. Because of this, I would like to devote the conclusion of this paper to an explanation of this "deficiency" and to safeguard the evaluator against such benchmark estimates.

What is primary health care? Although definitions can be given, there is no universal meaning to the term. Some of A.I.D.'s projects focus on comprehensive care and some on basic care. Obviously, here is the first divergence in cost. Basic health care is much more limited in scope, objective, and duration. Comprehensive care is none other than "the development concept in the guise of health care". To predict the costs of this type of health care would be to project the cost of the development process itself.

By the same token, it is impossible to calculate the costs of projects that have as their endpoint two divergent definitions of population. Some projects are pilot projects, some are national in scope, some are regional. The concept of "cost per individual" is not invariant to the endpoint of the project! Rather projects should be grouped by the range and scope of coverage and costs could be compared within those groups.

Must the project develop an infrastructure before it can begin to function, or can it draw upon the existing infrastructure? Does a Ministry of Health exist? Is there transportation to the target population? Do input markets exist for drugs, materials, personnel? Obviously, if such infrastructures do not exist, they must be first developed before the project can begin to provide primary health care. This brings up the next point.

Is the primary health care project to produce just health care, or is it to produce intermediate products? Will drugs, facilities, doctors, nurses, paramedics be produced by the project and then used within the project? OR will

the project buy these inputs directly? (If they are bought directly are they imported, produced at home, or donated?) If the inputs are to be produced within the project then all the concepts of cost and production must be applied to these goods also.

What does the population look like? Here those demanding health care must be considered, for this dictates the cost of health care. If the health care needs of the population are easily satiated, then the project may incur low costs. Over time, however, the needs of the population change. Population growth, demographics (especially emigration, and immigration), socioeconomic factors affecting the prevalence of disease will affect the type of care the health care unit is to provide. Thus the function of the project may remain the same and yet the cost of fulfilling that objective may change dramatically as the population changes. The astute evaluator should ask the project planner to "think through" this concept of evolving needs and the effect it will have on the project.

The above has sought to explain the differences that exist in health care projects. The evaluator/planner need not "rediscover the wheel" with each project however. Given the increased number of health care projects in recent years, many "like" projects can be found. It is anticipated that perhaps over time a catalogue of comparative studies could be compiled. "Like studies" would be alike on the basis of: providing similar care; duration; similar population; and comparable stages of national economic development. Within these groups evaluators can compare costs of coverage, success and failure, and learn from past budgetary mistakes.

The evaluator should develop a standard list of questions to ask of each project. Questions should fall in the category outlined in this paper and costs can be divided as they are in Table 2. In this way some systematic form of evluation can be applied to all projects.

In short, there is no short cut to a detailed evaluation of each project. No "cut-off" numbers can be given and none should be applied. Evaluators must develop a logical framework for the evaluation of projects. The two papers that I have authored for A.I.D. have presented in varying detail this logical framework. In conclusion, I must add that there is no short-cut to the thinking process -- the use of "short cut" numbers can lead to a severe misuse of health care resources.

ENDNOTES

[1]Merrill, p. 70

[2]Walsh and Warren, p. 970.

[3]Ibid.

[4]Gish, "The Political Economy of Primary Care and Health by the People", Social Science and Medicine, Dec. 1979.

[5]Ibid., p. 3.

[6]Gish, p. 208.

[7]Berry (1970), p. 68.

[8]See Gaspari, "The Costing of Primary Health Care", unpublished, pp. 12-13 for reviews of the Berry and Feldstein works.

[9]Ibid., p. 68.

[10]Dunlop (1973), p. 71.

[11]Ibid.

[12]In his review of the literature contributing to the conceptual development of an output measure, Dunlop notes that many works have used a homogeneous output indicator for care in analyzing the microeconomic theory of hospitals as well as care in applying statistical or econometric techniques. Other works have confused inputs with outputs by terming patient days or number of visits as output. The recipients of the service and therefore the rationale for providing the service, are strangely absent from this output measure.

[13]Dunlop (1973), p. 78

[14]Gaspari, op. cit., pp. 16-17 and Appendix A for detailed explanations of the Dunlop model.

[15]This latter purpose will be examined in a later section of this paper.

[16]Johns Hopkins (1976), p. 206.

[17]Ibid., p. 214

[18] Heller (1979), p. 39.

[19] A.I.D. Report, M. Over, p. F-11.

[20] Gaspari, op. cit., pp. 26-27 for an explanation of the technique.

[21] Berry (1974), p. 291.

[22] See Frank (1976), pp. 41-44.

[23] Klarman (1974), p. 177.

[24] For planning purposes however the recipient must be assured of this continued level of subsidy for the life of the project.

[25] This is merely the principle for learning by doing or practice makes perfect.

[26] Berry (1967), p. 126.

[27] Gaspari, op. cit., pp. 29-33 presents various works (and their results) that have addressed this issue.

[28] See Gaspari, op. cit., pp. 31-33 for details.

[29] See Gaspari, op. cit., pp. 32-33 for details.

[30] The technology matrix relates how raw materials, i.e., inputs are combined to produce the primary health care service.

[31] See Gaspari, op. cit., pp. 32-33 for details.

[32] Table 1 shows this inclusion as well as indicating the difference between direct and indirect costs based on their definition and how either can be measured.

[33] Anthony and Reese (1979), p. 503.

[34] Information on the calculation of overhead costs will not be reviewed in this work but can be easily obtained from any accounting book.

[35] (This concept is analagous to the economic concept of shadow prices; there is no economic analogue on the quantity side.)

[36] Anthony and Reese (1979), p. 546 mention other uses which are not applicable to the health care sector.

[37] Information on the Sine-Saloum project comes solely from, "The Sine-Saloum Rural Health Care Project in Senegal", U.S.A.I.D. 1980, Project Impact Evaluation.

[38] *Ibid.*, p. 1.

[39] *Ibid.*, p. 1.

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