

approximately \$500,000. An additional \$170,000 would be obtained from other sources.

5. Facilities

HEW's expenditures for facilities is anticipated to be \$8,000,000 plus an additional \$2,670,000 from other sources.

A summary of the benefits and costs associated with this program is found in Table X.

KIDNEY DISEASES RELATED TO HYPERTENSIVE VASCULAR DISEASES, HYPOTHETICAL PROGRAM
AT INTERMEDIATE HEW EXPENDITURE LEVEL, BASED ON THE CURRENT STATE OF THE ART

| Program | Expenditures | | Short-Term Benefits | | | Long-Term Benefits | |
|---|--------------------|------------------------------|-----------------------|--------------------|--------------------------|-------------------------------|------------|
| | | | Reduction Per Year In | | | Reduction In End-Stage Uremia | |
| | HEW (\$1,000) | Total (\$1,000) | Mortality | Prevalence | Morbid Days | Per Year | Cumulative |
| I.A. Screening, diagnosis and treatment of individuals 17 years of age and over with known curable (non-essential) hypertension and non-curable hypertension and individuals who would have had undetected hypertension without the initiation of the program component | | | | | | | |
| 1. Screening | 948 (57) | 4,740 (284) ^{1/} | | | | | |
| 2. Diagnosis and treatment | — | 463,200 (32,442) | | | | | |
| Sub-Total | 948 (57) | 467,940 (32,726) | | | | | |
| B. Supportive education and administration | 8,000 (8,000) | 10,670 (10,670) | | | | | |
| Sub-Total | 8,948 (8,057) | 478,610 (43,396) | | | | | |
| II. Research | 4,650 (4,650) | 6,200 (6,200) | | | | | |
| III. Training | 500 (500) | 670 (670) | | | | | |
| IV. Facilities | 8,000 (8,000) | 10,670 (10,670) | | | | | |
| TOTAL | 22,098 (21,207) | 496,150 (60,936) | 8,070 (2,270) | 69,750 (34,880) | 6,193,720 (2,056,820) | (4,820) | (96,300) |

^{1/} Figures in parenthesis refer to statistics attributable to renal complications

D. Kidney Diseases Related to Hypertensive Vascular Diseases, Hypothetical Program at Accelerated HEW Expenditure Level, Based on the Current State of the Art

1. Introduction

This program has four components:

- 1) Screening, diagnosis, treatment, and supportive education and administration;
- 2) Research;
- 3) Training; and
- 4) Facilities.

The estimated total cost for this program is \$566,700,000 (\$75,441,000 for associated renal complications). HEW will account for \$30,421,000 (\$28,639,000 for associated renal problems). Figure 11 illustrates the total program expenditures by components. A discussion of these various program components follows.

2. Screening, Diagnosis, Treatment, and Supportive Education and Administration

With an accelerated program there is no expected change in the target populations.

a. Relevant Population and Program Component Costs

The screening program for undetected hypertensive patients will be accelerated so that rather than taking six years to reach 50% of the 43,500,000 individuals at risk, three years would be sufficient to complete the task.

An average of 7,580,000 individuals are expected to be screened per year. Of these, 350,000 will have hypertension. ^{119/}

Screening costs are estimated at \$1.25 per individual (as part of a general screening program). Total screening cost is \$9,480,000

Costs (\$1,000,000)

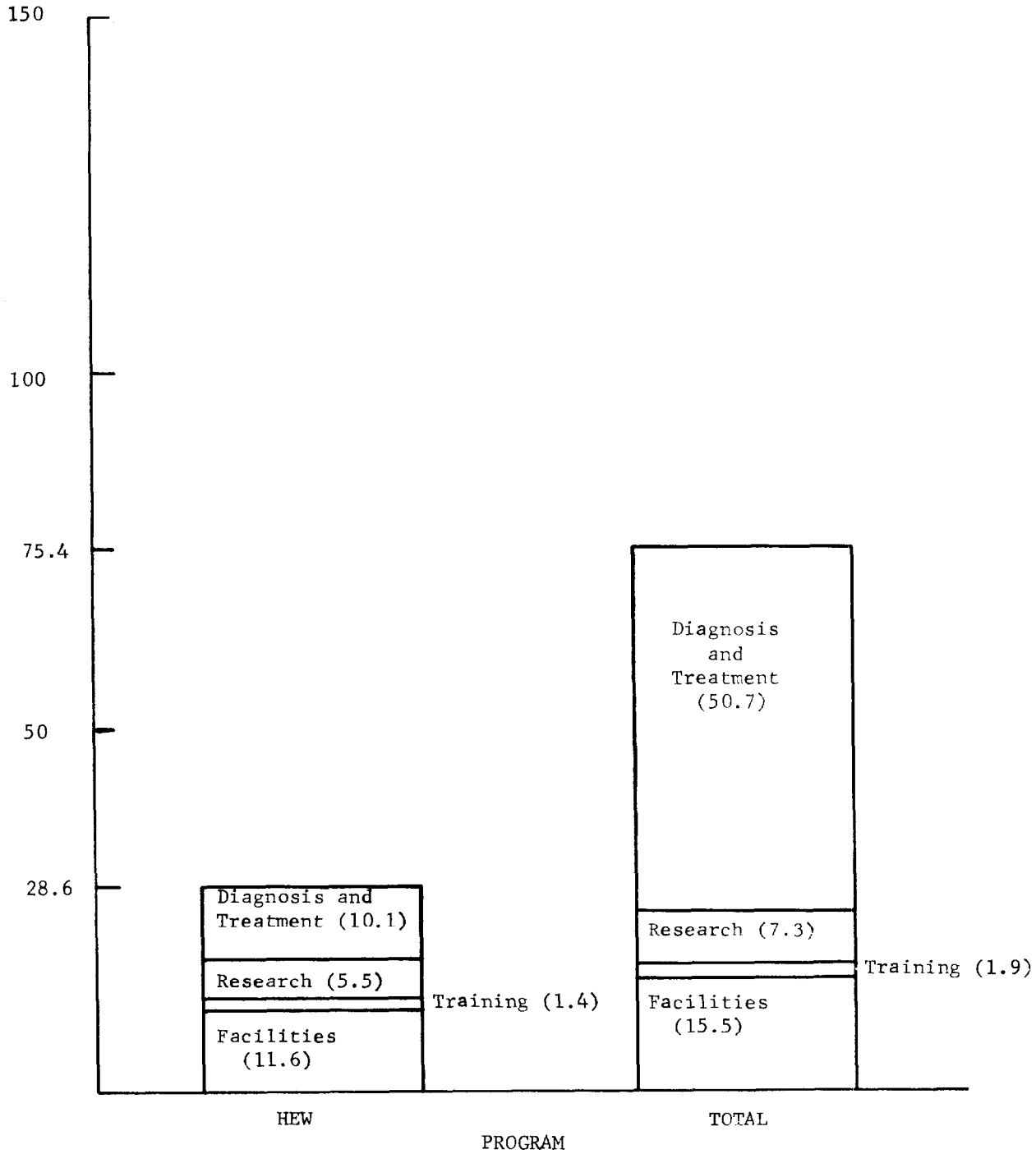


Fig. 11. Kidney Diseases Related to Hypertensive Vascular Disease, Hypothetical Program Costs at Accelerated HEW Expenditure Level, Based on the Current State of the Art.

per year (\$569,000 attributed to associated renal problems). HEW will contribute to this program an estimated \$1,896,000 (\$114,000 for associated renal problems).

If 15% of the 350,000 patients with positive screening tests have curable hypertension (i.e., 52,500 and if the yearly treatment and confirming diagnosis cost per individual is \$1,000, then total treatment costs for this group are \$52,500,000 per year (10% or \$5,250,000 for associated renal complications).

If 85% of the 350,000 have currently non-curable hypertension (i.e., 297,500), and if the estimated cost of treatment is \$200 per individual per year, total treatment costs for these individuals are estimated at \$59,500,000 per year (\$3,570,000 for associated renal disease).

Total costs for this component (and for all the surveyed population) is now estimated at \$528,680,000 (\$37,421,000 for associated renal complications). HEW's contribution is \$1,896,000 (\$114,000 for associated renal disease).

Financial support for education and administration in the accelerated program is \$10,000,000 to come from HEW with an additional \$3,330,000 anticipated from outside sources.

The total cost for this program component is \$542,010,000 (\$50,751,000 for associated renal complications), of which HEW will contribute \$11,896,000 (\$10,114,000 for associated renal complications).

b. Short-Term Benefits

The following are estimated short-term benefits:

(1) Newly Detected Potentially Curable (non-essential)
Hypertensives:

- 1) A 60% decrease in the immediate mortality of the individuals with curable hypertension is anticipated. From a base line of $290 \frac{120}{}$ deaths occurring without this health program, there would be 170 prevented deaths (50% or approximately 90 reflect deaths avoided in patients having associated renal problems).
- 2) A 60% reduction in prevalence of 31,500 from the base line of 52,500 cases is expected (50%, or 15,750, with associated renal problems). $\frac{121}{}$
- 3) Morbid days are also expected to be reduced by 60% from a base line of $840,000 \frac{122}{}$ to 504,000 (252,000 attributed to associated renal disease).

(2) Newly Detected Currently Non-Curable (essential)
Hypertensives:

- 1) An estimated 15% decrease in mortality from a base line of $2,140 \frac{123}{}$ deaths to 320 (27% or 90 patients having associated renal disease).
- 2) An estimated 20% reduction in the number of morbid days is anticipated, i.e., a decrease of 952,000 from a base line of $4,760,000 \frac{124}{}$ (27% or 257,040 due to associated renal problems).

(3) All Surveyed Hypertensives:

Total short-term benefits for the surveyed high-risk groups are 10,260 prevented deaths (2,370 with associated renal problems), a reduction in the number of cases by 85,500 (42,750 with associated renal problems), and a reduction in morbid days

by 7,395,200 (2,311,340 in patients with associated renal problems).

c. Long-Term Benefits

The following are estimated long-term benefits:

(1) Annual Long-Term Benefits

Under an accelerated program, there will be no change in the number of currently undiagnosed hypertensives who can be reached compared to the number reached in the intermediate program. Therefore, the annual long-term benefits will be identical with that group: an annual reduction of fatal end-stage uremia by 330 in currently non-curable hypertensives.

Total annual long-term benefits for all the surveyed high risk groups equal a reduction in fatal end-stage renal failure by 4,820 each year.

(2) Cumulative Long-Term Benefits

No changes from the intermediate program are anticipated. A reduction of 3,120 in the number of cases of fatal end-stage uremia will occur.

Total cumulative long-term benefits for all of the surveyed high-risk groups are 96,300 prevented cases of fatal end-stage uremia.

3. Research

Under an accelerated HEW funding program, an additional increase in the number of research projects is anticipated to encompass a total of 30 laboratory research study groups costing \$40,000 per group, for a total cost of \$1,200,000. Thirty clinical research study groups costing \$50,000 per group will also be in progress yielding a total of \$1,500,000.

Approximately \$2,800,000 will be expended on 70 individual research grants, averaging \$40,000 per grant. Total HEW support for research is expected to be \$5,500,000. An additional \$1,830,000 is anticipated from outside sources.

4. Training

The training of physicians and allied medical personnel would cost HEW approximately \$1,425,000 with an additional \$475,000 from other sources.

5. Facilities

Under an accelerated HEW health program, \$11,600,000 would be expended on facilities. An additional \$3,860,000 would come from other sources.

A summary of the benefits and costs associated with this program is found in Table XI.

Table XI

KIDNEY DISEASES RELATED TO HYPERTENSIVE VASCULAR DISEASES, HYPOTHETICAL PROGRAM
AT ACCELERATED HEW EXPENDITURE LEVEL, BASED ON THE CURRENT STATE OF THE ART

| Program | Short-Term Benefits | | | | | Long-Term Benefits | |
|--|---------------------|------------------------------|-----------------------|--------------------|--------------------------|-------------------------------|------------|
| | Expenditures | | Reduction Per Year In | | | Reduction In End-Stage Uremia | |
| | HEW (\$1,000) | Total (\$1,000) | Mortality | Prevalence | Morbid Days | Per Year | Cumulative |
| I.A. Screening, diagnosis and treatment of individuals 17 years of age and over with known curable (non-essential) hypertension and non-curable hypertension and individuals who would have had undetected hypertension without the initiation of the program component. | | | | | | | |
| 1. Screening | 1,896 (114) | 9,480 (569) ^{1/} | | | | | |
| 2. Diagnosis and treatment | = | 519,200 (36,852) | | | | | |
| Sub-Total | 1,896 (114) | 528,680 (37,421) | | | | | |
| B. Education and administration for I.A. | 10,000 (10,000) | 13,330 (13,330) | | | | | |
| Sub-Total | 11,896 (10,114) | 542,010 (50,751) | | | | | |
| II. Research | 5,500 | 7,330 | | | | | |
| III. Training | 1,425 | 1,900 | | | | | |
| IV. Facilities | 11,600 | 15,460 | | | | | |
| TOTAL | 30,421 (28,639) | 566,700 (75,441) | 10,260 (2,380) | 85,500 (42,750) | 7,395,220 (2,311,340) | (4,820) | (96,300) |

^{1/} Figures in parenthesis refer to statistics attributable to renal complications.

E. Kidney Diseases Related to Hypertensive Vascular Diseases, Hypothetical Program for Fiscal Year 1975, at Accelerated HEW Expenditure Level, Based on the Expected Advanced State of the Art in 1975

1. Introduction

This program has four components:

- 1) Screening, diagnosis, treatment and supportive education and administration;
- 2) Research;
- 3) Training; and
- 4) Facilities.

The estimated total cost for this program is \$878,675,000 (\$101,438,000 for associated renal problems). HEW will account for \$37,899,000 (\$35,832,000 for associated renal problems).

Anticipated advances in the state of the art include:

- 1) Advances in the knowledge concerning the underlying causes of hypertension, e.g., an appreciation of the renin-angiotensin mechanism;
- 2) Specific therapy directed toward the underlying causes of hypertension, e.g., an anti-renin substance in a situation in which renin could be a cause of hypertension;
- 3) Improved diagnostic tests for detecting hypertension, e.g., advanced use of radio-isotopes, improved split renal function tests, implementation of photo-electric methods for determining high blood pressure, etc.; and
- 4) Advances in the art of treatment of surgically treatable hypertension, e.g., improved vascular prostheses, etc.

Figure 12 illustrates the total program expenditures by components

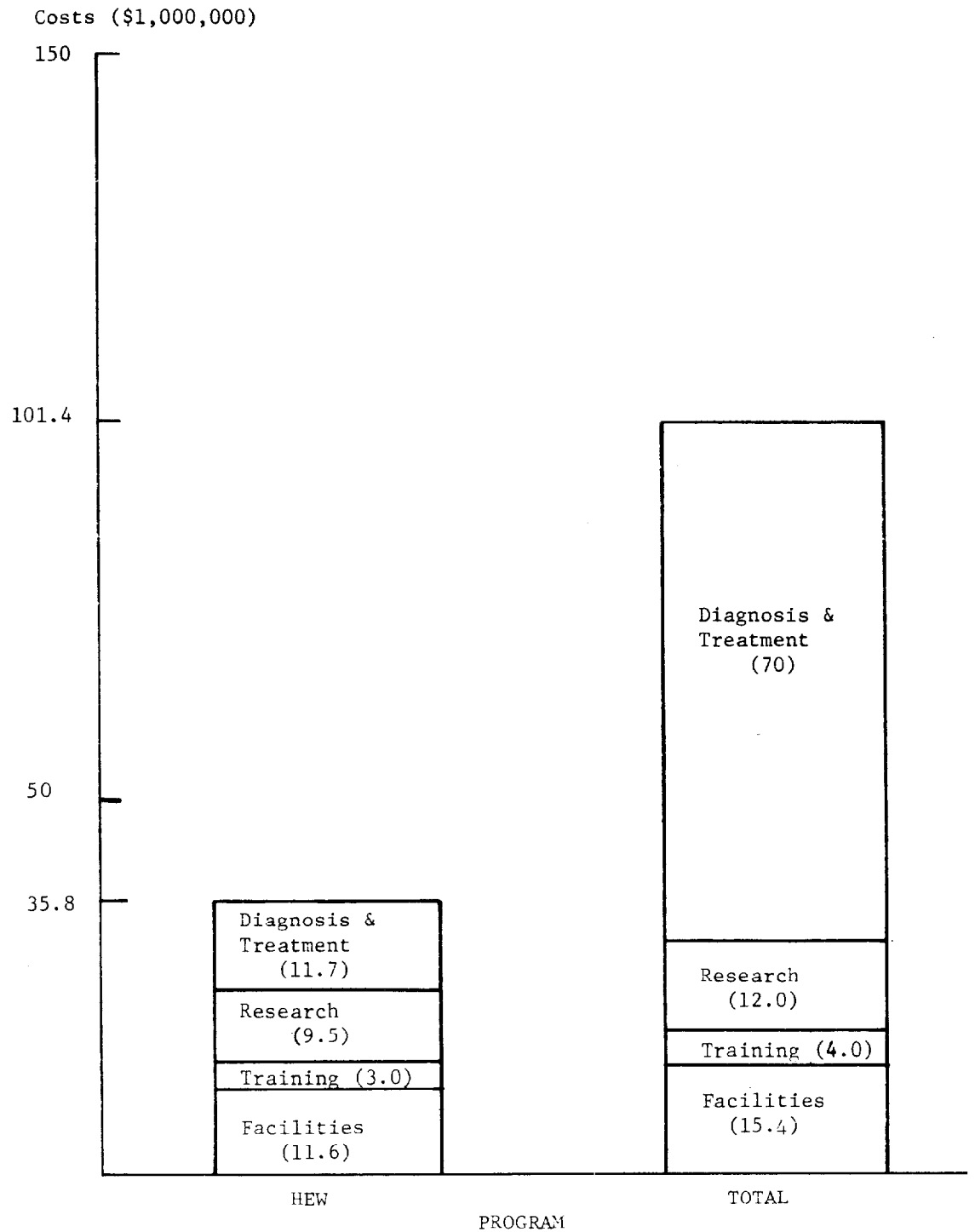


Fig. 12. Kidney Diseases Related to Hypertensive Vascular Diseases, Hypothetical Program Costs for Fiscal Year 1975, at Accelerated HEW Expenditure Level, Based on Expected Advanced State of the Art in 1975.

including associated renal disease. A detailed discussion of the various program components follows.

2. Screening, Diagnosis, Treatment, and Supportive Education and Administration

In 1975, the accelerated program activity reflects changes in the population. The ratio of the 1975 population of individuals 17 years of age and over to that of 1966 is estimated at 1.16.^{125/} No changes in the number of target population groups are anticipated.

a. Relevant Population and Program Component Costs

It is estimated that there will be about 104,400 patients with non-essential hypertension from among currently known hypertensives receiving more adequate treatment. At an estimated cost of \$1,000 per individual treated per year, a cost figure of \$104,400,000 (10%, or \$10,440,000, for those having associated renal disease) is arrived at.

In 1975, there will be approximately 9,198,800 individuals with essential hypertension among those currently known to be hypertensives. This accelerated program is designed to affect 20% of these individuals. As a result of improved treatment programs and further advances in the state of the art, it is estimated that the treatment costs for these individuals per year is \$300.^{126/} Assuming no additional expense for screening, the cost for treatment and differential diagnosis for the affected individuals is now estimated at \$551,928,000 (6%, or \$31,116,000, attributed to associated renal problems).

In 1975, assuming no change in the current health services system, there will be 50,460,000 individuals 17 years of age and over who have not been seen by a physician in the previous year.

Again, it is assumed that the program will be able to reach 50% of these patients (26,390,000) over a three-year period. With an accelerated program effort, approximately 33% (8,797,440) of these persons will be reached each year. Screening costs per individual per year remain at \$1.25 (as part of a general screening program). The total cost for screening is estimated at \$10,997,000 (\$660,000 for associated renal dysfunction). ^{127/} HEW's share in this program is estimated to be \$2,199,000 (\$132,000 for associated renal disease).

Of the anticipated 2,436,000 individuals who will have hypertension detectable in these screening tests, it is assumed that 50% will be detected over a period of three years; 406,000 will be reached each year. Of this group, 15% or 60,900 individuals will have non-essential hypertension. At a cost of \$1,000 per year per individual for treatment and differential diagnosis, the total cost in this group is \$60,900,000 (10% or \$6,090,000 for patients with associated renal problems).

Approximately 85% of the 406,000 hypertensive patients, or 345,100, will have essential hypertension. At a cost of \$300 per year per individual for treatment, the total cost is estimated to be \$103,530,000 (6%, or \$6,212,000, attributed to associated renal diseases).

Total treatment costs for all groups are estimated at \$820,758,000 (\$53,858,000 for associated renal problems). These costs are not expected to be borne by HEW.

Total cost for this entire component (screening, diagnosis, and treatment) is \$831,755,000 (\$54,518,000 for associated renal problems).

HEW will contribute \$2,199,000 (\$132,000 for associated renal problems).

The educational and administrative support for this program component is estimated to cost \$15,460,000 of which \$11,600,000 would come from HEW and an anticipated \$3,860,000 would come from other sources.

Total cost for the entire program component is \$847,215,000 (\$69,978,000 for associated renal problems). HEW's contribution is \$13,799,000 (\$11,732,000 for associated renal problems).

b. Short-Term Benefits^{128/}

The following are estimated short-term benefits:

(1) Known Hypertensives with Potentially Curable (non-essential) Hypertension:

- 1) A 65% reduction in immediate mortality is expected from a base line of 660 expected deaths (i.e., 430 prevented deaths of which 220 have associated renal problems). About 5 of the 65%, or 30 (20 from renal involvement), can be attributed to the advanced state of the art;
- 2) A reduction of 65% in prevalence is anticipated, or 67,860, from a base line of 104,400 (33,930 with renal problems). About 5 of the 65% or 5,220 prevented cases can be attributed to advances in the state of the art (2,610 with renal problems); and
- 3) A 65% reduction in the number of morbid days from a base line of 1,670,400, or a reduction of 1,085,760 days (542,880 of the reduction in morbid days would have associated renal problems). About 5 of the 65% reduction in morbid days, or 83,520, is attributed to advances in

the state of the art (41,760 are in patients with renal problems).

(2) Known Hypertensives with Essential Hypertension

- 1) Mortality will be reduced by 55%, or by 31,860, from a base line of 57,930 (8,600 with associated renal problems). Forty of the 55% decrease, or 23,170, is attributed to advances in the state of the art (6,260 represent patients with associated renal problems);
- 2) It is estimated that a 40% reduction of 735,900 in the number of cases from a base line of 1,133,760 will occur (198,690 with renal complications) all of which is attributed to advances in the state of the art; and
- 3) A 50% reduction in morbid days, or 14,718,050, is anticipated from a base line of 29,436,160 (3,973,880 in patients with associated renal problems). Thirty of the 50% reduction, or 8,830,850 days are attributed to the advances in the state of the art (2,384,330 in patients with associated renal disease).

(3) Undiagnosed Individuals with Non-Essential Hypertension

- 1) An estimated reduction in immediate mortality by 65%, or by 220, from a base line of 340 (110 with associated renal problems). About 5 of the 65% reduction, or 20, is attributed to advances in the state of the art (10 represent patients with associated renal problems);
- 2) A 65% reduction, 39,590, in prevalence is also anticipated

from a base line of 60,900 (19,800 are patients with associated renal problems). About 5 of the 65% reduction, or 3,050 controlled cases are attributable to advances in the state of the art (1,530 of these would have had associated renal problems); and

- 3) Morbid days will be reduced by 65%, or 633,360, from a base line of 974,400 (316,680 of these in patients with associated renal problems). Five of the 65% reduction, or 48,720 days are attributable to advances in the state of the art (24,360 in patients with associated renal problems).

(4) Undiagnosed Individuals with Essential Hypertension

- 1) A 55% reduction in immediate mortality, or 1,360, is anticipated from a base line of 2,480 deaths (370 of the prevented deaths would have been associated with renal failure). Forty of the 55% reduction, or 990 deaths avoided are attributed to advances in the state of the art (270 in patients with associated renal problems);
- 2) Prevalence will decrease by 40%, or by 138,040, cases, from a base line of 345,100 (37,270 would be cases with associated renal disorders) all of which is attributable to advances in the state of the art; and
- 3) A 50% reduction in morbid days, or 2,760,800, is anticipated from a base line of 5,521,600 (745,420 in patients with associated renal problems). Thirty of the 50% reduction, or 1,656,480 morbid days avoided may be attributed to advances in the state of the art (447,250

of these in patients with associated renal disease).

(5) All Surveyed Hypertensive Patients

- 1) Immediate mortality will be reduced by 33,870 cases (9,300 would have been patients with associated renal problems). Approximately 24,210 of these are attributed to advances in the state of the art (6,560 of these would have been patients with associated renal problems);
- 2) Prevalence will be reduced by 981,390 cases (289,690 with associated renal problems). 882,210 of the total reduction in prevalence is attributed to advances in the state of the art (240,100 would have been patients with associated renal problems); and
- 3) Morbid days will be reduced by 19,198,000 (5,578,860 in patients with associated renal problems). Approximately 10,619,570 of the total reduction is attributed to advances in the state of the art (2,897,700 in patients with associated renal problems).

c. Long-Term Benefits^{129/}

(1) Annual Long-Term Benefits

It is anticipated that 3,690 out of 5,680 individuals with known non-essential hypertension (who would normally progress to renal failure), can be prevented from developing end-stage kidney failure each year. Approximately 5 of this 65% reduction (a reduction of 280 cases/year) is attributed to advances in the state of the art.

For the group of known patients with essential hypertension, it is expected that 4,830, or 30% of 16,100 individuals (who would develop renal failure), can be prevented from progressing to end-stage renal failure each year. About 20 of the 30% reduction (a reduction of 3,220 cases/year is attributed to advances in the state of the art.

In the group of individuals with undetected non-essential hypertension it is anticipated that a 65% reduction in end-stage uremia will occur from the base line of 640 (420 such cases averted each year). About 5 of the 65% reduction, or 30 cases of prevented end-stage uremia per year are attributed to advances in the state of the art.

In the group of individuals with undetected essential hypertension it is anticipated that a 30% reduction (540 cases) in end-stage uremia will occur from a base line of 1,810 cases of renal failure which would normally occur each year. About 20 of the 30% reduction, or 360 cases averted can be attributed to advances in the state of the art.

For all surveyed hypertensive groups the reduction in end-stage uremia is estimated at 9,480 per year. Approximately 3,890 of these cases are attributed to advances in the state of the art.

(2) Cumulative Long-Term Benefits

In the group of patients with known non-essential hypertension a 65% reduction in cumulative long-term cases of end-stage uremia is anticipated. This will amount to a reduction of 73,890

cases from a base line of 113,680. Approximately 5 of the 65% reduction, or a reduction of 5,680 cases of end-stage uremia can be attributed to advances in the state of the art.

In the group of patients with known essential hypertension a 30% reduction in cumulative long-term end-stage uremia is anticipated. This amounts to 96,590 cases avoided from a base line of 321,960. About 20 of the 30% reduction, or 64,390 cases of end-stage uremia avoided, are attributed to advances in the state of the art.

In the group of individuals with undetected non-essential hypertension it is estimated that a 65% reduction in end-stage uremia will occur. This will amount to 8,310 cases avoided from a base line of 12,790 (5 of the 65% reduction, or a reduction of 640 cases, is attributed to advances in the state of the art).

In the group of individuals with undetected essential hypertension it is anticipated that a 30% reduction of 10,870 in the number of cases of end-stage uremia will occur from a base line of 36,240. About 20 of the 30% reduction, or a reduction of 7,250 cases is attributed to advances in the state of the art.

Total cumulative long-term benefits for all groups surveyed are the prevention of 189,660 cases of end-stage uremia, 77,960 of which are attributable to advances in the state of the art.

3. Research

It is anticipated that in this hypothetical situation an estimated \$9,500,000 would be required from HEW and an additional \$2,500,000 from

other institutions to support the various research programs.

4. Training

With the advanced state of the art, it is anticipated that there will be an additional requirement for the training of physicians and allied medical personnel requiring increased financial support amounting to \$3,000,000 from HEW with an additional \$1,000,000 to come from other agencies.

5. Facilities

Expenditures for facilities are estimated to be \$15,460,000 of which \$11,600,000 will come from HEW and an additional \$3,860,000 will come from other sources.

A benefit-cost summary associated with this program is presented in table XII.

6. Estimated Benefits Dependent on Research and Development^{130/}

Advances in the state of the art would produce a further 5% decrease in short-term mortality, prevalence, and morbid days for known patients with non-essential hypertension. A 5% long-term reduction in end-stage uremia is also anticipated.

A further 40% decrease in immediate mortality and prevalence is estimated for the group of patients with known essential hypertension. Also anticipated is an additional 30% decrease in morbid days and an additional 20% reduction in end-stage renal failure.

A summary of the short-term benefits dependent on research and development follows:

Table XII

KIDNEY DISEASES RELATED TO HYPERTENSIVE VASCULAR DISEASES, HYPOTHETICAL PROGRAM FOR FISCAL YEAR 1975
AT ACCELERATED HEW EXPENDITURE LEVEL, BASED ON EXPECTED ADVANCED STATE OF THE ART IN 1975

| Program | Expenditures | | Short-Term Benefits | | | Long-Term Benefits | |
|---|------------------------------|----------------------|-----------------------|----------------------|---------------------------|-------------------------------|------------|
| | | | Reduction Per Year In | | | Reduction In End-Stage Uremia | |
| | HEW (\$1,000) | Total (\$1,000) | Mortality | Prevalence | Morbid Days | Per Year | Cumulative |
| I.A. Screening, Diagnosis and treatment of individuals 17 years of age and over with known curable (non-essential) hypertension and non-curable hypertension and individuals who would have had undetected hypertension without the initiation of the program component | | | | | | | |
| 1. Screening | 2,199 (132) ^{1/} | 10,997 (660) | | | | | |
| 2. Diagnosis and treatment | — | 820,758 (53,858) | | | | | |
| Sub-Total | 2,199 (132) | 831,755 (54,518) | | | | | |
| B. Supportive education and administration | 11,600 (11,600) | 15,460 (15,460) | | | | | |
| Sub-Total | 13,799 (11,732) | 847,215 (69,978) | | | | | |
| II. Research | 9,500 (9,500) | 12,000 (12,000) | | | | | |
| III. Training | 3,000 (3,000) | 4,000 (4,000) | | | | | |
| IV. Facilities | 11,600 (11,600) | 15,460 (15,460) | | | | | |
| TOTAL | 37,899 (35,832) | 878,675 (101,438) | 33,870 (9,300) | 981,390 (289,690) | 19,198,000 (5,578,860) | (9,480) | (189,660) |

^{1/} Figures in parenthesis refer to statistical significance.

- 1) 24,210 prevented deaths (6,560 in patients with associated renal problems);
- 2) A reduction in prevalence by 882,210 (240,100 cases with associated renal problems); and
- 3) A reduction in morbid days by 10,619,570 (2,897,700 in patients with renal problems).

A summary of the long-term benefits includes:

- 1) An annual reduction in cases of end-stage kidney disease of 3,890; and
- 2) A cumulative reduction in the cases of end-stage kidney disease of approximately 77,960.

All of these benefits have been based on the projected 1975 population of individuals 17 years of age and over, which is estimated to be 16% greater than the 1966 population. Disregarding the effects of population changes, it is estimated that the following short-term benefits are the result of research and development advances (using 1966 population figures):

- 1) Approximately 20,870 prevented deaths (5,660 in patients with associated renal problems);
- 2) A reduction in prevalence by 760,530 (206,980 cases with associated renal problems); and
- 3) A reduction in morbid days by 9,154,800 (2,498,020 in patients with associated renal problems).

Long-term benefits dependent on research and development are estimated as follows:

- 1) An annual reduction in the cases of end-stage kidney disease of 3,350; and
- 2) A cumulative reduction in the cases of end-stage kidney disease of 67,210.

V. END-STAGE KIDNEY DISEASE

A. Introduction

This section describes programs which are concerned with alleviating the effects of end-stage kidney disease--the result of a natural progression of the infectious, hypersensitivity, hypertensive, and other kidney disease processes. End-stage kidney disease is currently treated by two procedures, chronic intermittent hemodialysis and kidney transplantation.

Approximately 50,000 people die as a result of uremia each year.^{131/} Of these 50,000 about 79% are in the age group above 55, about 19% are in the age group 15-54, and about 2% are in the age group 0-14. It has been estimated that of the 50,000 annual end-stage uremia victims, about 8,000^{132/} are ideally suited for dialysis therapy. While published estimates of transplant candidates are not available, it is assumed for the purposes of this report that about 6,000 of the ideal dialysis candidates are also ideal transplant candidates. It is also assumed that an additional 2,000 persons would be suited for transplantation but not for chronic dialysis.^{133/} Most patients suitable for either procedure are within the 15-54 age group.

A schematic representing the progression of a patient into a hemodialysis and/or transplant program is presented in Figure 13. With the development of end-stage uremia, the patient becomes a candidate for chronic intermittent dialysis or renal transplantation. Following the transplant procedure (especially if a cadaver kidney has been used), the patient may require temporary dialysis until the transplanted kidney is functioning normally. If the transplant has been successful, the patient exits from the program. If the transplant is unsuccessful, the patient is returned to the chronic

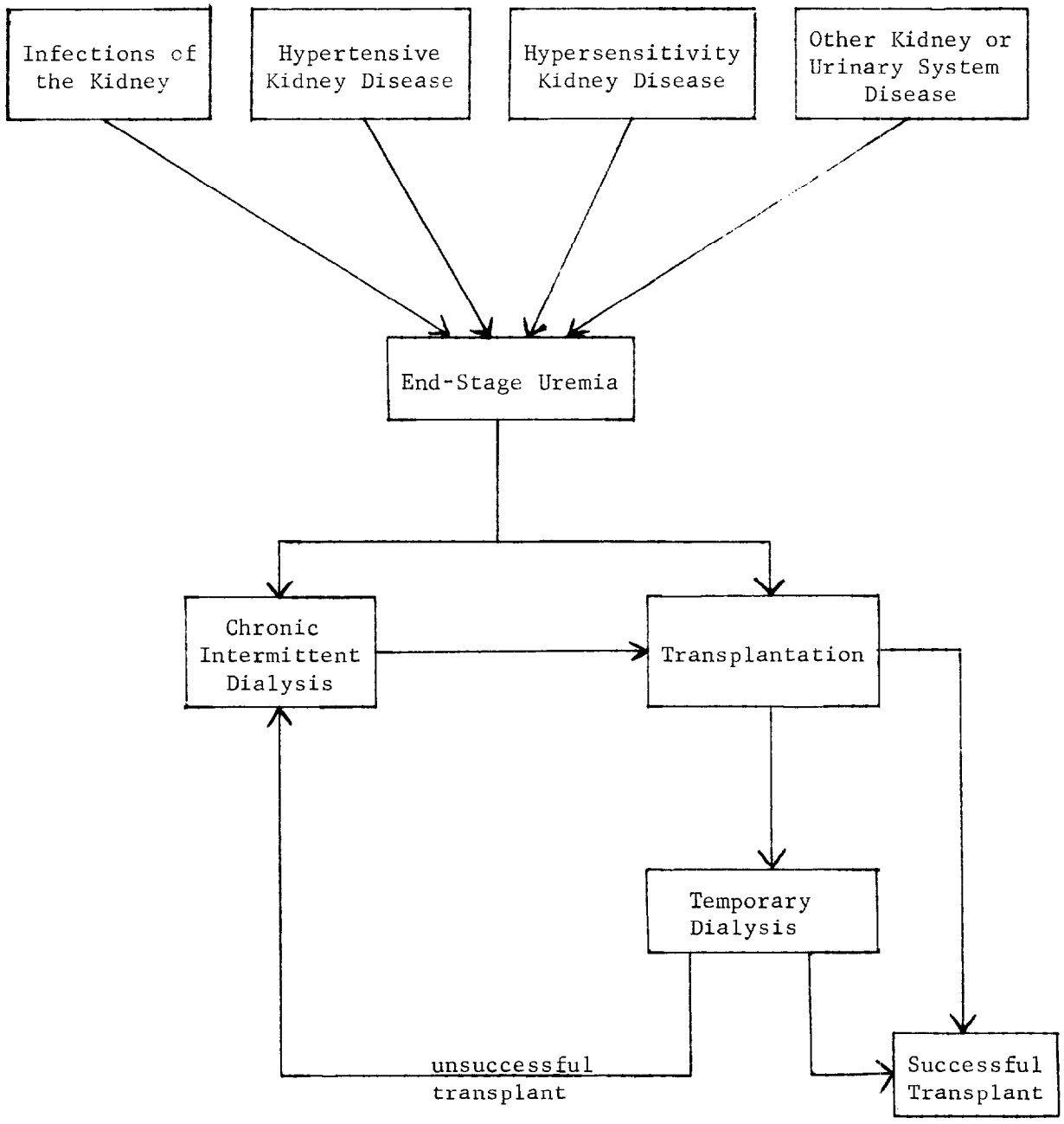


Fig. 13. Schematic of Transplant and Dialysis Patients.

intermittent dialysis program either for life or to await a second attempt of transplantation. Certain patients undergoing chronic intermittent dialysis therapy are suitable for transplantation and may be dialysed only until a matching donor kidney is available. Death, of course, can occur at any stage in the schematic.

Benefits attributable to the various dialysis programs presented in this section are measured in terms of reduction in mortality (lives prolonged) for the year in which the program is active.

In contrast to transplantation, which--if successful--is a one-time treatment, chronic dialysis is an ongoing type of treatment. All patients on dialysis who survive the first year must be treated in successive years. Thus, if during year x, there are 1,000 patients who are being maintained on hemodialysis, all of these patients less those dying during the year must be treated in subsequent years. If the mortality rate among these 1,000 dialysis patients is 20%, only facilities for some 200 new patients would be available for the 8,000 ideal dialysis candidates who will develop end-stage uremia during the next year. This situation is further complicated by the addition of those persons with unsuccessful transplants who require subsequently chronic dialysis treatment in order to survive.

The benefits attributed to transplantation are measured in terms of a reduction in mortality (patients cured). As is shown in Figure 14, the patient undergoing transplantation may, as a result of the procedure, a) be cured, b) die, or c) have an unsuccessful transplant subsequently he will enter a chronic dialysis program or be retransplanted. The benefits, as measured here take into account only those who are cured by the transplant procedure. Those persons not successfully transplanted who survive will, of course, become part of the chronic dialysis patient population or will be retransplanted.

Four specific programs have been postulated in this analysis. (See Chapter 4, Research Methodology.) These are described in detail in the following sections.

B. End-Stage Uremia Program, Hypothetical Program at Current HEW Expenditure Level, Based on Current State of the Art

1. Introduction

This program has five components consisting of:

- 1) Treatment by dialysis,
- 2) Treatment by transplantation,
- 3) Research,
- 4) Training, and
- 5) Facilities.

HEW costs and total costs of this program are presented in Figure 14.

As can be seen, total program costs are about \$33,000,000 with HEW expenditures at approximately \$21,000,000. This hypothetical program is essentially a reflection of the current allocation of funds for end-stage uremia programs. A discussion of the various components of the program follows.

2. Dialysis Treatment

As was indicated earlier, with the present operational state, only about 8,000 of the 50,000 annual uremic victims are ideal candidates for life-long chronic hemodialysis. Of these 8,000 annual dialysis candidates about 750^{134/} are currently receiving treatment. Treatment costs for some 225 of these treated patients can be attributed to HEW funding,^{135/} about 175, to the Veterans Administration^{136/} and the remainder to other sources.

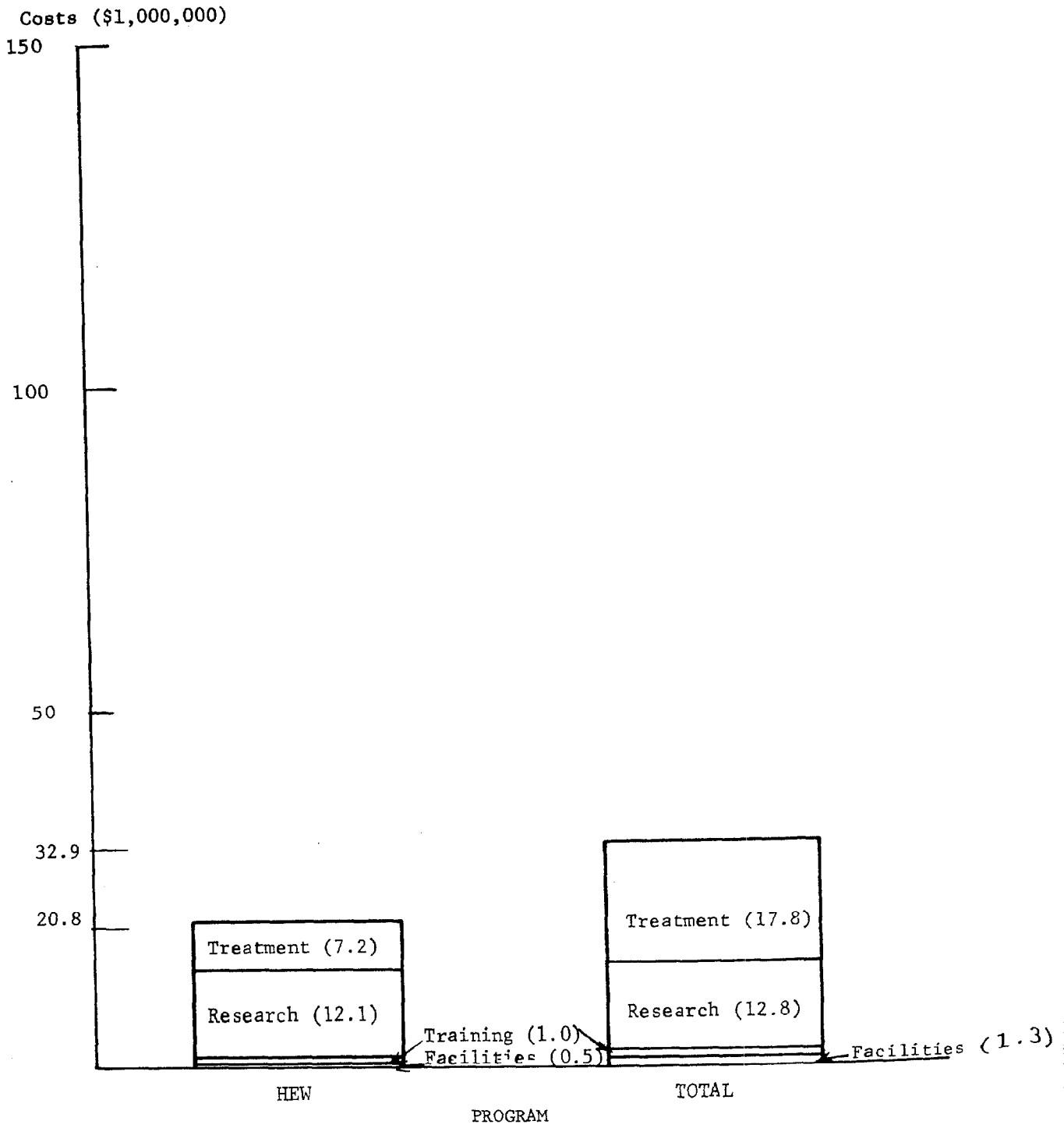


Fig. 14. End-Stage Uremia, Hypothetical Program Costs at Current HEW Expenditure Level, Based on the Current State of the Art.

The present cost of chronic dialysis is approximately \$15,000 per year per patient.^{137/} The cost of dialysis as used here is derived from the cost in organized hospital dialysis centers supported by Government funds. If such a treatment were to be undertaken independently, private costs would run considerably higher. It has been estimated for the purposes of this study that the cost of private dialysis is on the order of \$20,000 per year per patient. Current total expenditures for chronic dialysis therapy for the year are approximately \$13,000,000 of which about \$3,400,000 can be attributed to HEW.^{138/}

In determining the benefits associated with this dialysis program, (see Section A above), it is assumed that treated patients suffer an annual 20% overall mortality.^{139/} Approximately 600 lives are saved due to the total current program efforts. Of these, about 180 lives saved can be attributed to HEW funding.

3. Transplantation Treatment

As indicated above, approximately 8,000 individuals of the 50,000 who die annually from end-stage uremia are ideally suited for transplantation. Of these, approximately 300 patients per year are now being treated by transplantation. About 240 of these can be attributed to HEW funding.^{140/} Those individuals who are not cured by transplantation and who survive, usually must revert to chronic intermittent dialysis in order to survive.

The cost of transplantation is estimated to be approximately \$16,000 per patient per year.^{141/} A total of \$4,800,000 is spent in transplant treatments of which about \$3,800,000 can be attributed to HEW.^{142/}

Benefits associated with this transplant program are measured in terms of a reduction in mortality (patients cured, see Section A above). The average mortality rate among patients undergoing transplantation (with kidneys from living donors or utilizing "cadaver kidneys") is estimated to be about 40%.^{143/} Among the 60% who survive, about one-half are cured.^{144/} The remainder must revert to chronic hemodialysis therapy or adjunctive dialysis pending retransplantation. The number of patients cured as a result of the total program was found to be 90 of which 72 can be attributed to HEW funding.

4. Research

Expenditures in dialysis and transplant research totaled about \$12,800,000 of which \$12,100,000 was expended by HEW. Current HEW programs include intra- and extramural laboratory and clinical research and demonstration grants involving about 188 projects.^{145/}

5. Training

It is estimated that about \$1,000,000 is being expended by HEW in the area of training and education of personnel to work in dialysis and transplant operations and related research programs. This value also reflects total U. S. training expenditures.^{146/}

6. Facilities

Expenditures for facility construction, expansion and remodeling are estimated to be about \$1,300,000,^{147/} of which \$500,000 is being expended by HEW.

No benefits were estimated for research, training and facility expenditures although quite obviously these funds will provide long-term benefits.

7. Summary

HEW expenditures for this program are about \$21,000,000 with total program expenditures estimated at about \$33,000,000. Total benefits derived from these expenditures are about 690 lives saved of which about 250 can be attributed to HEW.

A summary of benefits and costs attributed to this program are presented in Table XIII.

Table XIII

END-STAGE UREMIA, HYPOTHETICAL PROGRAM
 AT CURRENT HEW EXPENDITURE LEVEL, BASED ON THE CURRENT STATE OF THE ART

| Programs | | | Short-Term Benefits | |
|------------|-------------------|---------------------|---------------------------------|---------------------------------|
| | Expenditures | | Reduction in Mortality for 1966 | |
| | HEW (\$ 1,000) | Total (\$ 1,000) | HEW Program (No. of Lives) | Total Program (No. of Lives) |
| Dialysis | 3,400 | 13,025 | 180 | 600 |
| Transplant | 3,840 | 4,800 | 72 | 90 |
| Research | 12,100 | 12,800 | | |
| Training | 1,000 | 1,000 | | |
| Facilities | 500 | 1,300 | | |
| Totals | 20,840 | 32,925 | 252 | 690 |

1. End-Stage Uremia, Hypothetical Program at Intermediate HEW Expenditure Level, Based on Current State of the Art

1. Introduction

This program describes what could be accomplished in an end-stage uremia program with an "intermediate" funding level (i.e., two to three times greater than the current level), and no change in the current state of the art. There are five components in this program including:

- 1) Dialysis treatment,
- 2) Transplantation treatment,
- 3) Research,
- 4) Training, and
- 5) Facilities.

The total cost of this intermediate program would be about \$70,500,000 of which HEW would contribute about \$56,000,000. Figure 15 graphically presents the expenditures under this program. A description of the program components follows.

2. Dialysis Treatment

There are now a total of 1,430 persons undergoing chronic dialysis therapy due to the increase in funds supporting treatment. Of these, about 880 can be attributed to HEW support. It is estimated that because of the general availability of HEW funds, the VA will have about 200 chronic dialysis patients (an increase of 25 over the current level program), and that there will still be about 350 patients being treated through other resources.

It is anticipated that the annual cost of chronic dialysis will remain at about \$15,000 per year for patients supported by HEW and VA funds, and that treatment by private resources will remain at about \$20,000. A total of \$21,000,000 will be expended for dialysis treatment.

Costs (\$1,000,000)

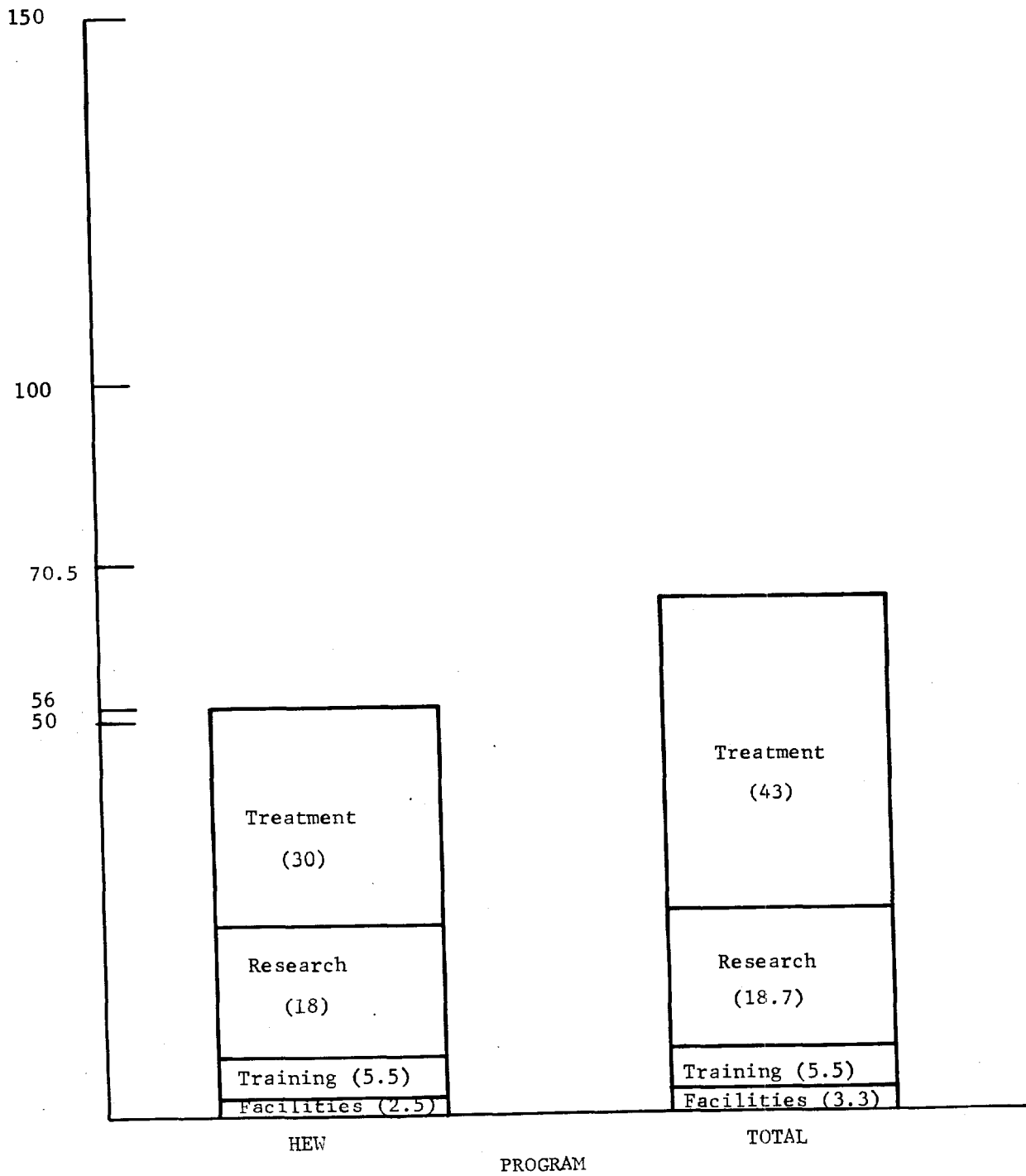


Fig. 15. End-Stage Uremia, Hypothetical Program Costs at Intermediate. HEW Expenditure Level, Based on the Current State of the Art.

It is assumed that there is no change in the 20% annual overall mortality rate associated with chronic dialysis therapy. Total benefits derived from this program are about 1,144 lives prolonged of which about 704 can be attributed to HEW funding.

3. Transplant Treatment

This program provides financial support for 1,387 persons undergoing kidney transplantations on an annual basis. Of these, about 1,187 can be attributed to HEW funding. It is assumed that the cost of transplantation will remain at \$16,000, which as indicated previously, includes the actual transplant procedure and pre- and post-operative supportive therapy. The total cost of the transplant program is about \$22,200,000 of which HEW contributes about \$19,000,000.

The benefits associated with this program are measured in terms of a reduction in mortality (patients cured). It is assumed that the general increase in funding has not markedly affected either the mortality rate associated with this procedure (about 40%) or the cure rate among surviving transplantees (about 50%). About 416 patients are cured as a result of this program of which 356 can be attributed to HEW funding.

4. Research

It is anticipated that research expenditures will increase to about \$18,000,000. While no specific research plans for dialysis and transplantation will be outlined, it is anticipated that the existing 188 intra- and extramural research projects (please see previous program) will increase in number and in some instances, in scope. Research